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Abstract

This paper forms the introduction to a special issue of *Land Use Policy* based upon a selection of papers presented at the "Using and Shaping the Land" symposium that took place at the conference "Nature, Society and History: Long-Term Dynamics of Social Metabolism" in autumn 1999 in Vienna. This introductory paper offers a framework and an analysis of the following questions: What is the relationship between land use and social metabolism — i.e., socio-economic material and energy flows? How may specific environmental transformations be apprehended, and what have been the dynamics of change over the long haul? Lastly, how does land-use and land-cover change, as identified in the papers, relate to global change? The paper offers an ecumenical view of land-use change, and points towards a broader framework for analysis.

Keywords: Environmental history; Long-term land-use changes; Social metabolism; Colonization of natural systems; Land-use/land-cover change; Interdisciplinary research methods

Introduction

This special issue brings together selected papers from the symposium "Using and Shaping the Land" which was one of the six symposia at the conference "Nature, Society and History: Long-Term Dynamics of Social Metabolism" that took place from 30 September to 2 October 1999 in Vienna, Austria. This conference addressed, among others, the following practical questions formulated in the conference's mission statement: "How can we reshape our systems of production and our patterns of consumption — our societal metabolism — to be sustainable over the long term? How can we foster new forms of social and economic organization that enhance, rather than degrade, the carrying capacity of the earth's ecosystems? This current ecological challenge is the contingent result of the long-term historical development of anthropogenic systems. Modern systems of industrial metabolism — encompassing material and energy flows — are also an outcome of this history. Hence, an understanding of industrial metabolism is crucially dependent upon an understanding of long-term historical dynamics."[1]

Within this framework, the symposium from which the current special issue was derived asked the following questions: "What is the relationship between land use and social metabolism? How did societies in the past use and shape the land? What are the ecological impacts of globalization especially since the time of world exploration? What is the relation between land use and global change?" (see Footnote 1) The relationship between socio-economic metabolism and land-use change is dynamic, and must be treated through historical and spatial analysis.

A theme of this special issue, then, is a historical perspective. It is only over a longer period of time that relations between changes in socio-economic organization, land use and land cover become apparent (Batterbury and Bebbington, 1999). Reference to 'before' and 'after' specific events need not adopt the millennial

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[1] Quoted from the conference homepage at http://www.univie.ac.at/iffsocec/conference99.

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timeframe of some environmental histories, nor adopt the impressive sweep of global histories. Local (see the paper by Riera et al.), regional (papers by Garcia Latorre et al., Klepeis et al. and Hoshino), and national (papers by Bicik et al. and Krausmann) accounts of change dominate the case studies presented here. The majority of the contributions, with the exception of Klepeis et al., come from industrialized countries and their timeframe, while disparate, allows a comparison of the driving forces of changes in land use and land cover associated with industrialization and gradual settlement on three continents.

Theoretical considerations

When viewed in a long-term perspective, the relations between societal metabolism and land use become especially informative. The industrialization process offers a formidable example. From the perspective of societal metabolism research, industrialization is, among other things, characterized by the large-scale utilization of fossil fuels (and other forms of energy; e.g., nuclear energy and hydropower) instead of area-dependent biomass (Sieferle, 1997; Smil, 1992). Many other changes in socio-economic material and energy flows - – e.g., the surge in the use of metals, the development of greater spatial reach in transportation and trade — were only made possible through an increased appropriation and use of energy. This process of change in the phases of industrialization fundamentally changed the role of agriculture and forestry in regional and national economies: in agrarian societies these sectors were almost the sole source of energy, offering nutritional energy for humans and livestock, firewood, etc. Thus, agricultural yields and the productivity of available forests imposed significant constraints on socio-economic development, and it was these local resources that, in many pre-industrial societies determined the wealth of a region (Carlstein, 1982). By contrast, in modern industrial countries these sectors now usually account for but a few per cent of gross domestic product. Although they still provide a considerable proportion of the total energy input of industrial countries — for example, biomass accounted for roughly one-third of total energy input in Austria in 1990 (Haberl, 1997) — agriculture and forestry are seldom seen as important sources of energy. This is a very fertile area of study in the decade ahead of us. Are we adequately valuing the stock of carbon stored in soils and forests (Houghton, 1995), the role of ecosystem services made possible by these undervalued entities, and recognizing the vulnerability of our contemporary industrial metabolism should it experience even temporary lack of access to distant sources of matter and materials (Ayres and Simonis, 1994)? The fate of many of the world's tropical ecosystems may hang on a more equitable valuation of these areas relative to overvaluation of the products of industrial metabolism.

One reason for a general oversight of the continued role of biotic resources in the economy is that the members of industrial societies do not necessarily perceive human and animal nutrition and labour as energy-transformation processes — at least, as far as can be judged from energy statistics that often fail to account for these processes. Another reason could be that — contrary to agricultural societies — a positive relation between energy input and output of agriculture seems to be unnecessary for a society's survival anywhere in the western world under current socio-economic conditions, as other sources of energy needed to sustain socio-economic metabolism are readily available. Whereas a positive energy balance of agriculture was essential for agricultural societies, other criteria, for instance productivity per unit area or labour productivity (Boserup, 1965; Netting, 1993), were more important in industrialized agriculture. As a consequence, as many studies have shown, the relation between energy input and output of agriculture has quite dramatically fallen during the process of industrialization (e.g., Fluck, 1992; Pimentel et al., 1973). For example, while about 10 J could be gained for every Joule of energy input in pre-industrial US corn farming around 1700, the output of corn per Joule of energy input in the US had fallen to about 2.3 J around 1975 (Pimentel et al., 1990). In Spain, the relation between energy inputs into the agricultural sector and energy incorporated in all agricultural products fell from 1:6.9 to 1:0.75 from 1950 to 1977; that is, in the late 1970s agriculture had become essentially an energy-consuming instead of an energy-producing sector (Martinez-Alier, 1987). We conclude that the role of agriculture changes fundamentally during industrialization, from the most important energy-providing economic activity — the energy efficiency of which was decisive for the survival of society — to an economically marginalized sector in which energy efficiency is no major criterion, whereas labour productivity and area productivity are optimized. Moreover, with current trends in far-reaching transport and international trade these transformations are currently occuring on a global level; in other words, it could be said that industrialized countries transfer these changing roles to distant parts of the world with comparative advantages in food production, among others, through unfavourable terms of trade between countries.

The paper by Krausmann explicitly discusses these issues by applying the notion of "human appropriation of net primary production" (Vitousek et al., 1986; Wright, 1990) to Austria. Human appropriation of net primary production (HANPP) is a measure of the changes in ecological energy flows caused by land-cover change and by harvesting biomass. Based upon cadastral and statistical data on land use, agriculture, forestry, etc., Krausmann shows that in the last 165 years biomass

production nearly doubled, while HANPP fell significantly. This can be explained by the fact that, through fossil energy subsidies, the productivity of agro-ecosystems increased to such an extent that more agricultural produce could be obtained on smaller agricultural areas through a process of agricultural intensification, which left forests occupying a greater percentage of land cover. This increase in forested areas more than compensated for the massive increase in urban areas (which rose by a factor of 5). As rising forest areas also function as carbon sinks, these results are highly relevant to the Global Change debate: they indicate that the existence of carbon sinks in many industrialized countries could be systematically related to their fossil-energy-dependent energy system that contributes to the current carbon enrichment in the atmosphere. Imports of food, a fossil fuel subsidized agriculture with higher yields per unit area, and the use of fossil fuels instead of wood enables industrialized countries to cover their demand for biomass with smaller agricultural areas; therefore, their forest areas and biomass stocks are increasing, acting as a carbon sink (e.g, Houghton et al., 1999). This observation questions the logic behind a carbon crediting system, as envisaged by the Kyoto treaty, that requires lower reductions of fossil fuel related carbon emissions if a country disposes of carbon sinks related to land-cover change.

It is interesting to compare the findings reported in the paper by Bicik et al. with those of Krausmann, for two reasons: first, Bicik et al. report changes in land use and land cover in Czechia, a country that is not only adjacent to Austria, but was also a part of the Austro-Hungarian empire in the 19th century, over a similar period of time (1845–1999). For the 19th century, Bicik et al. were able to use data from the same set of enlightening and relevant cadastral surveys as Krausmann. Second, Czechia took a very different development route between 1945 and 1989, when it was a part of the communist state of Czechoslovakia. Although many differences could be exposed through a finer-grained analysis, the basic trends uncovered by the two studies are quite similar: agricultural areas decline, forested areas and 'other areas' (mostly urban and industrial areas) increase over time as the industrial metabolism extends the reach of its 'spatial fix' or 'footprint' (Wackernagel and Rees, 1996) and develops new sources of energy supply reliant on fossil fuels, relying more or less prominently on imported raw materials. Although Bicik et al. find some impact of changes in the political system (communist vs. market-economy) on changes in land use and land cover, the basic trajectories are astonishingly similar, giving rise to the speculation that transitions in the major features of socio-economic metabolism, especially the energy system, are reflected in land-use changes.

In conclusion, the techniques of land-cover change analysis presented by these papers offer productive advances in the sorts of data and interpretations useful to understanding environmental transformations in places undergoing shifts in the underlying relationship between human societies and their natural environment. Some of the methodological contributions of the papers are discussed in the next section.

Methodological advances

By its very nature, the study of changes in land use and land cover is an interdisciplinary endeavour. True interdisciplinary research requires more than the collection and analysis of brute facts — it involves "a combination of knowledge and feeling, of measurement and judgement, of information and ethics, of explanation and participation" (O'Riordan, 2000, p. 15). Therefore, the historical analysis of land-use change requires a diverse range of skills and methods, and a certain intuition to juggle inspirational scientific measurement and analysis with demands of ecological commitment and a critical eye (Thompson et al., 1986). In the most simple analysis, natural conditions (e.g., climate, slope, soil, etc.) can favour or preclude certain kinds of land use. Nevertheless, social and economic driving forces can lead to completely different patterns of land use in regions with similar natural conditions — a point raised many decades ago by the French Annales School in their studies of 'genres de vie' in rural Europe (Vidal de la Blache, 1922; Febvre and Bataillon, 1926). Accordingly, the impact of land use on ecosystems and biodiversity will be determined by natural factors, by socio-economic driving forces, by the visions or interpretations that people give to certain land uses or landscapes, and by the complex interactions between all three.

The paper by Riera et al. is an excellent example for the difficulties of tackling the complex interplay between societies and landscapes. Riera et al. compare the differences in land-use and land-cover change in two contrasting landscapes in Wisconsin, USA, that are both characterized by the existence of numerous lakes. Spanning the 20th century, their project reports on the social science component of the 'Long-Term Ecological Research Sites (LTER) network project on Wisconsin lakes, that has a significant scientific focus. One of the study sites is located in northern Wisconsin, where poor soils prevented agricultural development; the region around Wisconsin's capital Madison is the other study site. By comparing these contrasting landscapes, Riera et al. are able to show how the environmental history of lakes, riparian areas and the surrounding landscapes is formed in complex ways involving both natural factors and socio-economic driving forces. In brief, the human use of these lake systems has evolved in response to indigenous and early European settlement patterns, but also to the recreational and economic opportunities they afforded. Lake ecosystems have co-evolved with settlement, fur

and timber industries, recreation, changes in land tenure and legislation, and environmental pollution from intensive cultivation has been a significant factor in the southern lake systems.

Whereas the methodological problems of integrating data from natural sciences with interpretation and analysis by social scientists is not the main focus of the paper by Riera et al. (although reading the paper conveys insights on this issue), Bürgi and Russel explicitly discuss methodological issues related to long-term studies of landscape change. They propose two methods for interdisciplinary co-operation between landscape ecologists and historians: (1) 'specification of human impact' and (2) 'double comparative studies'. The first method begins by generating timelines of changes in environmental features and human activities. In a next step, links between the two types of timelines can be interrogated and the so-called 'interface categories' can be defined that are meaningful for both historians and ecologists. This method can yield insights into the interrelations between human activities and changes in the landscape (e.g., time lags between cause and effect). The second method, 'double comparative studies', can also be applied when records for the entire period under investigation are lacking. In this case, the situation in two regions is assessed at the beginning and the end of a period. By comparing both the changes over time and the differences between two regions, human driving forces and natural factors can be discerned and interpreted. Of course, double comparative studies are only useful when time lags are considerably shorter than the length of the period under study. Other forms of comparative study need to be developed to fully understand land-use change. Social scientists commonly talk about the comparative method but rarely practice it because of the complexity of building up data sets that are comparable. Land-use policy in the 21st century will need the information and insights provided by comparative analyses to avoid the myopias of the past from recurring.

One problem, identified by early ecological theory as well as by those concerned with resource access and the 'regional political ecology' of land-use systems (Blaikie and Brookfield, 1987) is the interaction between processes operating at multiple scales. Hoshino's paper applies innovative statistical techniques to show how diverse processes at multiple scales have combined to create the landscapes of contemporary rural Japan. The paper provides clues as to how complex social environmental and political data may be converted to data sets suitable for modeling, and the models themselves performed. The paper does not discuss how these aspects of Japanese landscapes are perceived and interpreted. In short, Hoshino analyses what factors determine the proportion of agricultural area in Japan's administrative units, i.e., municipalities (numbering around 3200) and prefectures (47). He finds that both natural conditions and socio-economic driving forces influence agricultural patterns. The most important natural condition seems to be the availability of flat lowlands suitable for paddy rice cultivation — the most important crop in Japan. The influence of socio-economic dynamics is less straightforward, nevertheless Hoshino succeeds in establishing a model that is able to explain not only obvious interdependencies (e.g., agriculture is more often abandoned in regions offering good job opportunities outside the agricultural sector), but also some unexpected relationships. For example, the influence of topography on the share of agricultural land is smaller in regions with high agricultural investments — this can be explained by the fact that agricultural investments are mainly used to improve the land. It is also interesting to note that Hoshino's model is able to detect the importance of agricultural co-operatives that provide technical advice and market agricultural products. In regions with well-managed agricultural co-operatives, the proportion of farmed land is higher than in other locations, since farming seems to be more profitable there. The decisive advantage of Hoshino's model, however, is his ability to demonstrate that it is possible to take into account the multiple spatial levels on which these decisions occur (see also the discussion below).

Environmental history and land-use change

To think of environmental history, and historical ecology, is to bring attention to the fact that a complete explanation of ecological structure and function must include the actual sequence and the timing of the causal events that produce an observed structure or function (Winterhalder, 1994). While it may be possible to reconstruct all the important dimensions of physical objects without recourse to their history, such a task becomes impossible when studying living objects (Batterbury and Bebbington, 1999). Living things do not manifest their full array of capacities when observed, nor how their current expression came to be. It requires inquiry into history to understand what forces influenced the currently observed forms and functions, and to infer what it might be capable of in the future under different conditions (Harrison and Morphy, 1998).

Environmental history helps us to reconstruct changing landscapes over time and in space (Crumley, 1994; Roberts, 1996). Human beings adapt to, and bring about, modifications in ecosystems — and they have done so for thousands, if not millions of years. Historically informed environmental analysis is a necessity, if for no other reason than to correct the mis-perception that past environments were 'pristine' and that only recently have humans begun to have an impact on the earth (Beinart, 2000; Jacobsen and Firor, 1992; Redman, 1999). Hardly any spot on the face of the earth is unaffected by human

action, and humans have brought about changes in all landscapes, both positive and negative. This record of human impacts on the environment offers a rich menu or record of the choices we have made, and their consequences. Environmental history makes us more aware of the outcome of our past decisions and encourages reflection of what we might do in the future (Worster, 1984). Environmental historians show great sensitivity to the nuances of history, and dedication to detailed study. Environmental history in North America, Australasia and Europe is now trying to develop from its methodological roots in social-science analysis of oral histories and archival sources, reaching out to new techniques for analyzing landscape change (e.g., GIS); as Beinart puts it, the field is "bringing sensitive science back in" (Beinart, 2000, p. 295).

Klepeis and Turner provide a useful discussion of the historical 'disconnect' between the fields of environmental history, and the 'science' of global environmental change. Their aim is to tie together the mutual contributions of these fields, in a study of the driving forces of land-cover change in the Southern Yucatán Peninsula, Mexico. The significant contribution of a historical analysis, present in Garcia Latorre's paper as well, is that it contextualizes present and short-term land use of the type studied in land-use and land-cover change models. Interpretative errors, for example assuming that old growth forest cover was free of human impact in past centuries, are therefore avoided. Klepeis and Turner call for an "integrated land history" to bridge the divide between these epistemological camps, echoing the comments of Hamilton (1999) who signals the poor record of the International Geosphere–Biosphere Programme, and indeed of geographers, in situating themselves at the crossroads of social and biophysical sciences. Their study traces long-term dynamics of human occupance and forest composition, noting the vital importance of 'natural forces' and infrastructure development in regional land use change. A statistical assessment of land-cover data is supplemented by oral histories, sketchmaps and political analysis. The sentiments of these authors echo the recent comments of Liverman (1999) who sets out the main areas where further cross-disciplinary work is needed, in studies of human vulnerability to climate change, in the environmental history of long-term climatic change, and through good regional studies of land use, of the sort presented in this journal.

The central features of the analysis of changes in land cover in the dry Spanish province of Almería by Garcia Latorre et al. are that the signatures of different modes of governance and political/social upheavals are etched into landscapes, human memory, and into the fabric of places. Garcia Latorre et al. describe how the expulsion of Muslim peasants by a Christian feudal system between the 11th and 15th century led to a change from a land-use system relying mainly on irrigated perishable crops like vegetables and fruits to a system of dry farming, producing mainly crops that could be stored, i.e., cereals. They argue that only through this shift towards storable products could the Christian lords conveniently tax the peasants and collect surplus production. However, because of the low precipitation, dry farming needed much higher cultivated areas in order to nourish the same number of people. The ecological consequences of this shift between irrigated and dry farming were not felt immediately, however. The expulsion of the Muslim population led to a considerable decline in population and a large proportion of the vast, sparsely populated frontier area was mainly used for sheep grazing. Things changed quickly in the 19th century, when Almería became one of the most important lead-producing areas in Europe. Not only did lead mining consume large quantities of wood, it also encouraged a surge in population numbers that resulted in intensive cultivation, based upon area-consuming dry farming. The surge in timber demand together with quickly rising agricultural areas resulted in significant deforestation. Ironically, while industrialization in the early 19th century seems to have been a major driving force behind deforestation, the decline of the importance of lead mining and the consequent economically backward position of the region in the late 19th and early 20th century seems to have contributed to a further deterioration: lacking fossil-fuel inputs in agriculture, especially in irrigation, resulted in a low productivity of agro-ecosystems and a continuation of area-consuming agricultural practices. Based mainly upon historical methods, but taking into account a wealth of ecological and other scientific findings, Garcia Latorre et al. provide an impressive case study of the interrelations between socio-political, socio-economic and landscape-ecological change.

Conclusions for future studies

Studies in the field of land-use and land-cover change require 'conceptual frameworks'; those terrible things that students are always being invited to 'explore' or 'develop' before they are released into the real world to conduct research. The papers in this volume suggest some ways in which good studies on land-use and land-cover change may be carried out, and the tools they may use. More coherence and direction in land-use studies carried out by different researchers at different sites could be desirable, as it would facilitate comparisons and generalizations (Turner, 1997).

Yet advances in our theoretical understanding of the interaction processes between societies and their natural environment, at many spatial and temporal scales, appears necessary to successfully launch an attempt to propose more standardized methods and conceptual frameworks for land-use and land-cover change research

(Turner et al., 1995). The papers in this special issue demonstrate that different conceptual frameworks point our analyses towards different aspects of land-use and land-cover change that are all valid, but try to answer different questions.

This problem of the incommensurability of research frameworks is even more difficult as studying changes in land use and land cover requires bridging the gap between social science, natural sciences and the humanities. The papers in this volume, written by historians, geographers, human ecologists, biologists, ecologists — to name but a few — are good examples for the challenges and opportunities this poses.

Some of these challenges derive from the paradigmatic and methodological standards of these disciplines. For example, many social scientists are hesitant to include natural processes as factors explaining social relations in a causal way because they are scared of anything that smacks of environmental determinism. This debate has a long history in the different disciplines that study society–nature interactions (e.g., Beinart, 2000; Moran, 1979; Orlove, 1980) and in the current discussion of economic and cultural globalization (Giddens, 1999). If we want to avoid saying that the 'environment' influences social relations in a causal way then it is all too easy to apply alternative frameworks that de-emphasize this linkage. Firstly, we can examine how social relations and politics impact the natural environment; the reverse causality. This is the terrain of many political ecologists and political economists (Bryant and Bailey, 1997). Secondly, we can perceive the natural environment as a source of risk, which is mediated through complex social institutions with uncertain effects (Giddens, 1999). The papers in this special issue suggest, quite simply, that societies and ecosystems influence one another, although neither of them can be explained entirely through this interaction; i.e., they should be regarded as interacting and autopoietic systems (Fischer-Kowalski, 1997; Fischer-Kowalski and Weisz, 1999). In a cultural–ecological framework that privileges 'natural' controls on human behaviour and organisation, (Steward, 1955; Netting, 1981; Townsend, 2000), institutions are structured by environmental conditions. An example is the development of social institutions for hunting and childcare among small bands of !Kung San bushmen, that evolved as a response to the wide dispersal of protein sources (nuts) — the establishment of large villages would, at certain historical moments, have led to starvation (Lee, 1979). Yet, social institutions are generally believed by the majority of scholars to be partially autonomous from the local environment; not only, but especially in industrial societies, because far-reaching transport of people and goods tends to make local environmental conditions less important for achieving livelihood security. Industrial societies' 'footprint' does not only affect local ecosystems, but extends far from their immediate location. In these circumstances the importance of local biophysical conditions exists in other ways, such as through the capacity of local systems to handle industrial waste, air and water pollution, hydrology as affected by paved surfaces, urban decay and crime, and the fluctuating or even rising cost of housing and services. Scrutinising political and institutional change to understand certain environmental impacts of societies, then, is an especially rewarding research strategy, as can be seen in the papers by Klepeis and Turner, and Bicik et al. in this volume.

The multitude of spatial and temporal scales that have to be taken into account in studies of land-use and land-cover change pose another challenge to the research community. To trace processes through scales is an especially complex task when paradigms and methods of different disciplines have to be integrated. When tracing the impacts of, say, CFCs on the atmosphere, natural scientists can make causal links between local use of these chemicals and regional or global effects on the global atmosphere. These causal links are missing if we consider a social factor like class exploitation or the swift collapse of Communism. We know that political exploitation and rent-seeking behaviour occurs at local, regional and international scales, but the effects of exploitation at one scale cannot be linked well and rigorously to another scale — the links are contingent ones only, even in the literature on geopolitics and economic geography. Therefore, if the scale of an investigation into changes in land use and land cover is altered, often the 'answers' and 'processes' change too. Whether this is a result of real differences in process at a given scale of analysis, or a result of a data disconnect between one scale of analysis and another, remains a challenging question in the study of the human dimensions of global change. This is a task which is a central concern of the research of Ostrom (1990), Moran et al. (in press), Turner et al. (1995) and other scholars. Hoshino's work is important because it provides a (somewhat reductionist) way to offer such predictive capacity. Some will be made uneasy by our conviction that the social sciences lacked any mechanism to link, say, global capital flows to local livelihood systems without resorting to statistical modelling, and the critics may be content to only make assertions or inspired guesses about these linkages. To attempt more, as Hoshino does, might return us to positivism, with its well-known strengths and weaknesses and its failure to deal adequately with values and human agency.

Currently, this issue of scale commensurability and linkages is tackled by collecting and analyzing data at multiple scales and comparing them across cases (see Turner et al., 1993), but it seems that further progress will be needed to build robust understanding of the complex interrelations between changes in landscape-ecological and socio-economic systems. We feel that answers will rely on our ability to promote and co-ordinate interdisciplinary theorizing, empirical work and communication.

Research efforts in these fields are legion. To mention just one, the Land-Use and Land-Cover Change (LUCC) programme jointly sponsored by the IHDP and IGBP programmes plays an important unifying role. The conceptual framework of societal metabolism, currently being developed in human ecology, could also be a starting point for attempts at such theoretical integration. Within this paradigm, land use can be conceptualized as colonization of terrestrial ecosystems — i.e., as deliberate human influence and control of ecological systems intended to provide, for example, certain inputs to societal metabolism (e.g., agriculture), or to provide the infrastructure needed to maintain societal metabolism (Haberl and Schandl, 1999). The work on HANPP reported here by Krausmann is an exemplar for empirical studies inspired by this kind of theoretical reasoning.

Tracking common processes across localities and scales will make us more visible as interdisciplinary researchers, able to contribute strongly to intellectual and even to policy debates. For example, we hope that research like that presented in this special issue will also be used to develop tools and instruments of land-use policy, and to explore the interrelations between land-use policy and other policy fields; e.g., energy policy or natural resource management. Although the search for relevance may provide a strong motivation for some, we also feel that the urge to understand complexity and diversity will never (and should not) cease to absorb the many people who cut their teeth in the field looking at highly politicized and fundamentally complex natural, social, and institutional landscapes.

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