



Urban land-use change: The role of strategic spatial planning

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ABSTRACT

To date land-change science has devoted little attention to spatial policy and planning in urban landscapes despite the widely accepted premise that planning affects urban land change. This is primarily due to lack of relevant data and an underdeveloped theoretical understanding regarding the impact of spatial planning on urban land change. To be able to better analyse the role of spatial planning in urban development we need to distinguish: 1) the intentions expressed in the plans; 2) the means of implementation of the plans through governance processes and 3) the role of external conditions influencing implementation. Based on a synthesis of the current literature on how spatial planning is implemented in land-change models, and drawing from the literature on planning evaluation, we sketch a research agenda to further develop the understanding of these three components and their interconnections as well as their application in quantitative land-change modelling approaches for urban regions.

1. Introduction

Land change is one of the key processes of global environmental change (Magliocca et al., 2015; Turner II et al., 2007; Verburg et al., 2015). The studies on the topic have gradually advanced from a focus on patterns of land-use and land-cover change to an analysis of dynamic interactions within socio-ecological systems and the resulting impacts on, for example, ecosystem services and biodiversity (Rindfuss et al., 2004; Rounsevell et al., 2012). In this context, land change is understood as the result of interacting political/institutional, economic, cultural, technological and natural/spatial driving forces and the respective actors (Bürgi et al., 2004; Hersperger et al., 2010). Whereas data on economic and natural conditions have a long tradition in being used to explain land changes, researchers only recently started to pay attention to policies, plans, and regulations on land use, within their specific institutional and governmental contexts. Meta-analytical studies have emphasized the role of land-use policies and spatial planning as a major underlying driving factor for many different land-use change processes (van Vliet et al., 2016).

Compared with forest and agricultural related research, studies on land change in urban regions are so far a small part of land-system research (Geist et al., 2006; Magliocca et al., 2015; Seto et al., 2011). However, urban regions, which are also broadly defined as cities or metropolitan regions, are some of the most dynamic land-change

systems worldwide. With strong further urbanization expected over the coming decades they will cover increasing areas of the earth surface and host the majority of the human population (Seto et al., 2012). At the same time, urban land change is not restricted to the core city, but includes many new urban-rural spaces functionally tied to the city (Brenner and Schmid, 2015) and has many impacts on rural hinterlands (Bren d'Amour et al., 2016) and hence deserves more attention in land-change science (Müller and Munroe, 2014).

A widely accepted premise is that, especially in urban regions, spatial planning - a multifaceted activity with many purposes, including project planning, master planning, land-use planning and strategic planning - influences patterns of land use and land cover (Couclelis, 2005). Amongst the many purposes of spatial planning, spatial planners and governments have been trying to steer urbanization processes with the aim of developing sustainable cities and regions (Albrechts et al., 2017; Collier et al., 2013). However, conceptualizing the role of planning in guiding land change is a great challenge (McNeill et al., 2014). This is partly due to the fact that research on the contribution of planning to land change is at the interface of two paradigms (Briassoulis, 2008; Hillier, 2007): planning scholars tend to stress contextuality and social construction of space; whereas land-change scientists incline to assume the existence of realities that can be objectively described and measured and lend themselves to generalizations. The difference between the two paradigms can be illustrated

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through how they position themselves in respect to the concepts of space and uncertainty. Many urban geographers and planning theoreticians conceive space as a social construct (Harvey, 2006; Lefebvre, 1991) and expect future urban development to be open ended. Uncertainty is inherent; to be expected and subject to exogenous factors (Graham and Healey, 1999). Land-change scientists quantify and model space by identifying correlation or causality between drivers and outcomes, and strive to identify sources and levels of uncertainty in land-cover projections (Alexander et al., 2016). Research to bridge the two paradigms is sparse. Consequently, planning is not well integrated in quantitative land-change assessments.

In this paper we aim to provide a way forward to better link the planning and land-change domains and thus to enable the assessment of the impact of spatial planning on land change. While recognizing that there are many kinds of spatial planning, it remains unclear which planning is best suited for developing this link, and the answer likely depends on the questions under study. We refer in the text in a general manner to spatial planning whenever possible, but when we discuss examples and illustrate our points we focus on strategic spatial planning. Strategic spatial planning commonly practiced in urban regions is suitable for exploring the link between planning and land-change domains because of (1) the territorial extent of most strategic spatial plans covers functional urban regions; (2) the strong focus on a strategic mission in these plans, often 20–50 years into the future; and (3) the fact that strategic spatial planning has consolidated over the last decades in many urban regions around the world. However, in most planning cultures, strategic spatial plans do not influence land management and allocation directly but are defined as frameworks for action (Albrechts, 2004; Hermelin, 2009). Their role is, thus, to help planners frame practical judgments about the pursuit of multiple purposes in changing local situations and to facilitate discussions with citizens and other actors (Albrechts, 2010; Walsh, 2012; Healey, 2009). The outputs of strategic planning processes are the plans, consisting of a written report and often a cartographic representation of the envisioned regional development. Key strategies typically refer to (1) how much growth is expected and/or desired to fulfil the region's need for economic development and housing, (2) where distinct types of urban development (e.g. dense housing, single family homes, mixed uses, industrial facilities) should unfold, and (3) which areas should be protected in order to assure the long-term persistence of natural and cultural assets.

To pursue the aim of linking planning and land-change, we present a conceptual framework based on three interrelated components that help disentangle the role of spatial planning in land change. We start with an analysis of how planning is operationalized in current land-change studies and models and a review of factors crucial for successful plan implementation as discussed in planning-outcome evaluation literature. Based on that, we sketch a research agenda on how to further develop the three interrelated components (i.e. land-change intentions as expressed in plans, territorial governance, and external conditions) in the context of land-change science.

2. Planning in land-change studies and models

In land-change science, spatial planning is often classified as a political driver (Geist and Lambin, 2006), whereas in political science, planning is considered a public policy (Sabatier and Jenkins-Smith et al., 1999). For illustration purposes, Fig. 1 shows on the left-hand side a simple model of explaining land change: Five groups of driving forces determine the actor's autonomy and motivations in taking decisions and subsequently actors cause change (Hersperger et al., 2010). Political and socio-economic drivers are strongly interlinked and mediated by technological forces. These drivers act within a background set by cultural and natural drivers and feedbacks are omnipresent (e.g. Brandt et al., 1999; Bürgi et al., 2004; Rounsevell et al., 2012). When the policy cycle is applied to spatial planning as shown in

Fig. 1, the following steps are commonly identified: problem definition, goal formulation, regional and local analysis of past, current and future socio-economic trends and environmental conditions, plan design, implementation, and evaluation (Steiner, 2008; Steinitz, 2012; Hersperger et al., 2015).

Planning thus entails the processes of plan making (designing the plan) as well as plan implementation and is affected by local socio-economic factors and external processes. However, plans are rarely implemented as they are. For example, urban development can occur as informal development in areas that were not foreseen for development or development can be partially lacking in areas that were intended for development (e.g. due to a lagging economy) (Loh, 2011). This incomplete implementation is an issue of governance and poses a mayor challenge for conceptualizing the role of spatial planning in urban development.

2.1. Qualitative and quantitative assessments of planning in land-change studies

Much research on political drivers so far has been in the form of qualitative assessments of policy and planning effects on land change in case studies around the world (Plieninger et al. 2016). A number of studies focus holistically on landscapes and aim to distil a historical description and explanation of land change (e.g. Seabrook et al., 2006; Thapa and Rasul, 2006; Bieling et al. 2013). Such studies highlight how policy and planning shape the changing landscape in interplay with the other driving forces (Fig. 1). For example, Santana-Cordero and colleagues (2017) studied land change, driving forces, as well as actors and institutions in three coastal landscapes of the Canary Islands and identified case-specific development models. They found that socio-economic, political and natural driving forces were especially important to explain the very different developments in terms of land cover and land-change processes (e.g. resource extraction and urbanization) in these three landscapes. Other qualitative studies take a slightly different approach and focus on the contribution of planning and policy to land-change (e.g. Biciak et al., 2001; Hersperger and Bürgi, 2010; Zhu, 2013; Hersperger et al., 2014; Pagliarin, 2017). Such studies address the influence of policy and planning, as interplay of drivers and actors, relative to other influences. For example Mu and colleagues (2016) studied the contribution of planning to urbanization. They conclude that national policies favoured urbanization in the hinterlands and that the effect of these policies, reinforced by regional and local planning policy, caused the observed transformation of the study area Zhengzhou (China) from an agricultural to an urban centre.

Quantitative assessments often use regression models (e.g. Hu and Lo, 2007; Liu et al., 2011; Kasraian et al., 2017), but also other methods such as AHP (Osman et al., 2016) or ANOVA (Warren et al., 2011) to investigate the relative contribution of planning and policies to land change. Typically, planning is represented in a rather simplified approach by a binary variable for conservation (e.g. Hu and Lo 2017) and/or designated growth areas (e.g. Kasraian et al., 2017). Such quantitative assessments have confirmed the role of conservation policies in keeping areas open (e.g. Kasraian et al., 2017 for the Randstadt in The Netherlands) and for guiding growth (e.g. Liu et al., 2011), but also pinpointed the limited effects of plans in certain contexts (e.g. Osman et al. 2016 for Cairo, Egypt). Overall, there are rather few quantitative assessments which might be due to the fact that they build upon a rather simplistic conceptualization of planning, unsuitable to do justice to complex land-change situations.

Qualitative and quantitative assessments, as outlined above, show for locations across the world to what degree political drivers, together with other relevant drivers have affected land change. However, generalizations regarding the role of planning remain difficult because of the diverse and complex socio-economic and natural contexts. Indeed, meta-studies that synthesize case studies and provide more comprehensive results are scarce for urbanization (van Vliet et al., 2016). This

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