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Research Paper

Methods for identifying land use conflict potential using participatory mapping

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HIGHLIGHTS

- Conceptualizes and operationalizes methods for identifying and mapping land use conflict potential.
- Uses PPGIS data from a regional study in Australia to map potential conflict for residential and industrial development.
- Evaluates three different methods (values, preferences, combination) to map land use conflict potential.
- Describes the strengths and weaknesses of each mapping method with examples from the case study.
- Argues that conflict indices derived using both values and preferences are currently the best method but more research needed.

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ABSTRACT

The number of public participation GIS (PPGIS) applications to inform local and regional land, use planning has increased significantly over the last decade. An important rationale for undertaking, participatory mapping is to anticipate and identify areas of potential land use conflict. To date, there, has not been a systematic evaluation of methods for identifying land use conflict potential with PPGIS data. This study uses data from a regional planning study in Australia to describe and evaluate alternative methods for identifying land use conflict potential. A simple, two dimensional model of land use conflict is presented and operationalized with spatial data to provide a heuristic device for regional land-use planning practitioners. Land use conflict is posited to derive from differences in landscape values and land use preferences that can be formulated into different conflict indices and presented in maps. We demonstrate application of the conflict mapping model using residential and industrial development in the region as examples. The spatial distribution of landscape values, values compatibility scoring, land use preference differences, and a combined values and preferences scoring index are all viable methods for identifying and mapping the potential for land use conflict. The preferred method for assessing the potential for land use conflict is one that integrates two dimensions: land use preference directionality (supporting or opposing) and the importance or intensity of landscape values. We discuss the strengths and limitations of each conflict mapping method.

1. Introduction

Land use conflict occurs whenever land-use stakeholders have incompatible interests related to land areas that result in negative effects (von der Dunk, Gret-Regamey, Dalang, & Hersperger, 2011). The sources of land use conflict are many and may include disagreement over fundamental values, resource scarcity, social power imbalances, and a lack of clear institutional arrangements including property rights, among others. At the extreme, conflict over land can escalate into violence (Alston, Libecap, & Mueller, 2000). An aspiration of land use planning is to meet current and future societal needs while keeping land use conflict bounded and functional. In Western societies, zoning ordinances and land use controls for private property seek to identify and separate potentially incompatible land uses while the development of comprehensive and regional plans identify broad land use allocations to harmonize expectations about future land use. But the rationalization of land use can never circumvent land use conflict because land and society are in a continual state of flux. Change in the social or physical environment (or both) is the catalyst for land use conflict. Thus, the question is not about land use conflict

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avoidance per se, but conflict management and amelioration. The methods described herein identify the potential for land use conflict so that social resources can be allocated to manage the conflict through communication and community engagement.

Two main types of conflict emerge in the psychology literature: social values and interpersonal conflict. Social values (i.e., social acceptability) conflict occurs between groups who do not share similar values or norms about an activity and can occur even when there is no direct physical contact between groups (Ruddell & Gramann, 1994; Vaske, Donnelly, Wittmann, & Laidlaw, 1995; Vaske, Needham, & Cline, 2007). For example, while not witnessed first-hand, residents may philosophically disagree with industrial development in a particular location within a region. This has been seen with respect to social conflict over rural growth priorities (Greider & Garkovich, 1994). Interpersonal conflict occurs when the physical presence or behaviour of an individual or group interferes with goals, expectations or behaviour of another individual or group (Jacob & Schreyer, 1980). In a land-use planning context, interpersonal conflicts can relate to clashes over the health impacts of mobile phone antennas (Marcus, 2007), visual blight of wind turbines (van der Horst & Toke, 2010), noise from road traffic (Joerin, Theriault, & Musy, 2001), rural and urban lifestyles in peri-urban landscapes (Hite, 1998), the demolition of historic buildings (Hunziker, Buchecker, & Hartig, 2007; Rollero & De Piccoli, 2010) and changes to the natural environment (von der Dunk et al., 2011; White et al., 2009).

Multiple, specific forms of land use conflict have been described in the literature. In a recent review, von der Dunk et al. (2011) identified six conflict types of noise pollution, visual blight, health hazards, nature conservation, preservation of the past, and changes to the neighbourhood. Most of these types of conflicts have been explored or examined in separate studies; for example, the visual blight of wind turbines (van der Horst & Toke, 2010), noise from road traffic (Joerin et al., 2001), and conflicts associated with land clearance for new residential developments (Young et al., 2005). Often these conflicts are associated with not-in-my backyard (NIMBY) reactions to new developments, as exemplified through studies on residential development (Pendall, 1999), commercial developments such as airports (Freestone, 2009), and sustainable energy developments such as wind power (Devine-Wright, 2013).

Despite conflict being associated with location and physical space, relatively few studies have mapped the potential for conflict spatially. Over the past two decades, spatial decision support systems (SDSS) that link multi-criteria analysis methods with geographic information systems have been used to facilitate understanding of conflict (Armstrong, 1993; Carver, 1991; Godschalk, McMahon, Kaplan, & Qin, 1992; Jankowski, Nyerges, Smith, Moore, & Hovarth, 1997; Malczewki, 1999; Thill, 1999). More recently, Brody et al. (2004) used a SDSS to map the potential for competing stakeholder values when establishing protected areas in Texas. Multiple values associated with a range of stakeholders were mapped and hotspots of potential conflict identified. Results indicated place-specific differences in potential conflict, with the greatest amount of conflict predicted to occur in the coastal environment. This work was expanded to include the value proxies of biodiversity, aesthetic, recreation, commercial fishing, marine transportation, coastal development, historical/cultural sites, and research and education within mining lease blocks in Texas (Brody et al., 2006). Those site blocks with the highest value score (a function of occurrence and coverage) were assumed to be the areas of highest potential conflict for oil/gas production. Brown and Weber (2011) used Internet-based public participation geographic information systems (PPGIS) methods to enable visitors to Alpine National Park, Australia, to map their park visitation experiences. A layer showing the diversity of park experiences was presented as a proxy for potential visitor conflict. Bourgoin, Castella, Pullar, Lestrelin, and Bouahom (2012) used participatory landscape simulation to help villages understand the implications of land zoning for their livelihoods. People drew areas of different land uses on a board made of 100 one-hectare cells and assigned economic and environmental returns (values) to different land-use types. The resulting values helped participants to negotiate land-use conflicts and adapt their plans until consensus was reached. Each of these mapping approaches assumes that the magnitude of value or activity assignment is a proxy for interpersonal conflict. However, these mapping approaches do not effectively identify areas of social values conflict or areas where groups do not share similar norms about development.

Other studies highlight the potential for conflict based on development preferences as mapped by residents of, or visitors to a region. When aggregated, these preferences are a useful proxy for social values conflict because they enable the identification of areas where acceptable and inappropriate types of development overlap (a form of social acceptability), as perceived by different groups. In 2004, a baseline study of residential and tourism development preferences was conducted on Kangaroo Island (KI), South Australia, using paper-based PPGIS (Brown, 2006) and in 2010, a follow-up internet-based PPGIS monitoring study was conducted to examine whether residents' tourism development preferences had changed over the last six years (Brown & Weber, 2013). Locations of preference conflict were identified where tourism development hotspots were spatially coincident with "no development" preference hotspots. In 2010, the conflict areas had expanded to new coastal areas in the north and south of KI (Brown & Weber, 2013). PPGIS techniques have also been used to assess the social acceptability of three residential development policies (protecting productive lands, growth boundaries, targeted protection of conservation lands) with respect to rural agricultural regions experiencing exurban development (Goldberg et al., 2011; Nielsen-Pincus et al., 2010). Results demonstrate a complex set of conflicting trade-offs which need to be considered by rural planning authorities. Urban growth boundary policies produced the most socially acceptable development patterns and supported habitat for a wide range of species (Goldberg et al., 2011).

Each of these development preference mapping studies do not identify where social values conflict may be magnified by interpersonal values conflict. An exception is recent work in the Chugach National Forest, Alaska, which generated a conflict potential index that combined acceptable and inappropriate forest use preferences within each forest management area and the number of landscape values mapped in the area (Brown & Donovan, 2013). Understanding the interactions between social values and interpersonal conflict is important to enable land management agencies to identify the location, nature, and intensity of potential conflict from the public and stakeholders to ensure that prospective land use allocation or management decisions are informed about the trade-offs and potential consequences of those decisions.

We present a new conceptual model of land use conflict potential (Fig. 1) for use by planning practitioners who are employed in state agencies or local government and are responsible for developing and revising regional land-use planning strategies. This model is an empirical and spatial approach to land-use conflict assessment and combines the elements of social conflict (operationalized as land use preference agreement/disagreement) with interpersonal conflict (operationalized as place value intensity) and relies upon potential conflict emerging through the mapping of values and preferences. We propose that the highest potential for land use conflict will occur in areas where there is development preference disagreement (a large difference between areas of acceptable and inappropriate development preference) and high place importance (high landscape value intensities). High potential for land-use

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