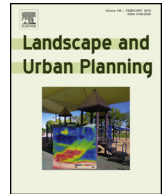




Contents lists available at ScienceDirect

# Landscape and Urban Planning

journal homepage: [www.elsevier.com/locate/landurbplan](http://www.elsevier.com/locate/landurbplan)

## A network approach to assessing social capacity for landscape planning: The case of fire-prone forests in Oregon, USA

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### H I G H L I G H T S

- We analyzed the social network structure for ecoregion-scale planning.
- Despite shared concern about wildfire, organizations comprised distinct networks.
- Organizations with different goals and geographic foci comprised distinct networks.
- Social network ties among organizations were stronger at the sub-ecoregion scale.
- Network analysis can quantify social capacity for landscape planning.

### A R T I C L E I N F O

#### Article history:

Received 1 October 2014

Received in revised form 13 October 2015

Accepted 27 October 2015

#### Keywords:

Organizational networks

Social network analysis

Social capital

Landscape planning

Wildfire management

Forest restoration

### A B S T R A C T

Management of ecological conditions and processes in multiownership landscapes requires cooperation by diverse stakeholder groups. The structure of organizational networks – the extent to which networks allow for interaction among organizations within and across ideological and geographic boundaries – can indicate potential opportunities for cooperation on landscape-scale problems. In the arid landscapes of the western United States, where increasingly large wildfires burn irrespective of property boundaries and land designations, organizations involved in the restoration of forests and the protection of property from wildfire could benefit from working together to share information and coordinate strategies. We investigated patterns of interaction among organizations concerned with increasingly uncharacteristic wildfire risk in the Eastern Cascades Ecoregion of Oregon for evidence of structural conditions that create opportunity for cooperation. Through social network analysis of interview data, we found that despite sharing concern about wildfire risk in an area with a common set of ecological conditions, organizations with forest restoration and fire protection goals comprised distinct networks, as did organizations that focused on different geographic areas of the ecoregion. When interpreted through the lens of social capital and organizational theory these findings raise questions about the extent to which the structure of the organizational network reflects capacity to address wildfire risk in fire-prone forests on the ecoregion-scale. This study provides insights on the utility of a structural approach for investigating social capacity for landscape-scale planning.

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## 1. Introduction

The need to plan natural resources management at the landscape scale is well-recognized because many environmental processes occur across large areas (Knight & Landres, 1998). The probability and potential severity of a wildfire, for example, is a function of the composition and distribution of flammable vegetation sometimes quite distant from the location of a forested stand

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(Ager, Vaillant, Finney, & Preisler, 2012). In many cases, however, planning at landscape scales is difficult because administrative boundaries established by society do not conform to ecological boundaries (Landres, Knight, Pickett, & Cadenasso, 1998). This is especially true with large landscapes such as ecoregions, which are composed of many public and private land ownerships (Powell, 2010). Around the world, organizations, agencies, and academic scholars seek to increase understanding of cooperation across ownerships on natural resource management to improve natural resource management (Brunckhorst, 2011).

In lieu of agencies or organizations equipped to manage multi-ownership landscapes, organizational networks can potentially play an important role in natural resource planning on large spatial scales. Organizational networks are defined as sets of interacting organizations and the ties among them. Ties refer to relationships and interactions between organizations, such as for the purpose of working together or sharing information. Organizational networks generally form when capabilities of existing organizations are insufficient to complete a given task on their own, and costs prohibit adding to those capabilities internally, and when there are functional gains associated with connecting to others (Benjamin, Brechin, & Thoms, 2011; Wolf, 2011). Organizational networks can serve as collaborative institutional structures uniting stakeholders into both formal and informal arrangements that can help facilitate flows of information and resources, and fulfill functions necessary for dealing with cross-boundary issues that traditional ownership-focused organizations cannot. Because networks are not bound to a specific structure, they can operate across multiple jurisdictions and geographies (multiscalar), have many centers of authority (polycentric), and consist of local to national stakeholders and organizations (multi-level) (Powell, 2010). This flexible structure allows networks to address large-scale, multi-jurisdictional problems beyond a single organization's capacity (Butler & Goldstein, 2010).

By bringing organizations with different goals, geographic foci and land management preferences into contact with each other, networks can help create conditions for cooperation across ownership boundaries on landscape planning. Cross-boundary cooperation refers to communication, coordination and joint-implementation by multiple parties of plans and actions on scales larger than single ownerships (Yaffee, 1998). The theory of cooperation is based on the benefits of reciprocity to participating parties when combined efforts can achieve more than individual efforts. For cooperation to be possible, several social conditions must be met: parties must share a common understanding of a problem (shared cognition) and sense of belonging to a common group (shared identity), and view other parties as fair, capable and entitled to play a role (perceived legitimacy) (Bouas & Komorita, 1996; Gass, Rickenbach, Schulte, & Zeuli, 2009; Rickenbach & Reed, 2002; Swaab, Postmes, van Beest, & Spears, 2007; Tyler, 2006; Tyler & Degoey, 1995). Opportunities for exchanging information and ideas, such as through formal and informal networks, are important for building social conditions that foster cooperation among diverse stakeholders (Ostrom, 1990; Yaffee, 1998). However, the natural social tendency to interact with others who are geographically or socially near (i.e., homophily) (McPherson, Smith-Lovin, & Cook, 2001) conceivably could impede social cohesion among diverse stakeholders across large areas. Little is known about the extent to which shared concern about natural resource problems can counter this tendency.

Given the potential role networks can play in landscape planning, and the fact that increasingly large and intense wildfires are a pressing challenge in many countries (Williams, 2013), we investigated a network of organizations concerned about wildfire risk for evidence of social ties that promote cooperation on landscape-scale planning. Our goal was to investigate whether

shared concern about landscape-scale problems could counter homophily as an influence on the structure of an organizational network. Our research questions were: (1) To what extent are organizations with different management goals and geographic foci interacting with each other around the problem of wildfire risk, and (2) What do these patterns of interaction suggest about opportunities for cooperation on landscape planning?

We hypothesized that organizations concerned with wildfire risk would interact more with organizations that shared the same goals and geographic focus than with organizations that did not. According to social capital and social network theories, this tendency would suggest that while subnetworks of like-organizations may be in a position to communicate about, coordinate, and jointly-implement plans, the network as a whole would not exhibit a structure that promotes cooperation.

Our geographic focus was the Eastern Cascades Ecoregion (ECE) in Oregon, USA (Omernik, 1987) (Fig. 1), where wildfires are becoming increasingly large and difficult to control. Ecoregions are large landscapes with distinct assemblages of natural communities that share species dynamics and environmental conditions. Cooperation on planning at the ecoregion scale can be helpful because it can facilitate management of a common problem in a common set of environmental conditions (Powell, 2010). For example, in the case of wildfire, cooperative planning could facilitate agreement on circumstances under which management techniques such as thinning and prescribed burning are appropriate for reducing flammable vegetation and restoring forest conditions to lessen the risk of large wildfires, and strategic use of these techniques.

Social network analysis (Wasserman & Faust, 1994) served as the basis of our methodological approach. Social network analysis assumes that the structure of networks – the extent to which networks allow for interaction among organizations within and across social and geographic boundaries – can indicate potential to build the mutual understanding, group identity, and perceived legitimacy needed for cooperation on landscape planning. Network analysis has been used in sociology and organizational studies to quantify structural conditions for cooperation (Borgatti, Jones, & Everett, 1998; Burt, 2000; Lin, 1999), including in natural resource management contexts (Bodin & Crona, 2009; Bodin, Crona, & Ernstson, 2006; Newig, Günther, & Pahl-Wostl, 2010). In ecology, studies have used network analysis to understand ecological structures and processes for landscape planning purposes (Cook, 2002; Cumming, Bodin, Ernstson, & Elmqvist, 2010; Jongman, Külvik, & Kristiansen, 2004; Kong, Yin, Nakagoshi, & Zong, 2010; Minor & Urban, 2008; Rhodes, Wardell-Johnson, Rhodes, & Raymond, 2006; Saura & Pascual-Hortal, 2007). Some scholars have proposed social network analysis as a useful approach to examining social capacity for planning and management at landscape scales (Bodin & Tengö, 2012; Cumming et al., 2010; Guerrero, McAllister, Corcoran, & Wilson, 2013; Mills et al., 2014; Opdam, Steingröver, & Rooij, 2006), although empirical studies are limited.

We interpreted our findings about network structure through the lens of social capital and social network theory to identify opportunities for cooperation on landscape planning. These theories suggest that bonding social capital structure (i.e., interactions among actors in the same social group) promotes communication and collective action (Borgatti et al., 1998), transfer of knowledge (Reagans & McEvily, 2003), creation of common norms, and development of trust and mutual understanding (Burt, 2000; Coleman, 1990). Bridging social capital structure (i.e., interaction between actors from different groups), on the other hand, promotes access to new information and resources needed for complex problem-solving (Burt, 2000; Granovetter, 1973; Lin, 1999; Reagans & McEvily, 2003; Reagans & Zuckerman, 2001; Rogers, 1983; Ruef, 2002). We investigate the extent to which the network of organizations concerned with wildfire risk in the ECE exhibit a balance

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