Guidebook to cognitive mapping with diverse stakeholders in natural resource management
Overview

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Introduction

Forested landscapes in the wildland-urban interface include complex and reciprocal interactions between human and ecological systems; a relationship captured by the concept of social-ecological systems. While natural resource management has historically focused primarily on ecological components (e.g., vegetation management for timber production, development of wildlife habitat), such actions are both influenced by and have meaningful impacts on related social systems and vice versa (e.g., settlement patterns in disturbance-prone landscapes influences future decisions about disturbance response). Furthermore, many aspects of natural resource management are as much a social endeavor as biophysical, including the range of management options that are considered, the information used to inform options, the way options are communicated to the public and other stakeholders (defined broadly as any person or entity that has a direct interest in management decisions), the decisions made, the manner in which they are implemented, and the evaluation of outcomes.

While natural resource management has increasingly attempted to address social system components, current planning approaches are generally limited in their ability to effectively identify the psychological or social factors that influence preferred outcomes or management approaches among stakeholders. Each stakeholder brings his or her own values, worldviews, and understanding to a natural resource management decision and these have a profound influence on his or her views about preferred conditions and expectations of appropriate management approaches. However, these underlying variables are rarely discussed openly and, in many cases, may operate largely subconsciously within individuals.

This guidebook introduces two potential methodologies that managers could use to identify how stakeholders think about a natural resource management issue (relevant components, desired conditions, preferred management approaches) with the goal of improving stakeholder engagement in management decisions. The overall guidebook includes three sections: this overview and two detailed step-by-step guides (one for each methodology).

Cognitive mapping
Cognitive mapping can be used to develop a visual representation of how a person thinks about a particular concept, issue, or situation (Byrch et al., 2007). Through the process of developing this representation the individual must sort through, select, and analyze his or her own thoughts; seeing them on paper (or other media) can help the person recognize connections between their thoughts, and help them to clarify and better articulate their understanding of an issue (Ackermann et al., 1992).

Cognitive maps can be made individually, in groups, or through a combined approach, depending on the overall goal of the mapping exercise. According to Ackermann et al. (1992), when used in a group setting, individual maps can facilitate shared understandings and emergence of a common language. Each person is able to see their perspectives in the context of others, thus increasing understanding of their own and others' points of view, alternative approaches, and different ways of seeing the world. The presentation of maps in a group setting can be done either anonymously or not, each has unique advantages depending on the social context. If maps are presented to a group anonymously, the ideas and perspectives are less tied to the charisma or communication skills of the individual, which can facilitate everyone's voice being heard. At the same time, presenting maps with names associated can reduce assumptions within the group about how someone thinks about an issue, which can also be of value. A combined approach of presenting maps with and without names could take advantage of the benefits with both approaches.

Cognitive maps can be used at a variety of points in a decision process including: problem identification, setting management goals, identifying barriers and potential solutions to achieving desired outcomes, among others. The following are examples of possible applications:

- A National Forest is preparing to update its Forest Plan and stakeholders have expressed a variety of opinions about goals they feel should be advanced with the new plan. A cognitive mapping approach can be used to help participants identify and articulate concrete goals, consider interactions and potential tradeoffs between goals and other components of interest (e.g., habitat provision, fire risk reduction, recreation, restoration, revenue generation).
- A county has been identified as being at extremely high risk for wildfire. Public agencies have decided to concentrate efforts to reduce risk, but do not have a specific project in mind or a strong working relationship with nearby communities. Cognitive mapping can be used to identify a focal issue of particular concern to stakeholders in the area and values at risk on the landscape related to that focal issue.
- Interest groups, business interests, members of the public, community leaders, and government agencies have decided to work together on natural resource management in an area where there has been a history of contention. Cognitive mapping can be used as a starting point to identify underlying worldviews, values, and priorities, as well as specific challenges and ideas. Through this process areas of common ground can be identified, as well as areas of potential conflict that perhaps should be set aside until the group has a positive history of working together.

There are a variety of methods to develop cognitive maps, varying in their degrees of complexity, use of technology, and pre-determined structure. Both methods described here are meant to develop maps that illustrate each participant's understanding of a social-ecological system. These maps can then be compared to identify similarities and differences between stakeholders. One method uses cognitive maps to articulate participant views on current and desired future ecological, social, and economic conditions, and mechanisms to reach desired future conditions. The other method included multiple contacts with participants to facilitate development of a coherent articulation of their view on a specific management issue; participants were then recorded describing their perspective to share with other stakeholders. Both approaches also included a participatory workshop to enable group discussion and share participant perspectives on the particular issues in question. These approaches are designed to help participants better understand and articulate their own perspectives while also gaining a greater understanding of the perspectives of other stakeholders. In doing so, stakeholders are better able to understand the complex nature of natural resource management decisions and grapple with the

multiple interacting variables and interrelated outcomes that such decisions produce. Each method concluded by providing an opportunity for participants to assess the approach we used to engage them in the process. While it may not be required to provide such an opportunity for stakeholder assessment every time such an approach like this is used, doing so could not only provide useful feedback for managers to inform future efforts to engage stakeholders, but also serve to increase trust with participants as they feel their views are appreciated and can help shape future interactions.

Method 1: Using cognitive mapping to explore stakeholder perceptions of desired future conditions

Values, worldviews, knowledge, and experiences shape a person's conceptualizations of a landscape including the current conditions, desired conditions, problems they see related to conditions or management practices, and ideas on how to move toward desired conditions. Even when two people use the same terms, such as "healthy", "sustainable", or "restored" they can have different conceptualizations of what the terms signify and really be talking about different things.

In this method stakeholders are asked to define and describe factors associated with:

1) Current forest, social, and economic conditions
2) Desired future forest, social, and economic conditions
3) Mechanisms to reach desired future conditions including
    a. Policies and overarching strategies
    b. Specific management actions
    c. Partners and stakeholders

Once all of the individual cognitive maps have been created, the interview team reviews responses to identify key points raised by participants in each of the topics above, as well as areas of consensus and divergence in participant maps. Following this analysis, all participants are brought together in a one-day workshop to see and discuss their maps as well as those of other stakeholders. Since everyone is asked the same questions and the maps are constructed using the same overall framework, it is relatively easy to see where areas of common ground and divergent perspectives exist. During the interviews, particular challenges and specific ideas to reach desired future conditions may come up; lists of these can be made prior to the workshop to share with the group as a whole. Reviewing the range of agreement across the maps and lists of challenges and ideas can provide a foundation from which to work by facilitating relationship building and the setting of priorities. An example of a completed map is shown in Figure 1.

Figure 1. Example of a cognitive map covering current conditions (blue sticky notes), desired future conditions (green sticky notes), and mechanisms to reach desired future conditions (pink sticky notes).

Method 2: Fire management in a multi-functional landscape

This method is designed to help stakeholders to clarify and articulate their values and priorities associated with a particular management issue within a social-ecological system. In this approach individuals are taken through a process in which their voice is directly sought and retained through a video recording, which not only allows others to understand their viewpoint, it also helps the individuals themselves to develop and organize their own thinking. The methodology involves a four stage process: 1) semi-structured interview to build rapport and identify a specific management issue, or focal area, to explore further ; 2) the creation of a short video where participants share their perspectives around that management issue; 3) the creation of 'sticky dots' reflecting socio-ecological values associated with the management issue; and 4) a final workshop where the video and sticky dots come together to develop a cognitive map of values at risk around the management issue.

Once a focal area is selected, each participant is asked three questions:

1) The role of the focal area in managing risks from wildfires
2) Who they think is responsible for management of the focal area
3) What they believe needs to be done in the future

After participants have sufficient time to gather their thoughts and prepare their answers, they are video recorded answering the questions; each participant's perspective is then woven into a single video. From this single video the values at risk and priorities around the focal area are identified. These are placed on a set of color-coded stickers for each participant to place on maps of the landscape, thus creating a cognitive map of the values at risk around a specific focal area within a particular social-ecological system.

After creating the maps and watching the video, the research team facilitates a discussion with workshop participants to illuminate the areas of common ground and differences in perspectives within the stakeholder group. The cognitive maps of the values at risk provide a visual representation of priorities for management. An example of the resulting cognitive map is shown in Figure 2.

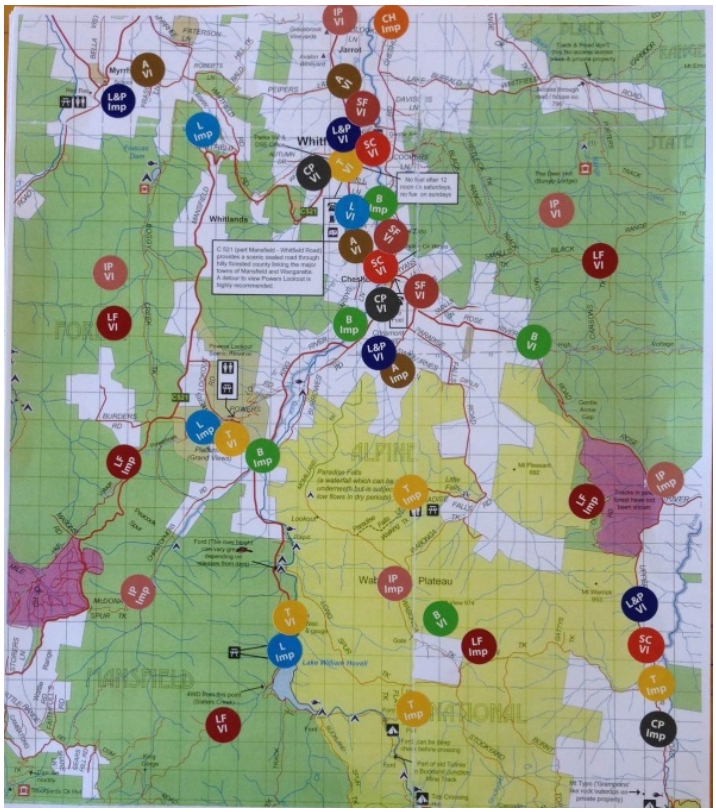

Figure 2. Example of a completed cognitive map of values at risk around a particular focal area within a specific social-ecological system

Summary

Managing multi-functional landscapes is highly influenced by social as well as ecological components. Cognitive mapping approaches can help diverse stakeholders better understand their own conceptualizations of these social-ecological systems and priorities for management. The combination of cognitive mapping and participatory workshops can serve to more fully engage stakeholders than traditional public participation processes when addressing management issues on a contested landscape. This overview introduces two methodologies developed for engaging stakeholders around management of a particular social-ecological system that can be adapted to meet specific management needs. Detailed step-by-step guides to both approaches can be found in companion documents titled "Section II: Using cognitive mapping to explore stakeholder perceptions of desired future conditions,"

and “Section III: Fire management in a multi-functional landscape,” located on the project website[1]: https://www.firescience.gov/JFSP_advanced_search.cfm.

References

Ackermann, F., Eden, C., Cropper, S., 1992. Getting started with cognitive mapping, *7th Young OR Conference, University of Warwick, 13-15 April, 1992*, Coventry, England, pp. 65-82.

Byrch, C., Kearins, K., Milne, M., Morgan, R., 2007. Sustainable "what"? A congitive approach to understanding sustainable development. Qualitative Research in Accounting & Management **4**, 26-52.

[1] As specific web addresses may change, this link takes interested readers to the JFSP research projects search page where our project can be found by selecting “Toman, Eric L” as the researcher name. The full project name is: “Managing Multi-Functional Landscapes at the Interface of Public Forests and Private Land: Advancing Understanding Through a Comparison of Experience in U.S. and Australia”.