The Social Fabric of Watershed Management

Subjects: Water Resources

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Watershed management, a critical component in preserving and enhancing our natural environments, necessitates a comprehensive understanding of the social networks that underpin the organizations dedicated to this cause. The intricate web of relationships and interactions within and between such organizations can influence their operational efficacy and impact on watershed conservation and management. A social network analysis (SNA) encompasses theoretically grounded methods designed to analyze various types and attributes of relations among individuals and groups.

watershed management social network analysis

1. Introduction

Watershed management, a critical component in preserving and enhancing our natural environments, necessitates a comprehensive understanding of the social networks that underpin the organizations dedicated to this cause. The intricate web of relationships and interactions within and between such organizations can influence their operational efficacy and impact on watershed conservation and management.

A citizen-based watershed group is a grassroots organization that is primarily driven by community members, distinct from formal non-governmental organizations (NGOs). It operates independently of government agencies, with its activities—including its establishment, management, and evaluation—carried out by the citizens themselves [1]. Characterized by voluntary participation, community-driven initiatives, and a focus on local environmental issues, these groups often embody a more localized approach to environmental stewardship than larger, more structured NGOs. An agency-based watershed group, in contrast, is typically facilitated, managed, and evaluated by government entities such as municipalities or other public administration bodies [1]. These groups are structured around governmental mandates and policies, focusing on broader, regionally relevant environmental concerns and compliance with regulatory frameworks. Mixed groups often arise in situations where there is a convergence of community interests and governmental objectives [1]. These hybrid organizations blend the community-driven focus of citizen groups with the structured approach of agency-based groups, facilitating collaboration and resource sharing between citizens and governmental entities. Understanding the fundamental differences and potential synergies between these types of groups helps in assessing the dynamics, roles, and impact of these groups in watershed management, particularly in terms of their social networks.

2. Social Network Analysis for Natural Resource Management

A social network analysis (SNA) encompasses theoretically grounded methods designed to analyze various types and attributes of relations among individuals and groups. The networks formed by individuals and organizations consist of webs of relationships and interactions [2]. SNA applies the structure of these relationships to systematically represent networks, using nodes and ties as foundational elements. This model underpins a suite of mathematical tools that analyze the causes and consequences of diverse types of relations.

In recent decades, there has been a surge in interest in employing SNA for natural resource management [2][3][4][5][6][7][8]. Social networks among individuals or subgroups can positively influence outcomes [9] but can also obstruct collaboration, productivity, and innovative capacity [6][10]. For instance, excessively tight social networks may resist evolution or the acceptance of new ideas and technologies from outside the network. Therefore, comprehending the dynamics of social networks is pivotal for planning, management, and innovation.

SNA emphasizes evaluating core types of ties within and between groups, including ties of common goals [11], information or knowledge sharing [7][12][13], learning [14][15], trust [11][16][17][18], funding support [13], idea sharing [13], and more. SNA seeks to interpret the hidden structural properties underlying visible ties by identifying the structural properties of support networks, examining relationships between individuals and stakeholders, determining the positioning of different individuals or stakeholders within the network, and revealing how relationships are structured within the entire network [19].

Ultimately, SNA is instrumental in understanding the functionalities of social networks, such as the roles and positions of key actors and the flows of knowledge and information, which can potentially influence elements like resilience and adaptive capacity for environmental change [20]. SNA can also identify, select, and engage core individuals or stakeholders in participatory processes related to natural resource management [7][10].

Numerous studies have demonstrated that SNA can be utilized to comprehend various resource management issues or to provide supplementary information. Researchers have employed social networks to enhance aspects of social capital in natural resource management, such as governance processes [6][12][21][22][23], local leadership [24], adoption of new skills or knowledge [7][14][15][24][25], productivity and innovation of capacity [6], involvement of new stakeholders [12][26], recruitment and self-development [27], conflict resolution [3][28], trust between stakeholders [17], and collaborative decision making [7][29][30]. In the analysis of networks, researchers have sought to unveil the structure of social networks suitable for given environments [16][27][29][31][32][33] or to discern the roles or positions of actors and ties in the network [12][28][34][35][36]. Among them, a few studies have concentrated on the social networks of watershed groups as “organizations” [3][24][37].

Ptak [38] offers valuable insights into the role of intermediaries. Their study explores the pivotal role of intermediaries in fostering policy integration and system transformation. This reinforces the importance of such roles in facilitating effective communication and collaboration in complex environmental management scenarios.

Analyzing social networks unveils the relationship between network relations and the underlying structural patterns that emerge among actors. Therefore, SNA examines the attributes of individuals, relations among actors, how

actors are positioned within a network, and how relations are structured into overall network patterns [39][40][41]. Consequently, SNA can be categorized into three levels: individual, subgroup, and overall network level [2][42]. Although analyses for all three levels are equally vital, most SNA studies for natural resource management have focused on stakeholder analysis [12][16][30][31], which necessitates network- and subgroup-level analyses. Nonetheless, individual-level analysis is also paramount in determining the relationship between the outcomes and roles of individuals and in determining if a subset of individuals can be represented as one node for a subgroup [8][25][34][43].

3. Watershed Management Groups

Some researchers [44] address watershed management from a global perspective, while others [24] approach it from national or regional viewpoints. This research specifically focuses on the watershed management of the Hudson River area in New York State, adopting a regional lens. Particularly, it examines how the formation of social networks among individual members of organizations managing watersheds can facilitate the flow of information and resources, thereby enhancing the effectiveness of these networks. Lastly, while some research [45][46][47] has been conducted on agency-based watershed management groups, others [24] have focused on citizen-based groups, and yet others [1] have examined mixed-type watershed management groups.

Building relationships through partnerships is a crucial aspect of watershed organizations, and numerous assertions relate to their effectiveness [24]. The concept of “conservation through cooperation” (Local Champions Speak Out: Pennsylvania’s Community) is pivotal. Different groups exert their influences in varied ways. While citizen-based groups often rely on traditional, adversarial means, such as lobbying and petitioning [48], the impact of mixed and agency-based groups tends to be more subtle and less visible, often through technical advice and changes in individual decision-making [1].

Researchers have found that agency-based groups adopt the strategies of the parent organization, as opposed to other types of groups, which may develop more internally based strategies [49]. The research by Graversgaard et al. [50] on agency-based watershed management in Denmark demonstrates that the integration of regional water councils as participatory groups significantly improved the effectiveness of river basin management plans, resulting in more efficient and ecologically favorable outcomes in watershed management. Thus, the type of watershed group can shape both processes and outcomes. However, there is a noticeable gap in the literature concerning comparative analyses of how different watershed groups utilize their social networks. Most studies have focused on the network and subgroup levels, often overlooking the individual level, which is crucial for understanding the roles and outcomes of specific actors within a network [8][25][34][42][51][52].

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