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Competing Structure, Competing Views: The Role of Formal and Informal Social Structures in Shaping Stakeholder Perceptions

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ABSTRACT. What is social structure, and how does it influence the views and behaviors of land managers? In this paper, we unpack the term "social structure" in the context of current research on institutions, social networks, and their role(s) in resource management. We identify two different kinds of structure, formal and informal, and explore how these link to views of land management and management practice. Formal structures refer to intentionally designed organizations that arise out of larger institutional arrangements; informal ones refer to social networks, based on the communication contacts individuals possess. Our findings show significant correlations between respondents' views regarding land management and their social networks; it is these informal structures that have greater influence on what stakeholders perceive. These findings suggest that stakeholders are less influenced by their particular organizational affiliation or category (e.g., "conservationist" versus "farmer"), and more by whom they speak with on a regular basis regarding land management. We conclude with a discussion on the practical implications for resource managers wishing to "design" participatory management, arguing that, if "diversity" is the goal in designing such participatory processes, then diversity needs to translate beyond stakeholder categories to include consideration for the personal, social networks surrounding stakeholders.

Key Words: *formal organizations; homophily; institutions; land management; social networks; social network analysis; social structure; stakeholder perceptions*

INTRODUCTION

What is social structure and what role does it play in natural resource management? This question looms large in discussions pertaining to the role of institutions for common-pool resources (Ostrom 1990, 1992), and as this Special Issue demonstrates, social networks as a type of social structure play an important role in resource management. We compare two kinds of social structures: formal and informal structures, and show how these two kinds of structures relate to the ways individuals think about and value the land. We first clarify what we mean by "formal" and "informal" structures, and ask how such structures would compare with one another. In answering this question, we look to Ostrom's (1990) definition of an institution, but we also look to others (March and Olsen 1989, López and Scott 2000, Rydin and Falleth 2006, Elder-Vass 2007) for help in disentangling ideas of

organizations, social networks, and institutions as structuring frameworks. With these working definitions in place, we then ask how stakeholders' views and opinions regarding land management coincide with (1) the social networks in which stakeholders are involved and (2) the organizational context in which they are found. Answering these questions involves an empirical analysis of ongoing case study research in the uplands of the United Kingdom. Our findings provide insights into the role of social structure in general and highlight in particular the role social networks play in shaping stakeholders' views on land management. We conclude with how these data can be used to make informed stakeholder selections, and offer some guidance on ways in which facilitators and/or researchers might use these insights in shaping their own efforts to build participatory, deliberative processes.

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LITERATURE REVIEW

The difference between formal and informal structures

"Institutions" are an abstract concept that scholars have struggled to define for quite some time. There is still no set agreement on the term, but in general, scholars tend to draw on the Parsonian (Parsons 1937, 1951) view of institutions as referring to established norms, rules, and practices that guide and constrain human behavior and action (North 1990, Ostrom 1990, Polski and Ostrom 1999, Bandaragoda 2000, López and Scott 2000, Elder-Vass 2008). Institutions can be classified as formal or informal (North 1990, Casson et al. 2010); the former generally refers to laws, written contracts, and other codified artefacts. Informal institutions can refer to conventional practice, beliefs, social networks, cultures, and norms that rest alongside, challenge, or reinforce more formal structures (Ostrom 1990, Polski and Ostrom 1999, Rydin and Falleth 2006).

Another distinction commonly made in the literature is that between an institution and an organization, where the former is often seen as guiding the creation of the lalter (North 1990). Organizations can be seen as groups of individuals with clearly defined roles, who are bound by some common purpose, as well as some common set of rules and procedures to achieve set objectives (Bandaragoda 2000). As such, organizations can, in some cases, act as proxies for institutions; certain organizations can be seen as reflecting higher-level institutional arrangements, and they often perform the same sort of constraining and guiding role in relation to individual actions and behaviors (March and Olsen 1989, Polski and Ostrom 1999, Bandaragoda 2000, Rydin and Falleth 2006). Because organizations can be seen as a set of "institutional arrangements" (Polski and Ostrom 1999), they can be distinguished in formal and informal terms in much the same way as institutions. As such, formal organizations can be defined as ones that are intentionally organized (Coleman 1990), arising out of larger institutional arrangements (March and Olsen 1989, Polski and Ostrom 1999, Rydin and Falleth 2006), where clearly defined roles are assigned to individuals, and where all members are bound by a common purpose (Blau and Scott 1962, Blau and Schoenherr 1971, Bandaragoda 2000). Examples of formal organizations include government and nongovernment agencies, farmers'

unions, and universities. Formal roles include those of conservationist, farmer, or councillors; these are roles that are defined largely by the organizational context (e.g., a councillor working for a local authority) or stem from an institutionalized practice (e.g., a farmer working the land in uplands UK). In contrast, informal organizations can be likened to clans, families, and social networks (Polski and Ostrom 1999, Rydin and Falleth 2006). Here, structure is understood as the social relations themselves, the patterns of interdependence among individuals and their actions, and how these patterns build into different structural configurations (Lopez and Scott 2000:3).

This discussion pertaining to formal and informal institutions and organizations points toward a basic distinction between two types of social structure. The first we refer to as informal social structures, and here, we see informal structures manifested in social relations or rather social networks. In contrast, formal organizations and institutions are examples of formal social structures. In both cases, we perceive structure as providing constraints and incentives for individuals to think and/or act a particular way. The purpose of the current study is to explore the differences of formal and informal structures in relation to stakeholder perceptions.

The role of social structure in influencing individuals

Research on social structures, both formal and informal ones, suggests a variety of ways in which social structures influence individuals' thoughts, values, and behaviors. In this section, we look at what research suggests to be the role of formal organizations in influencing individuals as compared with the role of informal structures, that is, social networks.

Formal organizations

Research across disciplines suggests that formal organizations can shape opinions, beliefs, and behaviors of individuals. For example, social movements research shows that organizational membership can predict individual members' ideological stances on certain issues (Carroll and Ratner 1996). In the organizational theory literature, formal organizations are described as constraining the views and behaviors of its members by virtue of shared beliefs, that is, a shared organizational

culture (Deal and Kennedy 1982, Hill and Jones 2000, Hill 2009). Here, organizational culture is described as a process involving shared values that develop into organizational norms, which in turn transform into concrete guidelines that outline the appropriate kinds of behavior for employees (Hill and Jones 2000). Such a perspective on the structural influences of formal organizations has been challenged more recently, however, with the notion of organizations having multiple (sometimes competing) cultures (Jermier et al. 1991, Martin 2002, Howard-Grenville 2006); here, organizations are seen as embodying not just one, overarching culture, but multiple subcultures, each of which can contain its own shared meanings regarding the organizational task or problem at hand (Jermier et al. 1991). In relation to resource management and governance, organizational culture (and/or subcultures) can be seen as guiding members views, opinions, and subsequent actions with regards to a particular problem or task (Welford 1997, Reinhardt 1999, Aragon-Correa and Sharma 2003, Howard-Grenville 2006).

Social networks

In contrast to this view of the role of organizations and organizational culture stands the literature pertaining to the influence of social networks. Here, the phrase "birds of a feather flock together" summarizes the arguments linking the role of social networks to the similarity among individuals according to views, beliefs, and behavior (Lazarsfeld and Merton 1954). Commonly known in the social networks literature as the "homophily effect," the main argument here is that individuals who are similar to one another are attracted to one another, and this social attraction leads to individuals forming a tie with one another (Blau 1977, McPherson et al. 2001). In addition, if the IESPACE.jpg social tie linking two individuals is a strong one (e.g., a close friendship) and/or multiplex (e.g., a friend who is also a colleague), then the likelihood for similarity across a range of characteristics increases (McPherson et al. 2001, Ruef et al. 2003), and this similarity increases further when the linked individuals are embedded in a circle of friends or similar sort of cohesive, dense structure (Krackhardt 1992, 1998, 1999, Krackhardt and Kilduff 2002).

Closely linked to arguments regarding social selection are those regarding social influence. Here, individuals who are tied to one another influence one another's perceptions and behaviors, thus resulting in more similarity over time (Friedkin 1998). As noted by Robins et al. (2001), it is difficult to pinpoint which comes first with regards to social selection and influence: are individuals first attracted to similar others or does similarity arise over time? Most likely, these processes are closely intertwined (Robins et al. 2001). Thus, in this article, we will understand both processes as part of the homophily effect.

In the context of natural resource management, homophily is discussed as a double-edge sword. On the one hand, individuals who are similar to one another have more mutual understanding, and thus are able to communicate implicit knowledge more easily (Raymond et al., *unpublished manuscript*). However, because knowledge exchange is more likely to occur between similar individuals, new information may only diffuse through a small, like-minded subsection of an otherwise heterogeneous population, thus not reaching other, dissimilar individuals and groups (Granovetter 1973). Homogeneity can also be problematic when stakeholders need to come together to problem solve or develop alternative management options. Here, diverse knowledge and view points are necessary, and thus groups composed of like-minded actors can be counterproductive to natural resource management efforts (Crona and Bodin 2006, Newman and Dale 2007, Prell et al. 2009). For example, Isaac et al. (2007) showed that dissimilar farmers were most likely to exchange knowledge about agricultural innovations. Newman and Dale (2005) suggest that homophily may reduce the resilience of communities to environmental change, whereas diversity is more likely to facilitate adaptive management. On an individual level, research has shown that individuals with ties to environmental organization members, not the organizations themselves, are more likely to have a personal plan to deal with climate change (Tindall 2008)

Taken together, research and theory suggest that both formal structures (such as formal organizations) and informal ones (such as social networks) can work to guide and constrain individuals' views and behavior. Furthermore, these two kinds of structures can easily coexist and reinforce one another. For example, belonging to an organization naturally increases the likelihood of forming ties with other organizational members (Feld 1981, 1982).

In relation to natural resource management, this means that attempts toward developing participatory processes in which stakeholders can potentially learn and influence one another needs an understanding of the ways current opinions among stakeholders coincide with their current social structures. In what follows, we investigate how formal and informal social structures relate to stakeholders' views regarding land management to see whether one seems to play a stronger role than the other.

CASE STUDY

Background

The current study took place in Nidderdale, Yorkshire, UK, officially designated as an Area of Outstanding Natural Beauty (AONB). There are 40 AONBs in England and Wales created by the legislation of the National Parks and Access to the Countryside Act of 1949, including about 18% of the countryside in England and Wales (please see http://www.aonb.org.uk for general information). This AONB status is given to safeguard the distinctive character and natural beauty of an area, along with its local habitat and geology. In doing so, an AONB is also seen as an important place for recreation and tourism.

The Nidderdale AONB covers 603 km^2 and consists of a mixture of private and public landownership consisting of heather moorlands in the upland areas and farmland in the lower reaches. It also offers a number of important ecosystem services, including drinking water, food, carbon deposits in peat, and cultural services, such as recreational benefits (AONB Office 2009). Recreation is of particular importance to the area, given its classification as an AONB, and as such, land management within the area must give special attention to the needs of the public. Toward this end, the Nidderdale AONB management is overseen by a Joint Advisory Committee (JAC), which includes a wide variety of organizations whose work has an impact on the AONB (AONB Office 2009) and who are seen as representing the diversity of opinion within the region. The actual management involves a variety of tasks, which include the following: advising local authorities, government agencies, and other organisations on how to protect the AONB; promoting awareness of the AONB across the wider

community; developing conservation projects with partner organizations; awarding grants for conservation projects; and providing opportunities for volunteers (AONB Office 2009).

Our intent in approaching the Nidderdale JAC was to first gain insight into the relevant stakeholders and issues affecting the area and, from this understanding, build an ongoing dialogue with these stakeholders to problem solve and develop a range of land management alternatives for addressing some of the controversial issues and challenges of uncertainty the region had been facing (e.g., how to cope with climate change or new policies). This site was the second of three sites we worked in, each representing different upland areas in the United Kingdom. The classification of this area as an AONB meant that we also had a relatively clear geographical boundary to work with, as well as an initial stakeholder group to begin discussions. The JAC provided us with background information on the uncertainties and challenges faced by the area, and we built on this initial understanding through conducting a social network analysis, as well as gathering data on land management views. All these data were considered part of the process of understanding the context of the area as a means for further planning participatory initiatives aimed at mutual learning and adapting to future change (Dougill et al. 2006, Hubacek and Reed 2009, Prell et al. 2009).

Data gathering

The data gathered on social structure include social network data and data on stakeholders' organizational affiliation.

Social network data (informal structure)

Social network data were gathered through structured phone interviews. The interview script consisted of a number of initial name-generator questions, each aimed at having respondents nominate or "generate" a name as someone with whom they communicated regarding issues of land management. In addition, follow-up name interpreter questions were asked, which elucidated information on the nature and strength of the tie. In particular, we approached all 28 members of the JAC, plus five additional individuals suggested to us by the JAC membership. These five additional

respondents came from national-level conservation groups such as English Nature and the Department for Environment, Food, and Rural Affairs (DEFRA).

In approaching these respondents, we opted not to present all 33 names as a roster to respondents, but instead chose this name-generator technique as we wished to uncover JAC members' communication networks within and outside the JAC. This desire to trace ties within and outside the JAC reflected our goals for looking at the informal structural influences surrounding JAC members (see the next section for discussion of formal structures). To do so, we could not assume that studying the JAC network alone would be sufficient for our purposes.

Once our 33 respondents nominated names of individuals, we used name-interpreter questions to gather data on the frequency of communication contact between these respondents and their nominees. Here, respondents rated their frequency with others by offering scores between 1 (infrequent communication) and 5 (very frequent communication). In addition, respondents stated how many different relations they held with these others, for example, whether their nominees were friends, neighbors, colleagues, employees, and/or employers (please refer to Appendixes 1 and 3 for further details on the gathering and structuring of these data).

The interviews with the 33 respondents resulted in another set of 30 new names, and we attempted to approach this new set of respondents to conduct a second round of interviews. We managed to reach 20 of these new respondents; thus, of the potential 63 names we wished to interview, we managed to interview 53. From the 20 new interviews, another 30 new names were nominated, and these we chose to ignore. At this point, we had gathered data on the JAC members and those individuals who were directly tied to JAC members, and as discussed above, it was this network surrounding JAC members that was of prime interest to us.

The networks of JAC nominees were of interest to us only to the extent to which these nominees' networks included JAC member names. Thus, nominees' ties to JAC members were recorded and the others discarded. A digraph of the final network data we used for analyses can be found below in Figure 1: this network consists of all 53 individuals we were able to interview, and the communication ties between them (please note: although these data

were valued data reflecting the frequency of communication between respondents, the digraph below does not attempt to visualize these relative frequencies, but rather treats ties uniformly as either present or absent, to allow for a clearer presentation). The 10 individuals we were unable to reach for interviews were not included in this final network (Figure 1); as our analyses required network data to be compared with attribute data (e.g. organizational affiliation), and as we were unable to collect attribute data on these 10 individuals, we decided to likewise remove these 10 names from the network data. The next two sections describe the attribute data we gathered.
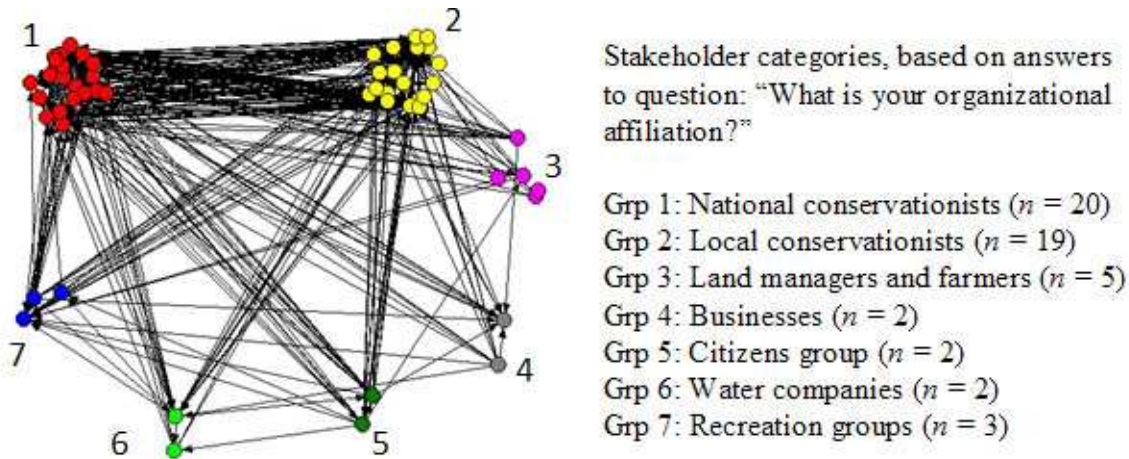
Organizational affiliation (formal structure)

In addition to asking respondents about their network ties, we also asked respondents in the context of our interviews to tell us what organization they either worked for or were affiliated with in issues pertaining to Nidderdale land management. The organizational affiliations that respondents listed ranged from government and nongovernmental conservation agencies (on both the local and the national level), various local businesses, recreation groups, water companies, farmers, and land managers. Those respondents who could not be linked to an organization of some kind were placed in the "citizen" category ($n = 2$). In Fig. 1, you can see the stakeholders have been grouped according to categories derived from these organizational affiliations, or in the case of two respondents, placed in the category of "citizen."

The digraph in Fig. 1 shows the 33 original respondents and 20 of their 30 nominees, as well as the communication ties linking these individuals together. Individuals have been grouped together based on stakeholder categories, which (as mentioned above) were based on stakeholders' organizational affiliation. Thus, Fig. 1 offers a pictorial representation of the two social structures of interest in this study, the informal structure comprised of the social network, and the formal structure comprised of stakeholder categories based on organizational affiliation.

The predominant amount of stakeholders falling into the conservationist category, on either the local or the national level, was not surprising; the JAC was composed primarily of conservationists, although attempts were made to bring in outsiders as well, in particular land managers and farmers.

Fig. 1. Digraph showing stakeholder communication network (*n* = 53).

Stakeholder categories, based on answers to question: "What is your organizational affiliation?"

Grp 1: National conservationists (*n* = 20)
Grp 2: Local conservationists (*n* = 19)
Grp 3: Land managers and farmers (*n* = 5)
Grp 4: Businesses (*n* = 2)
Grp 5: Citizens group (*n* = 2)
Grp 6: Water companies (*n* = 2)
Grp 7: Recreation groups (*n* = 3)

Please note: "Citizens group" (Grp 5) is composed of respondents who did not offer a name and asked to be called a citizen.

This was also a finding in previous research we had done in other upland regions in the UK (Prell et al. 2008, 2009). Thus, one question we held in the back of our minds was the extent to which JAC land management views seemed to coincide with a "conservationist bias." As will be seen in later sections of this paper, however, being labeled a conservationist actually had little to do with the way JAC members and/or their nominees thought about the land.

Land management views

In addition to gathering data on social networks and stakeholder organizational affiliations, our interview questions consisted of 29 Likert-scaled items on land management views. These questions were devised from previous scoping interviews with stakeholders both in Nidderdale as well as in other upland research sites (Prell et al. 2008, 2009). Thus, all items found on the questionnaire were relevant to UK uplands and ranged from general to specific issues regarding uplands land management (see Appendix 2). Our scoping interviews indicated that certain issues (e.g., heather burning) were more controversial than others. We wanted to try and capture such controversies with more precision and,

once uncovered, see whether certain formal or informal structures could help explain these differences in opinion.

The majority of the 29 statements yielded results showing strong agreement among the respondents. That is, most respondents tended to "strongly agree" with most of the statements. Only five of the statements resulted in scores showing a wider dispersion of opinions. As suggested earlier, previous research in nearby areas alerted us to certain controversial issues (Reed et al. 2005). As such, we interpreted the dispersion in views as reflecting controversy among respondents. The phrasing of these five items, along with their results, can be found in Fig. 2. Further, this figure groups these five land management statements according to which ones show medium and high amounts of controversy, where higher amounts of controversy are reflected in a wider dispersion in responses.

Upon reflecting on these five statements within the wider context of our research site, we were able to make some initial, intuitive interpretations for why these statements, in particular, were controversial. For example, the statement "changing land management to reduce water color" may have been controversial due to the high degree of uncertainty

Fig. 2. Controversial views of land management.
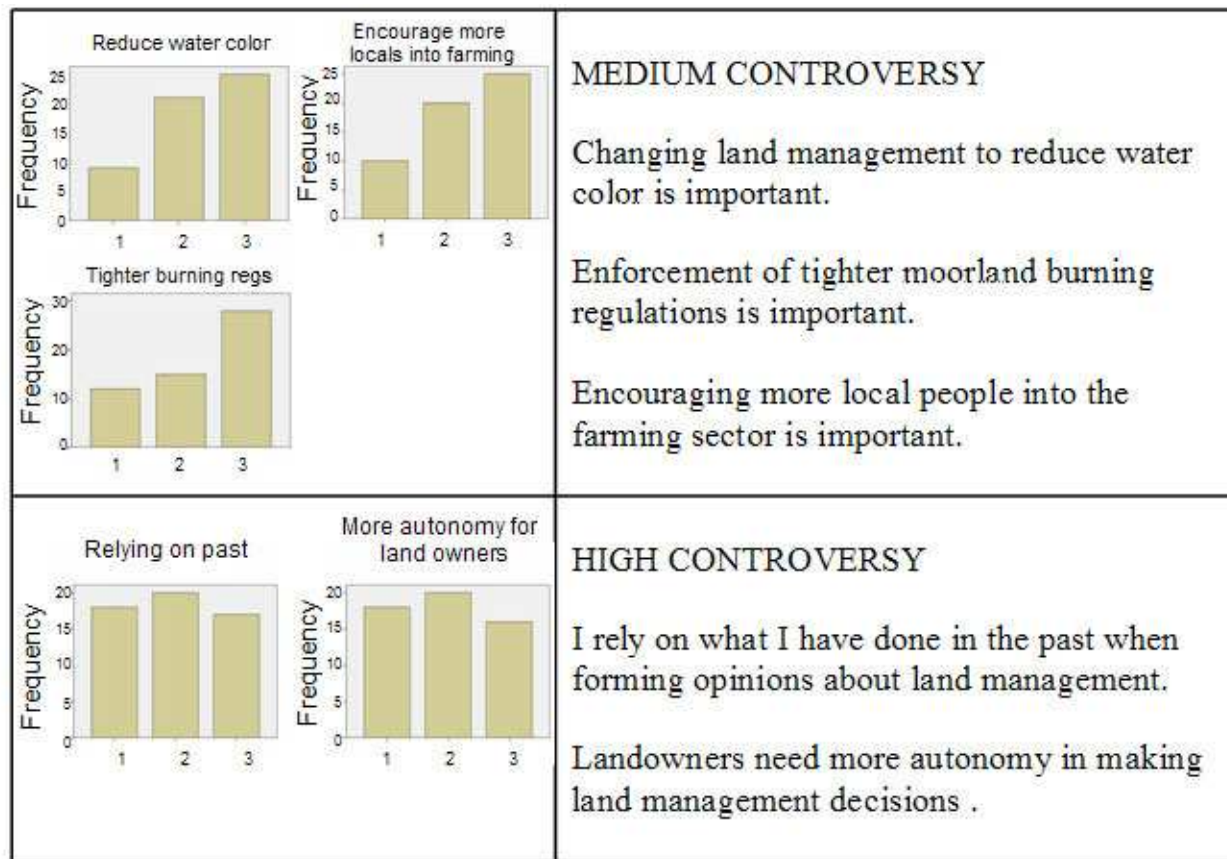
Please note: Each item was measured on a 5-point scale, where 1 = Strongly Disagree and 5 = Strongly Agree. However, to gain a better sense for how the stakeholders *differed*, we collapsed the results from the 5-point Likert scale to a 3-point Likert scale, where values 1 and 2 were collapsed into a "disagree" category; value 3 remained the same, representing a "neutral" category; and values 4 and 5 were collapsed together to form an "agree" category.

in the scientific literature about the effects of certain changes in land management (in particular, managed burning) on water color (Holden et al. 2007). This uncertainty may have been known by some of the respondents. The statement "enforcement of tighter moorland burning regulations is important" reflected a well-known contentious issue among stakeholders during the years of our research (2006–2009), despite the outcome of DEFRA's (2007) review of the heather and grass burning code. For example, we knew that

conservation groups had been lobbying for tighter regulation for some time, and this was not reflected in the outcome of the review (DEFRA 2007). Thus, we expected that many stakeholders would still hold the view that tighter regulation is necessary and that this view would contrast with the views of other stakeholders who argued for more flexibility in managing burning (Reed et al. 2005). Further, this desire for more flexibility is reflected in the controversy regarding the following statement: "landowners need more autonomy in making land

management decisions." Previous work in the UK uplands showed us that the issue of autonomy was a fault line between conservationists and land manager groups (Reed et al. 2005).

Finally, we knew from previous interviews that there were mixed feelings about current and historic land uses such as farming. We felt these mixed feelings germinated from reductions in subsidies, coupled with unstable market prices in farm products, increased input costs, and increased regulation (such as IED). Thus, dispersion of opinion regarding the statement "encouraging more local people into the farming sector is important" seemed to reflect this tension between a desire to keep old traditions alive and doubts over the future of upland farming. Perhaps for these reasons, previous experience and practices are perceived by some to be increasingly irrelevant to current and future land management decisions, and this could potentially explain controversy over the following statement: "I rely on what I have done in the past when forming opinions about land management."

Thus, on the basis of our larger understanding of the research site, we had developed an intuitive understanding for why these particular statements did not yield high amounts of agreement among respondents. Further, our interpretation rested largely on stakeholder categories such as "conservationist" versus "farmer," as well as on certain historical events in the area. The extent to which this interpretation was accurate, however, was precisely what we wished to explore: Could respondents' views be better explained by their stakeholder categories, or could these differences in opinion be better explained by an alternative, that is, stakeholders' social networks? In the following section, we discuss how we investigated these competing claims.

ANALYSIS AND DISCUSSION

Land management views and social networks

As stated in the literature review, past research on homophily suggests that people who share social ties with one another are more likely to share similar views. In addition, this tendency increases when (1) the tie shared between the two individuals is a strong one and (2) the individuals in question are embedded in denser structures, such as cohesive subgroups or cliques. Thus, in the context of this study, we

expected a high correlation to exist between those respondents sharing the same or similar scores on land management views and the presence of a tie between those respondents; further, we expected this tendency to increase when the tie shared was a strong one and/or one embedded in a cohesive structure.

To test this, we correlated the data for each of the five statements (Fig. 2) with our data on the frequency of communication. In particular, we made three data transformations on our social network data to bring out the structural features of interest before then correlating these structural features with our data on land management views (each of these data transformations is described in more detail in Appendix 3). The first transformation was a dichotomization, whereby we reduced the communication network data (which contained values indicating the frequency of contact) to a binary matrix consisting of 1s and 0s, where 1s indicated the presence of a tie and 0s the absence of a tie between two individuals. The second transformation consisted of aggregating the frequency of communication matrix with the matrices on the different relations. This aggregation resulted in a single, strength-of-tie matrix depicting the relative strength between any two individuals in the network.

The third transformation made use of the binary matrix to isolate and extract those ties that were embedded in a closed triangle. Ties embedded within a closed triangle are referred to in the social network literature as Simmelian ties (Krackhardt 1998). Figure 3 shows a picture of a Simmelian tie.
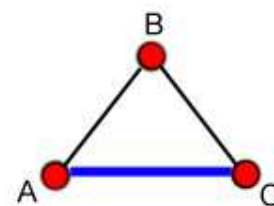

Fig. 3. Example of a Simmelian tie.

As Fig. 3 shows, actors A and C share a Simmelian tie with one another, as the tie they share is embedded within the larger structure of a closed triangle. In focusing attention on Simmelian ties,

we are, in essence, extending consideration for a higher level of structural density beyond simple tie strength, and in doing so, we link to arguments discussing the role of network cohesion in relation to homophily (Krackhardt and Kilduff 2002).

Correlations were then calculated between each of these three matrices and each of the five stakeholder views. The Geary C statistic was used for all correlations, and permutations used to control for the interdependencies of the network data (see Appendix 3 for more details). The findings for these analyses are shown in Table 1, followed by more discussion on each of these analyses and their findings.

Column 2 in Table 1 shows results for the binary matrix and the five land management views. The results show two of the five statements on land management correlating significantly with the presence of ties, implying that respondents who share a tie with one another also tend to share the same opinion. Column 3 shows the results for the strength-of-tie matrix. Here, the number of instances where stakeholders think similarly with regards to certain land management views has doubled, and at the same time, the significance levels have increased, implying that stronger ties are better predictors of similarities in views among stakeholders. A third round of correlations was done looking at the relationship between Simmelian ties and land management views. The results, shown in column 4, show only two statements correlating significantly with the presence of Simmelian ties. Furthermore, the significance levels have dropped somewhat, with one of the results only being marginally significant.

Such a finding is disappointing, given the theory and logic behind homophily arguments that denser structures would yield stronger tendencies toward similarity among individuals. However, in this particular stakeholder social network, there were not many Simmelian ties to begin with (a total of 15 Simmelian ties were located), and thus, even in spite of this low number of Simmelian ties, the data still move in the direction one would hope; that is, Simmelian ties are coinciding with similarity in views on certain controversial issues.

However, the lack of Simmelian ties may be a healthy sign of "network diversity" for the JAC. The lack of closed triads indicates that JAC members are not redundant in their network ties, that is, they

each have their own personal network that does not overlap much with other members'. In the interest of bringing diverse views to the table in resource management scenarios, such network diversity is encouraging. Although, as mentioned earlier in the context of homophily and natural resource management, such diversity may result in too much tension among the JAC members. This is a point we will discuss later.

Land management views and organizational affiliation

In addition to our analyses focusing on the relationship between social networks and land management views, we also investigated what relationship might exist between stakeholders' categories, based on organization affiliation, and stakeholders' land management views. Again, our interest was in seeing what social structures, alternative to those emerging from social ties, might help explain similarity in viewpoints regarding certain land management topics. We ran regression models with stakeholder categories as an explanatory variable. We controlled for respondents' age, as past research has shown age to be a strong predictor for respondents' similarities in views, values, and/or behavior (Feld 1982, McPherson et al. 2001). Each of the five land management views were run separately as the dependent variables. Only one of the models yielded significant results (Table 2).

Whereas the presence of ties, strong ties, and Simmelian ties can predict similarity in views for most of the land management controversies, here we have stakeholders' affiliations with organizations explaining only the one remaining controversial statement not picked up by previous analyses. This was a surprising finding; as noted earlier, our initial interpretation of the land management conflicts stemmed from our larger understanding of the conflicts among stakeholder categories in the UK uplands. Thus, we had expected stakeholder categories to explain more of the differences in opinion than what is found in Table 2.

To help us better understand the findings in Table 2, we conducted one final analysis to determine the relationship between stakeholder category and the presence of social ties. As previous research on homophily suggests, stakeholders might be attracted to those within their own stakeholder

Table 1. Autocorrelations between land management views and social network features.

Land management views	Significance Level		
	Tie	Tie-strength	Simmelian tie
Landowners need more autonomy in making land management decisions.	0.018	0.012	0.045
Enforcement of tighter moorland burning regulations is important.	0.003	0.011	0.05
Encouraging more local people into the farming sector	—	0.006	—
Changing land management to reduce water color	—	0.006	—
I rely on what I have done in the past when forming opinions about land management.	—	—	—

Please note: In correlating the Likert-scaled items with the social network data, a randomization test of autocorrelation, making use of permutation testing, was used. The Geary C statistic was used for testing levels of significance. See Appendix 3 for more details.

category. For example, farmers would communicate mainly with other farmers, and conservationists would talk mainly with other conservationists. If this were the case, then the effect of social networks, uncovered in our analyses, might be cloaking the influences of stakeholder categories, that is, individuals were not only communicating with others who thought alike, but in addition, they were communicating with others who were part of the same category. However, our analysis and findings showed this was not the case; in performing another Geary C autocorrelation between stakeholder category and tie presence, we found no significant results ($P = 0.31$). Thus, these stakeholders seemed to be forming ties with others from different stakeholder categories, who nonetheless shared similar views on certain controversial land management topics. In other words, JAC members do not necessarily seek out others who are part of their own organization and/or engaging in the same (institutionalized) practices (e.g., farming).

Because stakeholder category does not appear to be an attractor for forming ties, can we deduce that stakeholders seek out others who share similar views on land management practice? Although our data are not longitudinal (and thus we are limited in making causal claims), we can reasonably argue that an individual's views are not readily visible to outsiders, and therefore, views are not powerful sources of attraction. Instead, similarity in views among stakeholders most likely emerge from the presence of a social tie, and thus, it is these ties that influence, over time, similarity in views.

CONCLUSIONS

We began with a discussion on social structure, looking at what previous research says about the role of structure in influencing individual views, beliefs, and behaviors. Although the current study does not consider behaviors, we did look at a variety of statements that reflect stakeholders' views, opinions, and beliefs in relation to uplands management. Through identifying some controversial topics for land management among a group of stakeholders in Nidderdale's AONB, our aim was to try and understand and explain controversy through looking at features of stakeholders' social networks and compare these with stakeholders' categories. We used homophily arguments to frame our expectations regarding the role of social networks, and we turned to the literature on institutions and organizational cultures for guidance on the role formal organizations might play. With

Table 2. Regression model for stakeholder category and land management view.

	Unstandard coefficient	Standard coefficient
I rely on what I have done in the past...		
Stakeholder organizational category	0.21*	0.44*
Age	−0.05	−0.06
Model R = 0.179; F = 5.448; P = 0.013		

*Stakeholder category was significant at $P < 0.01$. Age was a control variable, but was not significant.

regards to networks, our expectations were largely met: similarity in views regarding land management coincided with various features of social networks. Only one controversial view was accounted for by stakeholders' categories. Taken as a whole, there is support for the argument that similarity in views coincides with the presence of social ties, be they strong or not, and the presence of higher order dense structures, such as those represented by the presence of Simmelian ties. There is less support, however, for the idea that one's organizational affiliation or stakeholder category plays a role in the views that individuals have on land management. As such, these results offer some practical implications for those interested in designing deliberative arenas for participatory natural resource governance. As such participatory endeavors seem to rely on the notion that engaging a diverse group of stakeholders is important (Pahl-Wostl et al. 2007), we argue that identifying where the diversity lies is not a straight-forward process. Our data suggest that organizational affiliation does not equate with particular views of land management (Knussen et al. 2004). Rather, views and values are closely linked to whom individuals speak with, and the more frequent the communication, the stronger the similarity in views. Thus, when bringing together diverse views and opinions is the aim, selecting stakeholders from different organizations and categories is simply not enough. Neither is it enough to simply find those stakeholders who represent different stakes. Individuals are embedded in social ties, and it is these ties that are the constraining and influencing forces that practitioners need to come to grips with. Thus, in issues of stakeholder selection and involvement, where the hope is to develop processes for mutual learning, we come back to our earlier conclusions from previous research (Prell et al. 2008, 2009): Understanding the social networks can help unlock and thus assist in changing the social dynamics and processes guiding natural resource management.

Responses to this article can be read online at:
http://www.ecologyandsociety.org/vol15/iss4/art34/
responses/

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APPENDIX 1. NAME GENERATOR AND INTERPRETER QUESTIONS

Q1: Please think back on the most recent decision you had to make regarding land management in Nidderdale. Did you discuss this decision with any person or organization? If yes, who was that person/ organisation? You may list more than one.

Q2: Are there certain places or events (e.g. Pubs, particular meetings) where you most often tend to discuss land management issues pertaining to Nidderdale? If so, where are these places, and with whom, at these places, do you converse about land management issues?

Q3: Are there any other individuals, government agencies, non-government agences, or businesses with whom you discuss land management issues pertaining to Nidderdale?

Q4: Finally, think back to the last time you had a disagreement or dispute regarding Nidderdale land management issues: who was the person or group with whom you had this dispute?

Based on the nominations respondents gave to these questions, we asked respondents a series of follow-up 'name interpreter' questions. These questions allowed us to gather more detailed information on the nature of the tie, and they included the following:

Q1: How frequently do you interact with this person or group?

[ ] very rarely [ ] a few times/year [ ] monthly [ ] weekly [ ] daily
(Please note: We inputted the above data as 1 = very rarely...5 = daily)

Q2: How would you define your relationship to them? Select as many as apply:

[ ] colleague [ ] friend [ ] boss [ ] employee [ ] neighbour [ ] other __
(Please note: We inputted each of the above relations as separate matrices, e.g. a 'colleague' matrix, 'friendship' matrix, and so forth. All responses recorded as binary data, e.g. 1 = friendship tie in friendship matrix)

APPENDIX 2. LAND MANAGEMENT STATEMENTS

In your opinion, how important are the following for the future of Nidderdale?

Please circle the number that best reflects your opinion:
strongly disagree 1 2 3 4 5 strongly agree

1. Developing alternative flood risk management approaches in the face of climate change is important

2. Improving water storage capacity in upland catchments is important

3. Increasing biodiversity is important

4. Changing land management to block grips is important

5. Changing land management to reduce sheep numbers is important

6. Changing land management to stop burning on blanket bog is important

7. Understanding the relationship between moorland burning and water colour is important

8. Enforcement of tighter moorland burning regulations is important

9. More financial support from Government for upland farmers is important

10. Encouraging recreation is important

11. Encouraging tourism is important

12. Reducing the negative environmental impact of tourists is important

13. Improving the links between the local community and land managers is important

14. Exploring Nidderdale's potential for wind farms is important

15. Restoring moorland grips is important

16. Land owners need to work more closely with agency staff and Government policy

17. Land owners need more autonomy in making land management decisions

18. We need to change current land management practices to address climate change

19. Improving the economic viability of upland farming is important

20. We need to encourage more local people into the farming sector

21. We need to improve carbon storage in uplands

22. We need to maintain shooting and sporting interests in the uplands

23. Providing affordable homes for local people is important

24. Changing land management to reduce water colour is necessary

25. We should allow the uplands to return to a natural state, without management

26. ' I rely on what I have done in the past when forming opinions about land management'

27. ' I think we should experiment with new land management strategies'

28. ' I think we should rely more on previous experience when it comes to land management strategies'

29. ' Land management practice is guided too much by regulatory bodies'

APPENDIX 3. ADDITIONAL METHODOLOGICAL NOTES

Population and network boundary

Identifying a network boundary is a tricky business in network analysis, and more details of ways of doing this can be found in Wasserman and Faust, 1994. We used snowball sampling, but also, to draw the boundary, we made use of theoretical justifications for stopping the sampling process; as described in the article, we were mainly interested in uncovering the social networks of JAC members, to compare this kind of social structure with that of stakeholder categories to see which structure correlated most strongly with land management views. As such, 'rolling a snowball' until no more new names were nominated was not deemed necessary in the context of our research, although we did discover that names did, indeed, start to repeat. In the end, we interviewed all JAC members, and we interviewed 20 of 30 new names these JAC members nominated, as described in the paper.

There were some other issues we encountered: certain answers provided by the second round of respondents were problematic, in that some respondents felt uncomfortable offering an actual name. Thus, some respondents nominated categories of stakeholders such as 'farmers', or 'neighbours' or 'county officials' as opposed to actual persons. As such, we tended to disregard nominations that were not linked to actual persons. Thus, the two shortcomings of our sample, therefore, were that we were unable to contact 10 of 30 nominated names, and we had no means of ascertaining whether certain responses such as 'neighbours' or 'farmers' may or may have been JAC members.

Use of permutation tests and p-values for analysing data derived from social networks

Complete social network data (as opposed to ego-network data) are assumed to be interdependent, i.e. that respondents are *not* independent of one another. And this interdependency assumption is seen as the very nature of social network data. As such, theoretical distribution models (such as a normal curve) can not be used for making inferences on network data. Thus, network analysts often make use of a form of non-parametric testing called permutation tests (also referred to as boot-strapping). Although permutation tests typically are used for deriving p-values, they do not work so well for deriving confidence intervals or for attaining coefficient values **(Good 2005). Thus, one can only comment on the significance of the relationship in question, and not on the strength of that relationship, and this is the reason why coefficient values are absent from Table 1. Finally, permutation tests were used not only for the Geary C statistic in computing network autocorrelations (Table 1), but also for the regression model used for analyzing the attribute data of social actors (Table 2).**

Use of the Geary C statistic for network autocorrelation

This statistic is a measure of spatial autocorrelation, and as such, focuses on the proximity of observations in time **(Geary 1954). In this case, the proximities translate into two observations in a two-dimensional space. As social network data correlated with individual attribute data can be conceptualized as this sort of two-dimensional space, the Geary C statistic was used. In addition, Geary C was chosen, as it is more sensitive to local network structure than other procedures, for example Moran I.**

Creating a binary matrix

To test for the relationship(s) between the presence of a social tie and similiarity in views, we transformed our valued data reflecting the frequency of communication between stakeholders to binary data. In transforming valued data to binary data, we in essence reduced the social network data to a recording of the mere presence or absence of a communication tie between any two pair of stakeholders, where a 1 represented the presence of a tie and 0 the absence of a tie.

Creating a strength-of-tie matrix.

The strength-of-tie matrix was created by aggregating i) the communication matrix containing valued data reflecting the frequency of contact between individuals (with 1 = rarely and 5 =daily); and ii) the six binary matrices that reflected the six potential relationships between individuals (friendship, colleague, boss, employee, neighbor, other). Thus, if an individual actor was recorded as both a 'friend'

and a 'colleague,' that person received a score of 1 in each matrix representing the different relation, and 0s in the matrices representing the other relations. The strength of tie matrix was then created through aggregating these different matrices. Thus, for example, the data gathered from a respondent who nominated another person as a 'friend' and 'colleague,' and who also stated they had 'daily' communication contact with that person (rated 5), was thus aggregated to one score, that of 7, in the new strength-of-tie matrix.

We are aware that this way of handling relationships glosses over qualitative differences in kinds of ties, e.g. an employer-employee relationship is different from a friendship one. However, for present purposes, we were interested in capturing the idea that a relationship could contain more than one kind of dimension. Future research can explore in more depth the qualitative differences in these stakeholder relations.

Creating a Simmelian ties matrix
We made use of the binary communication matrix (described above). Here, we used UCINET's procedure for creating a Simmelian ties matrix. In essence, this procedure extracts only those ties from an observed network matrix, where the ties in question are embedded in a closed triad, as shown in Figure 3. Thus, the resulting matrix generally has considerably fewer ties than the original matrix, as these other structure features are considered in making the extractions.

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