

SOCIAL NETWORK ANALYSIS TO SUPPORT THE FOREST LANDSCAPE PLANNING: AN APPLICATION IN ARCI-GRIGHINE, SARDINIA (ITALY)

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Abstract

Social capital is defined as what is existing in the structures of interactions between individuals and groups (collective and individual social actors) which are said to develop trust and social rules and to strengthen cooperation and reciprocity. On the other hand social capital depends on the quality and quantity of interactions and it can facilitate coordination and cooperation in decision making process. Considering that networks are a crucial part of the social capital, the present paper analyses the potentiality of Social Network Analysis (SNA) to support the forest landscape management planning. The authors have applied, in Arci-Grighine forestry district (Sardinia – Italy), the assessment of institutional social capital. The method used to evaluate institutional social capital considers three phases: i) the mapping of stakeholders, ii) the analysis of voluntary associations with particular reference to the environmental and forestry sector, iii) the analysis of social network considering type and force of ties (weak and strong ties). The authors present and discuss the utility of these tools to support collaborative forest planning, in particular to take into account the needs of stakeholders and the necessity of limiting the conflicts.

Key words: social capital, decision making, social network analysis, forest planning.

Introduction

Social capital is a certain set of informal values or norms shared among members of a group that permit cooperation among them (Fukuyama 1997). On another side, social capital is the actual or potential resources that inhered in inter-

personal group relations and is accessible to members of a group (Coleman 1988). Social capital is the norms, common rules, networks and social trust that facilitate coordination and cooperation (Putnam 1995). According to Pretty and Ward (2001) social capital is characterized by some features: rela-

tions of trust, reciprocity and exchanges, common rules, norms and sanctions, connectedness in networks and groups. The relations of trust facilitate cooperation and reduce the transaction costs between people and groups (Pretty 2003), reciprocity and exchanges contribute to the development of long-term obligations between individuals, rules and sanctions give individuals the confidence to invest in the collective goods (Pretty and Smith 2004) and social networks facilitate the information flow and the decision making process.

The social capital concept elaborated by social sciences has been extended to the natural resources management with particular emphasis to various types of management described by the terms collective-, community-, joint-, participatory- and co-management (Pretty 2003). Co-management is one of the main features of forest landscape planning. Forest landscape planning address long-term forest management issues, with special attention to social and environmental functions, that cannot be properly considered by referring to a single forest property. In consideration of this scale of analysis, forest landscape planning must take into account all society instances.

Normally, a high and well structured social capital is associated with a social substrate more suitable to introduce an incremental approach¹ (Buttoud 2000)

¹ Incremental approach considers that decisions are the result of all the needs and interests express by stakeholders, this approach is opposite to the rationalist approach that is based on a deductive chain of decisions taken by the public authority (Buttoud 2000).

in forest management. This is related to the fact that social capital promote healthier communities through partnerships with a shared sense of the common good (Crawford et al. 2008). To quantify the social capital in natural sciences is necessary to analyse some key-features as the memberships in voluntary associations and the connectedness in networks and groups (Liu and Besser 2003). These key-features are important elements to support forest landscape planning in evaluating whether there are the conditions to develop an incremental approach in the definition of management guidelines.

In consideration of the social capital role in forest management, the paper presents a method to quantify the key-features of social capital (associationism and social networks) at the beginning of a forest landscape plan development. The theoretical method is applied to a study case in a forest district localized in the Sardinia island (Italy).

Materials and Methods

The area of study is the Arci-Grighine district (39° 42' 7'' North; 8° 42' 4'' East) localized in the Centre-East area of the Sardinia island. The Arci-Grighine district has a total surface of 55,183 ha, corresponding to the 2.3% of the Sardinia surface. The population is 26,207 (2001 Census) for a density of about 0.47 persons per ha. The district comprises 21 municipalities; the most populous is Marrubiu with 4,671 inhabitants (density 0.76 persons per

ha) and the less populous is Siris with 249 inhabitants (density 0.42 persons per ha). The forest surface is 18,349 ha divided in 43.2% ha of broadleaf forests, 16.6% of evergreen forests, 39.6% of Mediterranean forests and 0.6% of mixed forests. Considering that the forests are 33.3% of land use of Arci-Grighine district, the other land uses are agricultural land (36.1%), grassland (10.7%), shrub land (12.7%), and agropastoral land (5.2%).

The purpose of the paper is to analyse the potentiality of social capital to support a forest landscape management plan (FLMP). Social capital is also a tool to understand the possibility of success of a collaborative approach in the forest planning decision making process.

To estimate social capital and the correlated social network 124 questionnaires have been submitted to the main stakeholders of Arci-Grighine district by interviewer. Stakeholders is "any group of people, organised or unorganised, who share a common interest or stake in a particular issue or system" (Grimble and Wellard 1997). In the present case the issue is the forest management of Arci-Grighine district. After a preliminary stakeholders analysis (Mitchell et al. 1997) the stakeholders have been divided in two groups: individual (forest and wood enterprises, forest owners, farmers) and collective stakeholders. The second group has been divided in two sub-groups: institutional organizations (such as municipalities, and other local administrations) and civil associations (environmental, game and sportive, tourist and cultural associations).

Considering this framework, 46 individual stakeholders and 78 collective stakeholders (43 institutional organizations and 35 associations) have been interviewed.

According with the study's objective the social capital is analysed considering two features:

- level of associationism with particular reference to the environmental and forestry sector;
- social network among associations and institutional organizations (collective stakeholders).

According to Woolcock (1998) social capital has a role in contributing to the production of desired socio-economic outcomes. In particular, the *level of associationism* is the participation in non-profit organisations and it is a key indicator of the economic growth of an area. The associationism rate captures the cultural and civic attitudes of a society and consequently it influences the economic performance and the effect of economic policy (Clemente et al. 2008). This aspect of social capital has been measured using three indicators: (1) number of associations with reference to the population, (2) average of associates per association, (3) average of active volunteer per association with reference to the associates.

Social network is a key information to investigate the social capital because it focuses on how social structure facilitates and constrains opportunities, behaviours and cognitions (Tindall and Wellman 2002). To analyse the social network of a community it is

fundamental to find out the social ties existing between collective actors. Moreover it is important to describe the strength of relationship that it is defined as "combination of the amount of time, the emotional intensity, intimacy (mutual confiding), and the reciprocal services which characterize the tie" (Granovetter 1973, 1361 p.) According to Harshaw and Tindall (2005) the weak ties are the ties with a low combination of time, emotional intensity, intimacy and reciprocal services, while the strong ties have a high combination of time, emotional intensity, intimacy and reciprocal services.

The strength of relationship has a different role to support the beginning of the development collaborative forest plan. Weak ties are more suitable to provide novel informations (Granovetter 1973) and this can make a network more resilient and adaptive to environmental changes (Prell et al. 2009). Strong ties are more influential in terms of attitude and opinion formation and these have the advantages to create a favourable environment for the mutual learning and the sharing of resources and advice (Prell et al. 2009). In this study the authors have considered three levels of strength of ties: strong ties, moderately weak ties and very weak ties.

Beyond, the type of connectedness is an important feature to characterize the network. In this paper only one type of connectedness is analysed: technical and projectual aspects of forest management.

The strength of relationship and the type of connectedness have concurred

in elaborating the network structure. The statistics and the graphical representation of network (structure) are elaborated by SocNetV 0.81. Finally, the results of structure have been analysed using two parameters of network: centralization index and position of key-actors in the network (centrality).

Centralization index measures the variability or heterogeneity of node centralities and it measures the degree of dispersion of all node centrality scores in a network from the maximum centrality score obtained in the network (Sinclair 2009).

The position of single actors in the network has been analysed through three measures of centrality (degree, closeness, betweenness). In particular it has been explored to which type of stakeholder (association or institutional organization) – with its respective role in forest management – is associated the maximum value of centralities.

Degree centrality (DC) is defined as the number of nodes (actors) in direct contact with a particular node (Freeman 1979). DC includes InDegree centrality (IDC) and OutDegree centrality (ODC): IDC is linked to the concept of prestigious and it depends on the number of incoming links, while ODC sets the actors in hierarchical centrality and this concept is associate to the power.

Closeness centrality (CC) is defined as the inverse of farness and it is the sum of distances of a particular node from all other nodes. CC measures how quickly an actor can access more actors in a network and it evidences which actors are able to contact and transmit informations to a high number of other actors.

Betweenness centrality (BC) is calculated as the fraction of shortest paths between node pairs that pass through the node of interest (Newman 2005). BC measures the influence that a node has over the spread of informations through the network. Therefore, it evidences the actors that have the role of intermediators in the decision making process. These actors have a real power in the control of informations.

Table 1. Average value of associates and active volunteers for type of association.

Type of association	Associates	Active volunteers
Environmental	105	60
Hunting	95	87
Cultural and sportive	14	9

Considering centralization and centrality, it is possible to characterize

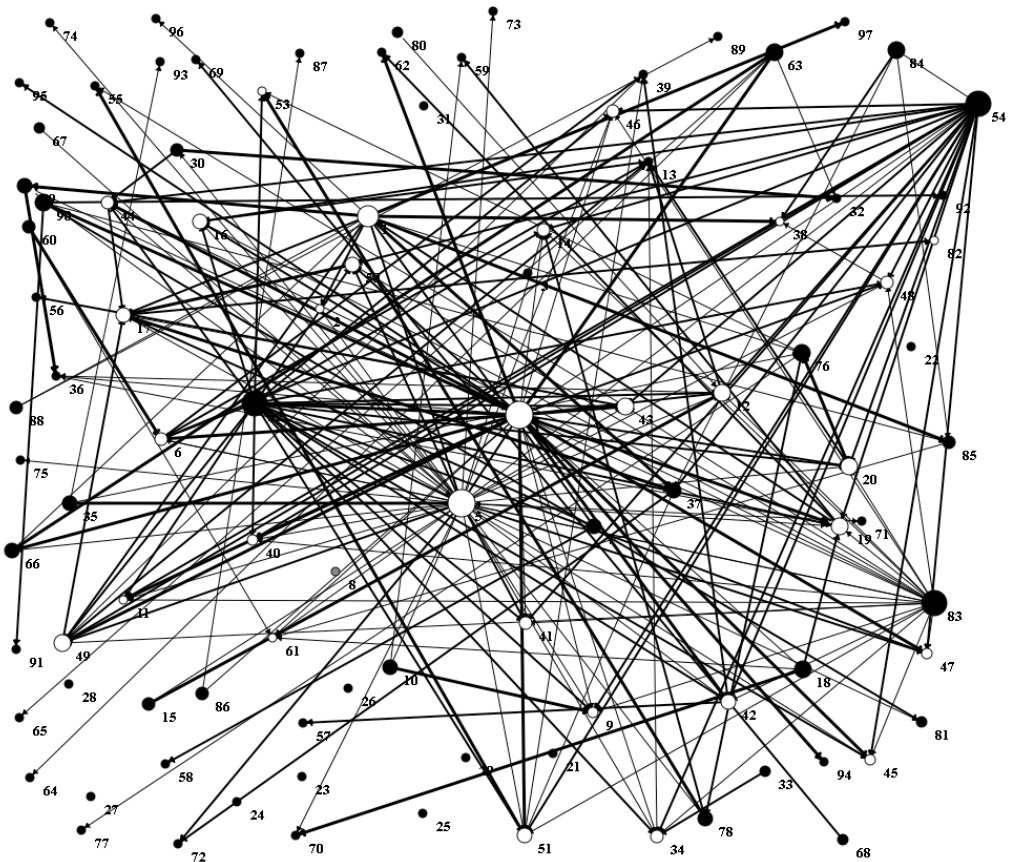


Fig. 1. Social Network Analysis (indegree and outdegree nodes) of the forest management sector in Arci-Grighine district (in white institutional organization, in black associations).

three theoretical types of network structure in decision making process in forest management:

- Centralized network: one or two actors are in dominant position and all the others are at the same level. Centralized network is helpful in the initial phase of forming groups and building support for collective action.

- Scattered network: no actors are in dominant position.

- Regionalized network: no actors are in dominant position but there are two or more groups of stakeholders in sub-dominant position. The sub-dominant groups can derive from different interest-groups or from a geographical fragmentation (two or more areas with a distinct policy and/or administrative centre).

Results

In consideration of the *level of associationism* linked to the forestry sector, in the Arci-Grighine district there are 8 environmental associations including the environmental education centres, 13 hunting associations and 14 cultural and sportive associations. Therefore, there is 1 association per 749 persons and considering only the environmental associations there is 1 association per 3,276 persons.

Eight environmental associations (100%), 7 hunting associations (53.8%) and 4 cultural and sportive associations (28.6%) have been interviewed. The average of associates per association is 79, but this value changes deeply in relationship to the type of association (Tab. 1). The environmental associations

have the maximum average of associates (105), while the average for the hunting associations is 95 members and for the cultural and sportive associations 14 members. This high difference is linked to the territorial context of reference. Normally the cultural and sportive associations are local, while the hunting and environmental associations have a wider area of influence (Archi or Grighine sub-district or province).

Analysing the active volunteers per association the framework changes: the average of active volunteers per association is 59 (75% of associates). For the hunting associations 92% of associates are also active volunteers, while in environmental associations only 57% of members are active and in the cultural associations 63% of members are active.

The *social network analysis* related to the technical and projectual aspects of forest planning and management is reported in Fig. 1. The network has 97 nodes (actors), 254 links and a density of 0.027. The mean nodal in- and outdegree is 4.67. Maximum value indegree and outdegree are registered by an institution (CFVA²). The maximum value of closeness centrality is for a multi-purposes association active in the pasture and in the horse tourism, while the maximum value of betweenness centrality is for Ente Foreste³. The structure of network is centralized in

² CFVA (Corpo Forestale e di Vigilanza Ambientale): is the organization devoted to the forest monitoring towards natural hazards (forest fires, landslides, etc.) and to the protection of the environment (biotopes, natural areas, etc.).

³ Ente Foreste: is the organization devoted to the forest planning and management of municipalities territory.

reason of the presence of two actors with high power in the decision making process and some actors in sub-dominant position. The actual structure is a more favorable structure for a top-down decision making process (rationalist approach) respect to a incremental approach.

Discussion and Conclusion

In conclusion, proposed method allows through two indicators (level of associationism and social network) to analyse and to evaluate the possibility of success of an incremental approach in forest planning and management. The ideal condition takes place when there are a high level of local associationism (1 association per maximum 1000 persons) and a network dense but not centralized in few powerful actors.

The associationism results of Arci-Grighine district confirm the discrete presence of social capital in Sardinia (Sabattini 2006). Also if the reserve of social capital in the forestry sector is relevant, differences among the three type of associations are registered. The difference is linked to the divergent objectives. Hunting associations have the purpose to assure hunting wildlife and to satisfy the demands for their associates. In consideration of these purposes the hunting associations are well organized and with a high contractual power. On the contrary the environmental associations pursue an ideological aim for the good of the collectivity. Consequently, these associations are large enough, but with few active volunteers and a low

power in a forest management decision making process. Cultural and sportive associations have intermediate characteristics but a deep rootedness in the local context. In consideration of social network related to the technical aspect of forest planning and management, we can evidence a complex and well structure network. The main limit of this structure is the power centralization in two actors that have at the same time the power in the decision making process and the control of information.

Finally, the strength point of the proposed method is the opportunity to analyse, with few and simple questions, the social capital and the correlated network before starting a participatory forest planning process. This opportunity is functional to the success of the incremental approach application.

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