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# Power of Forest Stakeholders in the Participatory Decision Making Process: A Case Study in Northern Italy

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**Abstract** – In European countries, current forest use aims to enhance goods and services supplied by forest ecosystems, taking into account the multiple needs and interests of society through a participatory process. A successful participatory process requires a thorough analysis of stakeholders' perceptions and preferences. The aim of this paper is to investigate the differences between stakeholders' perceived influence and real power in forest management. A questionnaire survey was carried out among 51 forest stakeholders in a case study in the Italian Alps. Perceived influence was measured by asking stakeholders to rate on a 5-point scale the extent to which they can influence forest management issues. Real power was analyzed using social network analysis (SNA), investigating the relationships that stakeholders have with each other in the network. Real power was measured using a Freeman's degree centrality measure, which focuses on the direct ties coming in and out for each stakeholder. The results show that public administration is the category of stakeholders with the most power in all forest management issues, while the actors of the tourism sector are in a marginal position. In addition, the results of the study suggest that in many cases stakeholders have a distorted perception of their own power.

**multi-objective forest management / influence / public participation / stakeholder analysis / social network analysis / Valle di Non (Italy).**

**Kivonat** – Az erdőkhöz kapcsolódó érdekcsoportok érdekérvényesítő ereje részvételen alapuló döntéshozatali folyamatokban – Észak-olaszországi esettanulmány. Az európai országokban a jelenlegi erdőhasználat az erdei ökoszisztémákból származó termékek és szolgáltatások erősítését célozza meg megfelelően a részvételen alapuló folyamatokban megnyilvánuló sokrétű szükségleteknek és érdekeknek. A részvételen alapuló folyamatok sikere megkívánja az érdekelték szemléletének és preferenciáinak részletekbe menő vizsgálatát. Jelen írás célja annak vizsgálata, hogy az érdekelték észlelt és valós, erdőgazdálkodásra gyakorolt érdekérvényesítő képessége között milyen eltérések találhatóak. Az olasz Alpokban 51 erdővel kapcsolatos érdekelt bevonásával kérdőíves felmérés készült. Az észlelt érdekérvényesítő képességet azon keresztül mérték, hogy az érdekeltéktől azt kérték, hogy 5 fokozatú skálán jellemezzék, milyen mértékben képesek befolyásolni az erdőgazdálkodással kapcsolatos kérdésköröket. A valós érdekérvényesítő képességet a társadalmi kapcsolati háló elemzés módszerével vizsgálták, feltárva az érdekelték egymás közötti kapcsolatait. A valós érdekérvényesítő

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képesség mérése a Freeman fokszám központiséggel történik, amely az egyes érdekelttek egymás közötti kapcsolatait veszi alapul. Az eredmények azt mutatják, hogy a közigazgatás csoportjába sorolható érdekelttek minden erdőgazdálkodást érintő kérdésben a legbefolyásosabbak, míg a turizmus szereplői a legkevésbé erősek. Továbbá a vizsgálat eredményei arra engednek következtetni, hogy sok esetben az érdekelttek torz képpel rendelkeznek a saját érdekérvényesítő képességükkel kapcsolatban.

**többcélú erdőgazdálkodás / befolyás/ nyilvános részvételi folyamat / érdekelt elemzés / kapcsolati háló elemzés / Valle di Non (Italy)**

## 1 INTRODUCTION

The participatory approach in the development of multi-objective forest management strategies has responded to the need to include multiple stakeholders and interests in the decision making process (Martins – Borges 2007, Pukkala 2002). This approach recognized that forest management should combine and synthesize multiple management objectives into a coherent set of practices (Appelstrand 2002). Moreover a participatory approach – involving local community in the decision-making process – is a way to increase social sustainability and an important tool to support sustainable forest management (Kangas et al. 2006, De Meo et al. 2011).

In the light of these considerations, it is evident that participatory forest management is a complex issue, where several stakeholders - who often have different interests and expectations (e.g. wood production, recreational activities, nature conservation) - are involved (Webler et al. 2001, Mendoza – Martins 2006). When both the number of stakeholders and the stakes are high, the participatory process is strongly influenced by the relationships, the coalitions of interests, and the balance of power among the participants. In this context, the analysis of stakeholders' power is relevant, in order to understand their role and the influence of individual stakeholders or coalitions in the decision process, and to guarantee transparency and fairness of the process itself (Paletto et al. 2012, Paletto et al. 2015). In particular, the analysis of power distribution among stakeholders is important in cases when the decision making process is influenced by a few powerful stakeholders, while a large number of stakeholders remain passive and without a real power.

The historical origins of the concept of power must be sought in Leviathan (1651) by Thomas Hobbes. The analysis made by Hobbes distinguishes the power of a person in i) natural power, which includes the abilities of the body and mind as intellect and strength, and ii) instrumental power, which derives from the acquired faculties and advantages of friends, money or reputation. Leviathan (1651) was the starting point for the development of subsequent theories of power such as those developed by Max Weber (1947) and Robert Dahl (1961). In current political science, power can be defined as “the probability that an actor within a social relationship will be in a position to carry out his own will despite resistance” (Weber 1947). Starting from this definition, power can be considered as the ability of an individual in a relationship to exert influence on another person, in order to obtain the expected outcomes (Simpson et al. 2014). In other words, the exercise of power implies that a stakeholder has power to the extent that he can use coercive, utilitarian or normative powers to impose its will in the relationship (Etzioni 1964). The possible strategies in order to influence a person can be direct or indirect: the first type is visible and unambiguous, while the second is less visible and more subtle. Weber's power definition was analyzed and re-elaborated by Dahl (1961) in his theory of community power. The fundamental principle of the theory is that society is pluralistic, where community interests are represented by means of open processes. In this pluralistic society, power is exercised by a specific actor, while other actors are prevented from doing what they would like to do. If power can be defined as the

potential to influence and as a basic force in social relationships (Keltner et al. 2003), then influence can be considered the exercise of power (Turner 2005). Social actors have a clear objective intent to influence the behavior of someone else to achieve their goals.

From a sociological perspective the concepts of power and influence have clear definitions, but in everyday reality they are closely inter-related. The interactions between individuals or groups are shaped by patterns of power and influence (Lasswell – Kaplan 1950). Power can be wielded through resources such as threats to use instruments for the purpose of causing damage, the control of tools that restrict the action of others, and all other elements that can hinder or be a detriment to others. The most common resources that power utilizes are strength, knowledge, prosperity, capital (material, immaterial and social), and organization. It is important not to confuse power with its resources, because resources alone do not necessarily translate into power.

Concerning influence, a person has influence on another when they are able to alter the other person's behavior through the application of pressure. It is a sort of mediate power that is able to modify the behavior of other actors without the need for orders or threats. On the other hand, this influence is a kind of social relationship that modifies the original behavior of someone through means such as communication, charisma, or persuasion (Nye 2008).

Another main issue when dealing with participatory forest management is to distinguish the levels of power and influence between stakeholders. Inter alia, it is important to analyze perceived influence that is defined as “the believed ability to affect other actors' behaviors or beliefs by effectively controlling resources (e.g. information, ability to make decisions, etc.) skillfully and willfully” (Weible 2005).

Starting from these considerations, the present research considers the “perceived influence” as the stakeholders strive to influence the decision making process, and power as the real capacity of stakeholders to influence the decision making process, which can be measured by objective methods. The main aim of the research is to define a useful method for comparing stakeholders' perceived influence and real power. The proposed method was applied in a case study in North Italy (Valle di Non, Trentino-Alto Adige region), characterized by multiple stakeholders' interests and high relevance of forest resources both from the economic and social point of view. Power was quantified through the analysis of stakeholders' relationships and networks (social network analysis), while information on perceived influence was collected through a questionnaire survey of forest stakeholders. Finally, results of perceived influence and real power were compared in order to highlight behaviors of the different stakeholders' categories. This type of analysis is useful because it can support the decision makers during the participatory process in order to include all the interests at stake in the final plan.

## 2 MATERIALS AND METHODS

### 2.1 Study area

The study area is the Valle di Non (*Figure 1*), in Trentino-Alto Adige Region (North-East of Italy). Valle di Non is a rural valley (596.7 km<sup>2</sup>), with a well-developed agricultural industry (apple and grape production) and forestry sector. As an outcome of a territorial specialization process that occurred during the last thirty years, the Valle di Non is home to a relevant quota of apple production (5% of the European production). Urban centers of the Valle di Non, 38 small country communes, are surrounded by fields and farms lying between 400 and 1,200 m a.s.l. where the main product - apples - are cultivated. The labor force employed in the primary sector is around 20% of the total labor force of the valley. The forest area is around 350 km<sup>2</sup> (59% of total area) and the main forest types are Norway spruce (*Picea abies* (L.)

H. Karst.), Scots pine (*Pinus sylvestris* L.) and European larch (*Larix decidua* Mill.) dominant forests. Broadleaf forests, mainly European beech (*Fagus sylvatica* L.) forests, are concentrated in the low part of the valley. Considering the forest property, forest areas are mainly public and common forests (80%) managed by municipalities and self-organization of common forests called *Amministrazioni Separate per i beni di Uso Civico* (ASUC). Forest management is conducted according to Forest and Wildlife Service of Autonomous Province of Trento guidelines (Notaro et al. 2009). The remaining 20% of forests belong to small private owners (Grilli et al. 2014). The standing stock of the high forests in Valle di Non is about 4 million m<sup>3</sup> with an annual increment of 64,000 m<sup>3</sup> per year. The harvesting rate is approximately 55% of annual increment.

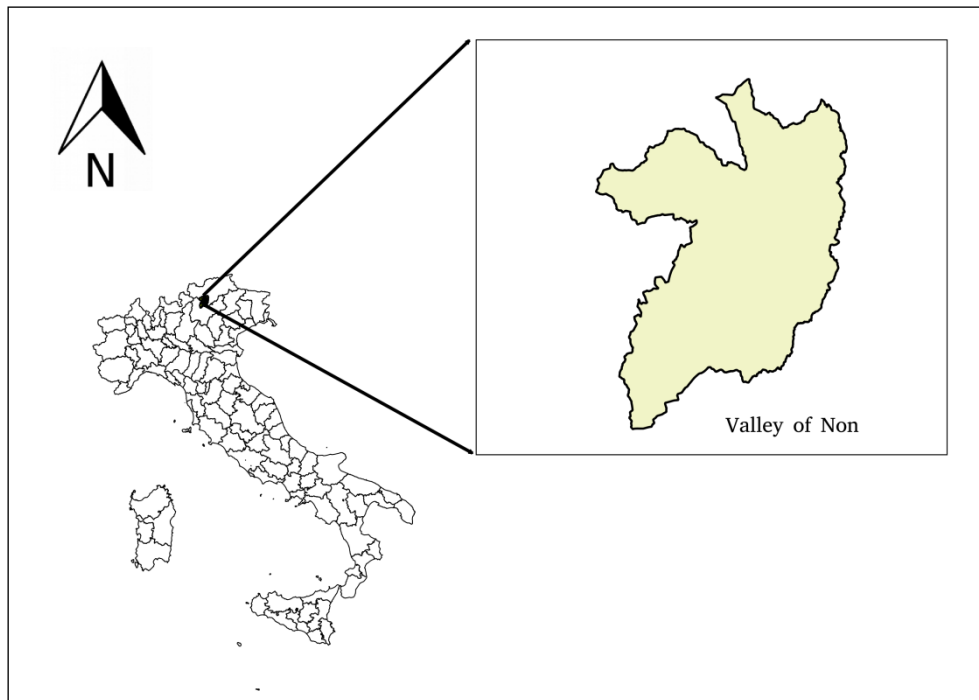


Figure 1. Location of the study area (Valle di Non) in Italy.

## 2.2 Three-stages methodology of research

The research framework was structured in three stages: (1) stakeholder analysis, (2) questionnaire survey, (3) statistical analysis and comparison of the data collected with the questionnaire.

The stakeholder analysis aims to identify, characterize, and classify the stakeholders in order to determine the extent of their future involvement in the decision making process (Grimble – Wellard 1997). All stakeholders - individuals, communities, social groups or institutions of any size, aggregation or level in society (Grimble – Chan 1995) - who affect and/or are affected by the policies, decisions, and actions of the system should be recognized.

In the present research, the stakeholder analysis was conducted through two steps. The first step was a brainstorming session between project researchers and local experts (forest managers and planners). A preliminary list of stakeholders was identified and then the sample was completed with a snowball sampling technique: names of other potential stakeholders are collected from the initial group. This sampling method is usually employed in the investigation of social networks and social dynamics (Noy 2008). At the end of the stakeholder analysis, 51 stakeholders were identified and classified in four main categories: 25 public administrations (municipalities, ASUC, Forest and Wildlife Service of Autonomous Province of Trento), 7 associations (alpine clubs, local hunting and environmental associations),

13 forest-wood chain actors (forest enterprises and sawmills), and 6 tourism sector actors (hotel keepers, agencies of tourism development).

During the second stage, a questionnaire survey was conducted among selected stakeholders through face-to-face interviews. The stakeholders, selected as representatives for each organization or association, were: mayors or council members of the municipalities, heads of the forest enterprises, sawmills and hotel operators, presidents of the associations and ASUC, and managers of the Forest and Wildlife Service of Autonomous Province of Trento. The questionnaire was aimed at assessing stakeholders' perceived influence and power in the participatory forest planning. The questionnaire included 17 closed-form questions and was subdivided in four thematic sections ("organization information", "personal information", "social and human capital", "forest management and local tradition"). Closed-form questions were used to analyze quantitatively the collected data. Moreover these questions are quick and easy to answer, and require little time investment. Being conscious of the limitations of closed questions, such as the impossibility of individual interpretation and in-depth response (May 1997, Paletto et al. 2013), time was left to the interviewees to discuss and express their opinions. A preliminary version of the questionnaire was prepared by the researchers previously involved in the stakeholder analysis and pre-tested with some local experts.

In the third stage of the research, the questions of the section "social and human capital" were processed and analyzed from the statistical point of view using XLStat 2012. Data analysis focused on the following aspects: (1) stakeholders' personal perception of their influence on the decision making process, (2) real power of stakeholders in terms of relational embeddedness, and (3) correlation between the two above mentioned aspects.

### 2.3 Perceived influence

The perceived influence of stakeholders on the forest management decision making process was assessed by the statements of the respondents. Stakeholders were asked to evaluate the influence of their organization in relation to six key-issues of forest planning and management. The key-issues were the following: (1) forest management for the production of timber, bio-energy and non-wood products (mushrooms and wild berries); (2) forest management for recreation, tourism and landscape purposes; (3) forest management for the protection against natural hazards (landslides, rockfalls, avalanches); (4) forest management to maintain and improve biodiversity and habitats; (5) environmental rehabilitation (quarries and landfills restoration), (6) management of wildlife (mainly ungulates such as red deer, roe deer and chamois). The six key-issues were chosen based on their importance in the multi-objective forest planning and the local guidelines of forest policy. The first issue focuses on the enhancement of the productive function of forests which includes both the wood production areas and the areas dedicated to non-wood products. The second issue includes the recreational areas, frequented by a large number of tourists, while the third considers the protective areas as defined by the third Ministerial Conference for the Protection of Forests in Europe (MCPFE). In the fourth issue protected areas, such as national and regional parks, nature reserves, and Natura 2000 sites are included. The fifth issue includes degraded areas such as quarries and landfills, while the last comprises the game reserves. Each of the six issues was scored using a 5-point Likert scale (from 0=no influence to 4=very high influence).

The data collected with the questionnaire were statistically processed and the main descriptive statistics (mean, median, standard deviation) were calculated. The aggregation of all key-issues was used as indicator for describing the perceived influence of the groups. In addition, the non-parametric statistical test of Kruskal-Wallis was applied in order to evidence differences between categories of stakeholders in relation to each single key-issue. The non-parametric statistical tests were chosen because the data distribution is not normal and the number of observations is low. All statistical tests were assessed at the  $\alpha = 0.05$  level.

## 2.4 Power

The real power of stakeholders was assessed on the basis of the relational embeddedness, using the social network analysis (SNA) method. SNA is a formal theory to define and analyze the relationships that organizations or individuals (stakeholders in general) have with each other and it focuses on positions and structural patterns of actors (Wasserman – Faust 1994, Scott 2000). Analysis of social networks allows the opportunity to unpack the social factors and provides information about knowledge exchange. According to Weiss et al. (2012) and Mills et al. (2014) SNA can highlight which stakeholders are important for influencing policy or actions, or for facilitating information and knowledge transfer.

The main practical applications of SNA in the forest sector found in the international literature are summarized as follows: Tikkanen et al. (2003) studied the regional network of forest-related organizations in northern Finland, Harshaw and Tindall (2005) employed a social network approach to examine the role of social capital in the relationships between people and forested landscapes in Canada, Vennesland (2004) analyzed the importance of networks in forest-based rural economic development in Norway, while Paletto et al. (2012) applied SNA in a participatory landscape forest planning study in Italy.

In the present paper, SNA was applied to highlight power distribution among forest stakeholders. In particular, network centrality was used and quantified in order to analyze the role and position of stakeholders in the network. Network centrality considers sociocentric network data that provide information on relationships among all actors within a bounded social network (Freeman 1979, Marsden 2002). According to Freeman (1979), global centrality can be expressed through three types of centrality: degree centrality, closeness centrality, and betweenness centrality. In sociological terms, degree centrality represents the level of communication activity; betweenness centrality represents control of communication as the ability to restrict the communication of others, while closeness centrality represents independence (Mizruchi – Potts 1998). In addition, network centrality is a fundamental concept to account for actors' social status, power and satisfaction with group activities (Bavelas 1950, Leavitt 1951). Some research showed a positive relationship between centrality in the network and power (Brass 1984, Krackhardt 1990). Despite this, not all measures of centrality can be considered an appropriate indicator of an actor's real power (Mizruchi – Potts 1998). According to Freeman (1979), degree centrality was defined as the number of alters to whom an actor is directly tied and represents the ability to communicate directly with others (level of communication activity). Considering these theoretical assumptions, in this research the degree centrality was considered as a measure of the real power of individual stakeholders. Information useful to assess degree centrality was collected through the survey questionnaire. Specifically, two types of information were collected: (1) number and type of stakeholders with which the respondent has a professional relationship in the field of forest planning and management (six key-issues), (2) strength of relationships. It is important to emphasize that only collective stakeholders (institutions, organizations and associations) were considered in the analysis. The strength of relationships was evaluated distinguishing three types of ties according to strength: very weak, weak, strong. Strong ties are comprised of all of those types of relationships in which either the stakeholders are involved in an emotional manner, while weak ties are those relationships established by different stakeholders among which communication is sporadic and where emotional intensity is generally low (Granovetter 1973).

The graphic elaborations and the degree centrality values were realized with the software programs NetDraw and UCINET 6.0 (Borgatti et al. 2002).

The Freeman's formula used to calculate the degree centrality is the following:

$$Dc(n_i) = \sum_{k=1}^n a(n_i, n_k) (N - 1)^{-1}$$

Where:

$D_c$  = degree centrality

$a_{ik}$  = arc between nodes (1 when there is a connection between  $n_i$  and  $n_k$ , 0 when there is not a connection between  $n_i$  and  $n_k$ ).

The degree centrality calculated for each stakeholder was aggregated in categories of stakeholders (public administrations, associations, forest-wood chain actors and tourist sector actors).

### 3 RESULTS AND DISCUSSION

#### 3.1 Perceived influence

The aggregate result (all key-issues together) for individual stakeholders' perceived influence shows that values are included in a range between 0 and 23. The highest values were recorded for the following stakeholders: Brèz municipality ( $P_i$  total=23), Forest and Wildlife Service of Autonomous Province of Trento ( $P_i$  total=20), Dambel municipality ( $P_i$  total=19), and the sawmill of Sarnonico municipality ( $P_i$  total=18).

Statistical results (mean, median and standard deviation) of perceived influence per category of stakeholders are reported in *Table 1*. The mean value was used as a synthetic indicator of perceived influence by category of stakeholders.

Public administrations perceive their level of influence as medium on four issues (wood production, forest recreation, hydrogeological protection and biodiversity conservation) and low and very low for wildlife management ( $P_i$  mean=1.08) and environmental rehabilitation ( $P_i$  mean=1.56). The total level of perceived influence of the public administrations taking into account all key-issues is 9.72.

Representatives of the associations declared a high and very high level of influence on two forest management issues: biodiversity conservation ( $P_i$  mean=2.50) and forest recreation ( $P_i$  mean=2.00), while for the other issues the level of influence is quite low. The high level of influence on the biodiversity conservation issue is mainly affected by the answers of hunting association representatives. This is reasonable because they contribute to the wildlife population census and to the provincial hunting plan. The total level of perceived influence of this category is equal to 8.43.

Actors of the tourism sector declared a low or very low level of influence for all forest management issues; according to these declarations the total level of perceived influence of this category of stakeholders is 2.67. It is interesting to highlight that their perceived influence is low ( $P_i$  mean=0.67) also on the valorization of tourism and recreation in forests. This scarce perceived influence is not surprising, since the decision making process in Valle di Non is mainly driven by public actors. Otherwise, it is important to underline that such a low score may be interpreted also as a scarce interest of these actors in natural resources management. In such a case, this result could be more worrisome, because tourism in Valle di Non is mainly nature-based and the tourism actors are expected to be the main drivers of tourism and recreational activities in forest.

Finally, the forest-wood chain actors declared a low level of influence on three forest management issues (wood production, forest recreation and biodiversity conservation) and a very low level of influence on the other three issues (protection against hazards, environmental rehabilitation and wildlife management). The highest level of influence is on wood production ( $P_i$  mean=1.62).



Table 1. Mean, median and standard deviation of perceived influence on six key-issues of forest management per categories of stakeholders.

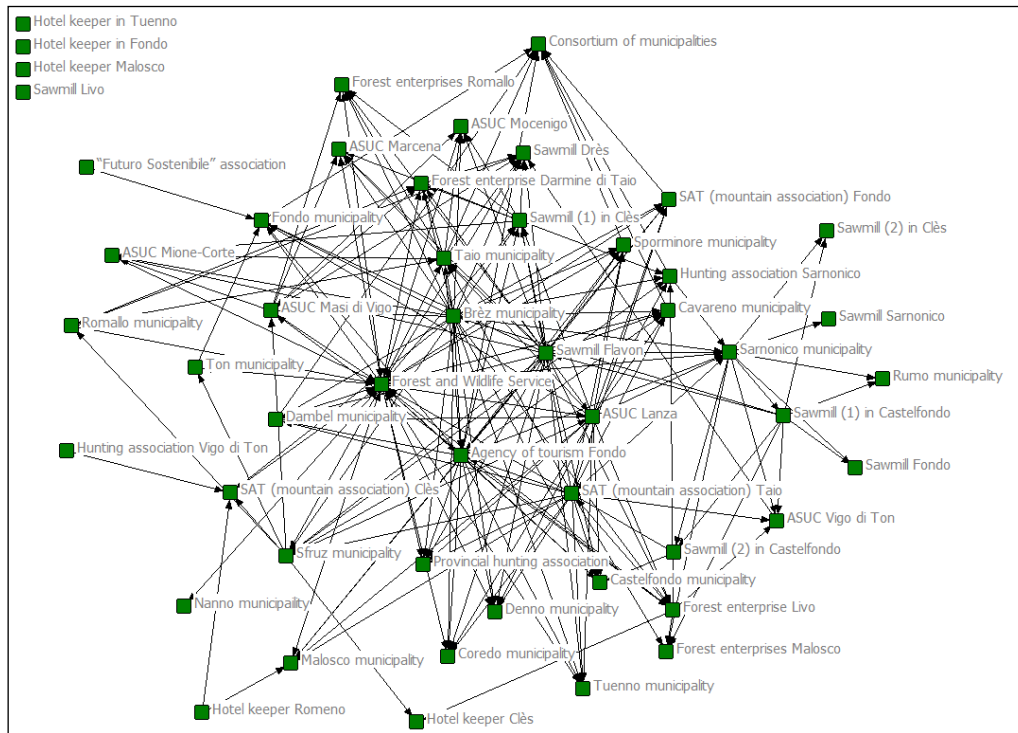
| Category of stakeholders               | Wood production | Recreation in forest | Protection against hazards | Biodiversity conservation | Environmental rehabilitation | Wildlife management |
|--|-----------------|----------------------|----------------------------|---------------------------|------------------------------|---------------------|
| <b>All stakeholders (n=51)</b>         |                 |                      |                            |                           |                              |                     |
| Mean                                   | 1.51            | 1.51                 | 1.19                       | 1.65                      | 1.16                         | 0.86                |
| Median                                 | 1               | 2                    | 1                          | 2                         | 1                            | 0                   |
| St.dev.                                | 1.31            | 1.36                 | 1.21                       | 1.42                      | 1.22                         | 1.28                |
| <b>Public administrations (n=25)</b>   |                 |                      |                            |                           |                              |                     |
| Mean                                   | 2.00            | 1.92                 | 1.57                       | 1.96                      | 1.56                         | 1.08                |
| Median                                 | 2               | 2                    | 2                          | 2                         | 1                            | 0                   |
| St.dev.                                | 1.10            | 1.32                 | 1.27                       | 1.30                      | 1.26                         | 1.47                |
| <b>Associations (n=7)</b>              |                 |                      |                            |                           |                              |                     |
| Mean                                   | 0.67            | 2.00                 | 1.50                       | 2.50                      | 1.29                         | 1.43                |
| Median                                 | 0               | 3                    | 2                          | 4                         | 1                            | 1                   |
| St.dev.                                | 1.21            | 1.90                 | 1.38                       | 1.97                      | 1.60                         | 1.51                |
| <b>Tourism sector actors (n=6)</b>     |                 |                      |                            |                           |                              |                     |
| Mean                                   | 0.17            | 0.67                 | 0.33                       | 0.67                      | 0.67                         | 0.20                |
| Median                                 | 0               | 1                    | 0                          | 1                         | 1                            | 0                   |
| St.dev.                                | 0.41            | 0.82                 | 0.52                       | 0.82                      | 0.82                         | 0.45                |
| <b>Forest-wood chain actors (n=13)</b> |                 |                      |                            |                           |                              |                     |
| Mean                                   | 1.62            | 0.92                 | 0.77                       | 1.15                      | 0.54                         | 0.38                |
| Median                                 | 1               | 1                    | 0                          | 1                         | 0                            | 0                   |
| St.dev.                                | 1.45            | 1.04                 | 1.01                       | 1.28                      | 0.78                         | 0.65                |

The non-parametric test of Kruskal-Wallis shows statically significant differences between categories only for the perceived influence related to wood production (K observed value = 13.415, K critical value = 7.815, p-value = 0.004). For this key-issue, the influence of public administrations and forest-wood chain actors is significantly higher than the other categories of stakeholders, while the non-parametric test of Kruskal-Wallis shows no significant statistical differences for the other five key issues.

### 3.2 Power

SNA results are reported in *Table 2* and *Figure 2*. As reported in *Table 2* (which shows the degree centrality values for all stakeholders in the network), Forest and Wildlife Service of the Autonomous Province of Trento are individual stakeholders with the highest values of degree centrality ( $D_c=137$ ), followed by two municipalities (Malosco municipality  $D_c=78$  and Brèz municipality  $D_c=87$ ) and an ASUC ( $D_c=63$ ). A high number of stakeholders have values of degree centrality that are rather low ( $D_c$  lower than 20). In light of these differences, we can assert that the forest sector network in Valle di Non is a highly centralized network, where one stakeholder (Forest and Wildlife Service) plays a key role, both in terms of power and prestige. This assertion is supported by the difference in values of degree centrality between Forest and Wildlife Service of the Autonomous Province of Trento and all other stakeholders. In addition, during the face-to-face interviews some stakeholders highlighted that the Autonomous Province of Trento is the key actor as regards all decisions on land planning and management in urban and rural areas. The centralized network presents the main advantage of rapidity and ease in decision-making, and the possibility for administrators to manage the forests of the valley with a unique and homogenous management approach. Conversely, this centralized network presents the main disadvantage in the risk of low participation in decision-making and of a de-empowerment of the other stakeholders in the area.

Besides, *Figure 2* shows that within stakeholders' categories there is a different distribution of power. In particular, it is important to highlight the marginal role of tourism sector actors: 3 hotel keepers have no ties with any other actor in the network and the other tourism sector actors are all in marginal positions, confirming the result derived from the perceived influence analysis. Instead, the forest-wood sector actors are in "key positions" in the network, in particular three sawmills (sawmill Sarnonico  $D_c=54$ , one of the two sawmills of Clès  $D_c=36$ , sawmill Drès  $D_c=35$ ) and two forest enterprises (forest enterprise Darmine di Taio  $D_c=38$ , forest enterprise Livo  $D_c=36$ ).



*Figure 2. Social Network Analysis (SNA) of the forest sector stakeholders in Valle di Non.*

To better understand real power distribution, it is important to make a distinction between indegree and outdegree centrality for the interpretation of the values in *Tables 2* and *Table 3*. The indegree centrality of a stakeholder depends on the number of incoming links, while the outdegree centrality sets the stakeholders in hierarchical centrality because it considers the outgoing links.

*Table 3* shows the main statistics, considering the four categories of stakeholders.

Those actors who show elevated values of outdegree centrality occupy a central hierarchical position in the network, and are therefore able to directly reach a high number of actors. Nevertheless, this position does not ensure clear-cut prestige since the acknowledgment of the other actors (indegree centrality) is required.

Public administrations is the category with a greater concentration of power and this fact is mainly explained by the values of in-degree centrality, that for public administrations shows a mean value of 17.32, while for the forest-wood chain actors and the associations is equal to 7.08 and 8.29 respectively.

Conversely, the outdegree centrality values are higher for the latter two categories of stakeholders (forest-wood chain actors mean  $OD_c=16.92$ , associations mean  $OD_c=18.86$ ) than for public administrations (mean  $OD_c=10.44$ ). This result can be interpreted as a unidirectional flow of requests for technical advice or financial support from the various stakeholders towards public administrations.

Table 2. Indegree, outdegree and degree centrality values per each stakeholder

| Stakeholder                       | Outdegree | Indegree | Degree |
|-----------------------------------|-----------|----------|--------|
| Hotel keeper in Tuenno            | 0         | 0        | 0      |
| Hotel keeper in Fondo             | 0         | 0        | 0      |
| Tuenno municipality               | 3         | 15       | 18     |
| Taio municipality                 | 15        | 18       | 33     |
| Forest and Wildlife Service       | 78        | 59       | 137    |
| Sawmill Fondo                     | 0         | 6        | 6      |
| Fondo municipality                | 3         | 20       | 23     |
| Castelfondo municipality          | 2         | 18       | 20     |
| Sawmill (1) in Castelfondo        | 26        | 3        | 29     |
| Sawmill (2) in Castelfondo        | 6         | 6        | 12     |
| Cavareno municipality             | 3         | 15       | 18     |
| Consortium of municipalities      | 0         | 3        | 3      |
| Sawmill Saronico                  | 36        | 18       | 54     |
| Saronico municipality             | 3         | 0        | 3      |
| “Futuro Sostenibile” association  | 6         | 14       | 20     |
| Hunting association Saronico      | 3         | 15       | 18     |
| Denno municipality                | 0         | 12       | 12     |
| Forest enterprises Malosco        | 3         | 15       | 18     |
| Malosco municipality              | 72        | 6        | 78     |
| Sawmill Flavon                    | 3         | 6        | 9      |
| Sawmill (1) in Clès               | 21        | 15       | 36     |
| Rumo municipality                 | 0         | 5        | 5      |
| Sawmill (2) in Clès               | 0         | 6        | 6      |
| Sawmill Drès                      | 9         | 26       | 35     |
| ASUC Vigo di Ton                  | 3         | 12       | 15     |
| Forest enterprise Darmine di Taio | 18        | 20       | 38     |
| ASUC Masi di Vigo                 | 21        | 11       | 32     |
| Hunting association Vigo di Ton   | 3         | 0        | 3      |
| Hotel keeper Romeno               | 6         | 0        | 6      |
| Hotel keeper Malosco              | 0         | 0        | 0      |
| Sawmill Livo                      | 0         | 0        | 0      |
| Hotel keeper Clès                 | 0         | 5        | 5      |
| Provincial hunting association    | 0         | 15       | 15     |
| Ton municipality                  | 6         | 6        | 12     |
| SAT (mountain association) Fondo  | 6         | 15       | 21     |
| Romallo municipality              | 12        | 9        | 21     |
| SAT (mountain association) Taio   | 23        | 6        | 29     |
| Forest enterprise Livo            | 21        | 15       | 36     |
| Brèz municipality                 | 81        | 6        | 87     |
| Forest enterprises Romallo        | 1         | 17       | 18     |
| ASUC Marcena                      | 1         | 17       | 18     |
| ASUC Mocenigo                     | 1         | 17       | 18     |
| ASUC Mione-Corte                  | 1         | 17       | 18     |
| ASUC Lanza                        | 54        | 9        | 63     |
| SAT (mountain association) Clès   | 3         | 12       | 15     |
| Agency of tourism Fondo           | 40        | 10       | 50     |
| Sfruz municipality                | 18        | 15       | 33     |
| Sporminore municipality           | 5         | 15       | 20     |
| Dambel municipality               | 6         | 15       | 21     |
| Coredò municipality               | 0         | 15       | 15     |
| Nanno municipality                | 3         | 15       | 18     |

Table 3. Mean values of indegree and outdegree centrality per category of stakeholders

| Category of stakeholder            | Indegree | Outdegree |
|------------------------------------|----------|-----------|
| Public administrations (n=25)      | 17.32    | 10.44     |
| Actors of forest-wood chain (n=13) | 7.08     | 16.92     |
| Associations/NGO (n=7)             | 8.29     | 18.86     |
| Actors of tourism sector (n=6)     | 2.00     | 2.00      |

### 3.3 Correlation between perceived influence and power

The correlation between perceived influence and real power is analyzed to investigate if there is a correspondence or a deviation between these policy issues, and to understand reasons for different trends. The Spearman correlation between the perceived influence and the values of indegree, outdegree, and degree centrality are reported in *Table 4*. Results show a statistically significant correlation between the perceived influence and the values of indegree centrality ( $r = 0.562$ ) and degree centrality ( $r = 0.388$ ). For the fact that the degree centrality is the sum of indegree and outdegree, it is important to focus on the differences between these two indicators. The correlation between indegree centrality and perceived influence is relatively high because indegree can be considered a good indicator of the prestige and prominence of a stakeholder. A stakeholder is considered prestigious and prominent, if he is particularly visible to the other stakeholder in the network and the number of his ties in the network is high. Stakeholders in a prominent position in the network have a greater ease of influencing the choices of others stakeholders. This can be considered an indirect form of power.

Table 4. Spearman correlation between perceived influence and indegree centrality, outdegree centrality and degree centrality

| Parameters | Indegree centrality vs. perceived influence | Outdegree centrality vs. perceived influence | Degree centrality vs. perceived influence |
|------------|---|--|---|
| r          | 0.562                                       | 0.189  | 0.388                                     |
| p-value    | <0.0001                                     | 0.183  | 0.005                                     |
| $\alpha$   | 0.05  | 0.05   | 0.05                                      |

The Spearman correlation between the perceived influence and the indicators of real power shows that some stakeholders have a distorted perception of their own power. A limited number of stakeholders have a perceived influence higher than the real power, and in this group fall some hotel keepers and associations. Instead, the key actor of the network - the Forest and Wildlife Service of the Autonomous Province of Trento - declares a level of influence far below its real power. A similar situation is reported for some municipalities such as Malosco municipality ( $P_i = 0$ ,  $D_c = 78$ ), Brèz municipality ( $P_i = 8$ ,  $D_c = 87$ ) and an ASUC (ASUC Lanza  $P_i = 8$ ,  $D_c = 63$ ). The first interpretation for these differences is tied to a distorted perception of the reality: there are actors who overestimate their influence in the society they are living in and actors who, on the contrary, underestimate their power. Another interpretation for these differences could be of strategic nature: those actors who hold positions of power in the society say that they are not conscious of their role of prominence.

## 4 CONCLUSIONS

Over the last few decades, scientific literature concerning the techniques and methods for collection and analysis of social preferences in natural resources management has experienced a rapid growth (Trakolis 2001, Tarrant – Cordell 2002, Kumar – Kant 2007, Rodríguez-

Carreras et al. 2013, De Meo et al. 2013, Paletto et al. 2013). Despite this growth of interest, the analysis of the relationship between the power of social actors and decisions taken during the management process remains a little-studied field. The present work tries to contribute to the scientific debate in this field, focusing on the issue of relations between the real power of actors and their perceived influence.

In this framework, it is relevant to highlight that perceptions shape behaviors more than real power. In fact, if actors perceive a centralized structure of influence in the decision making process, most stakeholders would prefer to have relationships with the actor with more (perceived) influence. On the other hand, if there is a decentralized structure of (perceived) influence, actors recognize interdependence among stakeholders and would be more available to cooperate in a participatory process for obtaining their goals (Bobbio 2006, Elster 1998). Perceived influence could be more explicative than real power in understanding decision-making behaviors (Pruitt – Thomas 2007).

Results of the present research demonstrate that analysis of the differences between perceived influence and real power could give decision makers information useful for understanding the stakeholders' behavior, to search for opportune integrations between actors, and to choose suitable methods to give everyone due consideration.

Moreover, results show that single stakeholders and categories of stakeholders could have a rather distorted perception of influence on decisions, and a clear vision of power distribution is not foreseen.

This kind of information, combined with other qualitative and quantitative information provided by SNA, can improve the participatory process and reduce possible distortions of information among the decision makers. What is clear from the Valle di Non case study is the centralized structure of the decision making process. A few of the actors have a high level of power and a dual role in being an intermediary for particular interests and, concomitantly, remain the decisional center.

The authors want to evidence that in order to better manage a situation of conflicting interests and trade-offs between stakeholders' objectives, the network should be as inclusive as possible. In particular, in the Valle di Non case study, a deeper involvement of the tourism sector actors could play an important role in conservation strategies, since tourism is known to have an important role in this field (Bookbinder et al. 1998, Gössling 1999). On the other hand, greater power for the forest wood chain actors could create decisions towards a more intense timber harvesting scenario. In any case, an inclusive network society stimulates the debate around natural resources, allowing for increased awareness about other stakeholders' interests and facilitating shared decisions.

Concerning the adopted methodology, survey questionnaires and social network analysis have the advantage of being simple and require a limited number of data. Limits of the method could be related to the typical disadvantages of face-to-face interviews such as: a higher need for personnel involvement, the necessity of interviewer training, higher costs of data collection, some stakeholders' unavailability to be interviewed, and incomplete answers to some questions.

Finally, it is of course necessary to point out that relations between real power and perceived influence and, in general, studies concerning relations between social network and forest management, are influenced by a combination of factors and deeply rooted in the local context. For this reason, case-study surveys offer ideas and insights that could be used to improve this field of research.

In particular, future steps of this research must be focused on alternative measures of real power through other indicators and the comparison between these indicators and SNA data.

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