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Collective action and forest resources sustainable management

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Abstract

In light of the current debate on decentralisation, local governance and sustainable development principles, many scholars put emphasis on collective management systems. These participative processes are analysed as solutions that should be implemented by development practitioners. For example, several European countries (*i.e.* France) favour public policies for the development of rural areas relying on the idea that the enhancement and protection of natural and cultural assets should be entrusted to local government and communities.

The aim of our communication is to present an analytical grid to explain and understand the modalities of coordination of the local actors involved in sustainable forest management. According to an institutionalist point of view (Bromley, 1991, 1992 ; Oakerson, 1992 ; Ostrom, 1990, 2000) and mobilizing the social capital theory (Bourdieu, 1987; Lin, 1995, 2001; Putnam, 1993, 2000 ; Woolcok and Narayan, 2000), we show social determinants are likely to influence the integration of sustainability issues in the forest resource management practices. We also analyse the capacity of the socio-ecological systems to resist external shocks (Anderies, Janssen and Ostrom, 2004).

Keywords: collective action, forest resources management, social capital, governance

JEL Classification: Q2, Q23, Q28

Introduction

Natural resource management methods – whether they concern forests or not – come within a context that has been changed completely by the definition of objectives for biodiversity preservation. These objectives have been set out as part of national policies¹ and of international agreements². One of the major changes is that these preservation objectives are incorporated into development concerns, since the sustainable use of resources is recommended with a view to interlinking these two categories of challenges regarded until then as being in opposition. So, as the blueprint law for forests (“LOF” of 19 July 2001) in France for example shows, the promotion of sustainability in forest resource management is central. It incites to combine environmental (biodiversity preservation, prevention of natural or technological risks), social (survival of services provided) and economic (resource renewal) concerns, from a participatory perspective.

To achieve the objective of sustainable forest management, new rules of use have to be worked out locally and the interests of the various forest users have to be reconciled. Sustainable management of forest resources therefore necessarily involves working out agreements and compromises, the objectives of which as much as the means of achieving them, must be co-defined by the stakeholders. These considerations refer to the strategic analysis of the "social-ecological system" defined by the interactions between the ecosystem formed by a forest area and the social system or systems into which the actors who play a part, either voluntarily or *de facto*, in its management (Mermet, 1992, 2005; Anderies et al. 2004) fit. Working out a strategy and/or a common project proves in fact to be a complex task and can only be achieved by a process of interaction and collaboration resulting in a convergence of stakeholder representations. That process therefore refers to coordination mechanisms considering the role of social determinants.

To tackle social local co-ordination, we mobilise the social capital approach (Bourdieu, 1987; Lin, 1995, 2001; Woolcok and Narayan, 2000, Putnam, 1993, 2000). Through this analysis, we will try to explain why agents have a proclivity for collective action in the

¹ For example, the "Natura 2000" network arising from the implementation of the European "Birds" and "Habitats" directives and the adoption in 2004 of the French National Strategy for biodiversity.

² Particularly the Convention on Biological Diversity ratified by France in 1994.

sustainable management of forest areas. Because of the collective support it requires, any question of how the principles of sustainability are integrated locally into forest management also refers to studies on common-pool resource management institutions.

This particularly involves input by the Anglo-Saxon school on common property (Ostrom, 1990; Bromley, 1992; Schlager and Ostrom, 1992) which emphasis is not only on the variety of forms of local institutional arrangements (formal or not) that control the uses of the resources and regulate their linking, but also on the identification of key structural elements to perpetuate the forms of collective action encompassed by institutional arrangements.

By relating to the founding contribution made by the works of E. Ostrom (1990, 2004), we will show the decisive influence that the quality of social ties has both on the natural resource management methods and on the ability of the social-ecological systems in which they operate to withstand external shocks (resilience).

Our paper is threefold. After presenting the regulation changes and their implications as far as forest resource management methods are concerned (1), we will look at the way in which social determinants are likely to influence the integration of sustainability challenges into natural resource management practices (2). Drawing on a broad consideration of common-pool resource management institutions, we will try to examine the elements of a theoretical formalisation with respect to the robustness of social and ecological systems (3).

1. Multiplicity of regulatory frameworks specifying forest resource management

The debate about sustainable forest management came to the international stage in the 1980s and has continued to be the subject of negotiations in various forums³. This phenomenon accounts for the change in the ways resource management methods are conceived that has developed on two fronts.

³ Particularly in the United Nations Conference on Environment and Development (UNCED), the Conventions on Biological Diversity and on Climate Change and the Food and Agriculture Organisation.

Firstly, with the advent of the concepts of biodiversity and sustainable development, we are seeing a broadening in the scope of nature protection policies and the types of action they encompass (Deverre, Mormont, Soulard, 2002; Mougenot 2003). The distinguishing feature of this broadening is that it takes into account "ordinary nature" and prompts reconciling conservation and development (1.1). At the same time, against a background of international pressure and to enforce their commitments made at the Earth Summit in Rio de Janeiro in 1992 (UNCED) and the Ministerial Conferences on the Protection of Forests in Europe (Helsinki 1993 and Lisbon 1998), national governments, particularly in France, have brought about changes to their national policies on forest resources management to incorporate the principle of sustainability (Barthod and Landmann, 2002). This reorientation of the French legislative framework means replacing a process of top-down action with the principle of "concerted action" (in other words participation) that characterises sustainable forest management (1.2).

1.1. Ordinary nature: the new object of conservation policies

Biodiversity management methods from a conservation perspective – whether these concern forest ecosystems or not – are currently under debate, while at the same time, as part of a national strategy for biodiversity, guidelines with ambitious aims have been adopted. Two main pathways have been adopted: the creation of reserves and protected areas and the promotion of practices for sustainable management of "ordinary" biodiversity (Lévêque and Mounolou, 2001; Barthod and Landmann, 2002; Rameau, 2002; Deconchat and Balent, 2004).

The first pathway consists of making inventories relating to the implementation of specific measures to be applied to species and spaces. More than fifty legal measures – of regulatory or contractual nature – that comply with a conservation philosophy based on the concept of protected areas and that concern forest biodiversity have thus been inventoried. Among the best known measures and worth mentioning, are those that relate to the enforcement of international agreements (biosphere reserves – UNESCO MAB programme – a pan-European strategy for biological diversity and landscapes introduced by the Council of Europe), the transposition of European directives into French law ("Birds" and "Habitats" directives with the implementation of Natura 2000) and national laws (listing or registration

of sites, National Parks, nature reserves, private nature reserves, national hunting and wild animal reserves, listed "protected forests", biotope protection areas, state-owned or local authority-owned forest reserves with no access or controlled access, purchases of land by the *Conservatoire des Espaces Littoraux et des Rivages Lacustres* (coastal areas and lake shores) and by *Conservatoires Régionaux des Espaces Naturels* (natural areas), Regional Nature Parks, etc.).

The advent of the notion of biodiversity has contributed to the questioning, in part, of the relevance of this "sanctuarization" policy which itself comes from an idea of "protection relating to heritage and aesthetic qualities" based on a prioritisation of species (Micoud, 2005). The net result of this is to set ordinary nature – which does not deserve any special attention – apart from "extraordinary" nature, which has to be protected. With the emergence of the biodiversity concept, the inevitable character of harmonising and networking protected areas on the one hand, and the need to define the methods and tools for integrating so-called "ordinary" nature into a truly global ecological policy (Mougenot, 2003; Micoud, 2005) on the other, are on the contrary, asserted.

One of the major challenges arising from the emergence of the notion of biodiversity thus consists of questioning the functionalist approach that organises local planning into categories of clearly defined areas for use, in favour of negotiated, integrated and sustainable management⁴.

The second challenge, linked to the first, lies in the introduction of a strict requirement: that biodiversity protection must not be carried out to the detriment of social and economic development. In accordance with that position, an integration of initiatives has been established aimed at contributing to biodiversity conservation as part of the everyday management of more "ordinary" forest environments. As the French forest blueprint states, a forest policy that aims to manage forests and their natural resources in a sustainable way also contributes to local planning with sustainable development in mind (Article L.1).

1.2. Regulation prerogatives aimed at stimulating a common-pool resource management dynamic

⁴ Recommendations of the report by the working party on biological diversity for the French Sustainable Development Committee in December 1998

Traditional approaches in matters of forest resource management have long been centred on top-down practices that used to play down or barely take into account the local constraints of the social context. Today, this process is tending to change. It is in this perspective that the forest blueprint intends to replace a top-down approach with participative management. This new mainspring for action (participation) marks the advent of sustainable forest management.

In this legislative arrangement, concerted action is put forward as being the only thing able to guarantee synergism between conservation, sustaining life support systems and sustainable development. It is worth noting that this demand for dialogue and partnership between the public and private actors is now becoming widespread and seeping into the practices of governing protected areas too (Barthod et al., 2003). Involving local communities and getting them to share in the setting up, declaration and management of protected areas seems in fact like the new orders outlined within the framework of the Durban Accord adopted during the Vth World Parks Congress organised by the World Conservation Union in 2003.

While the sustainable management of forests has to ensure that the biological diversity of forest ecosystems is preserved and that forests are renewed, it also suggests that their multifunctionality need to be taken into account. Sustainable forest management practices thus account for tensions between environmental, economic, social, political, cultural, etc. objectives. Working out a compromise based on prioritisation of these management issues seems to be a central challenge.

Regulation of the constraints (*i.e.* negotiating the terms of reconciling the economic, ecological and social functions of a forest in one area) tends to take place according to the specific characteristics to each local situation⁵. The normative ideas held by each category of stakeholder then play a decisive part in building the objects and aims of sustainable development. The question of the emergence and the taking of the first steps in a collective action dynamic seems to be an equally fundamental determining factor in forest management that is effectively sustainable and that contributes to maintaining biodiversity.

⁵ Defined as "concrete action systems" (Bernard, 2004).

So, incorporating the principles of sustainability in local management systems cannot be established without regard to working out common rules aimed at defining collectively acceptable objectives.

That being the case, a number of questions are raised: how are these collective action initiatives set up? What are their foundations? What institutional arrangements ease the adoption of common-pool resource management practices? These questions call for thought about a shift in forest management methods towards greater sustainability, by stressing the organisational and institutional dimensions of co-ordination between stakeholders.

2. Sustainable management of resources: on the importance of social relations in local resource management systems. A theoretical look

The decentralisation of natural resource management has been advocated since the early 1980s and with it the need to clarify the rights of the various groups of stakeholders. This recommendation can be seen as a pragmatic response to the failure of state control in southern countries and can also be considered as reflecting the dictates of free-market: it would involve, inasmuch as possible, coming close to a model of private appropriation of resources, which guarantees their efficient management (Boisvert, Caron and Rodary, 2004). We can however consider that, on the contrary, this recommendation for decentralising management refers to the merits of community resource management systems, with the local level being the most suitable for effective collective action (Ostrom, 1990). Among the arguments put forward is one supporting the awareness of the territorial level as an area of solidarity and sociability fostering stakeholder participation and mobilisation. Furthermore, because the territorial level is said to make stakeholder co-ordination easier (by stimulating their interactions), it would seem to contribute to the emergence of collective action and better control opportunistic behaviour. We therefore acknowledge the importance of social links in these processes.

2.1. Role of social local co-ordination in sustainable resource management

For the sustainable management of forest resources, reconciling the interests of the various users is only possible if these users make up their minds about both the purpose of the

agreement (i.e. what resources to consider? For what ends?) and the means to succeed (i.e. what management tools?). Fulfilling such an ambition implies that the stakeholders, who are involved in managing the forest, are able to get on and get organised.

These considerations refer to the strategic analysis of the system the forest represents (Mermet, 1992; Mermet et al., 2005). That analysis recognises each stakeholder as having their own rationale and a certain amount of freedom of action but endeavours to understand the interplay of these many rationales according to the interdependency between situated agents and the dynamics in use (Crozier and Friedberg, 1977; Friedberg, 1993). These considerations also relate to analyses dealt with by theoretical approaches to local development for which the role of representations, perceptions and values has to be taken into account in order to understand how the stakeholders appropriate a common project (Greffé, 2002; Teisserenc, 2002).

On that score, we underline the positive externalities brought about by the underlying relationship between the actors, which allows for better collection and circulation of information and strengthens the collective action processes.

2.1.1. Better collection and circulation of information

One of the sources of ineffectiveness in agents' choices involves the inadequacy or lack of symmetry of information, situations which are formalised in particular by the agency theory. And yet the links the agents maintain – which are based on a set of rules that ease their co-ordination – not only contribute to a better mutual knowledge of individual behaviours but also allow for less costly access to data about their immediate environment. Industrial districts and local production systems (LPS) work along these lines. They highlight the value of local co-ordination in sharing and disseminating information. For firms involved in LPS, access to information results in better knowledge of their economic environment. They illustrate situations where the degree of interaction between agents – belonging to the same socio-cultural environment and endorsing the same standards of behaviour – is high.

Sharing information therefore improves the effectiveness of decisions in comparison with individual choice procedures. Improved circulation of information prompted by local links

consequently proves to be worthwhile insofar as it contributes to reducing risk and uncertainty and to economising on transaction costs. These relations between stakeholders affect both individual and collective well-being. Welfare is enhanced, as collective gains net of costs to group members are said to be positive (Knack, 1999).

Dynamics like these described before bear collective efficiency. The agents, involved in the decision-making, are encouraged to get organised and co-operate. They thus improve their knowledge of the other local stakeholders, their intentions and their socio-economic environment. This accumulation of knowledge, which is the result of a social construct, smoothes the path of and strengthens collective action strategies. These determinants are central to the partnership approaches that sustainable development is aiming at.

2.1.2. Stepping up the rationales of collective action

The second type of positive externality generated by local co-ordination is collective action. The principle of collective action is based on the skill of agents at pooling resources in order to achieve objectives that they would have been unable to aspire to individually.

Collective action results from co-operation dynamics that are established between agents. Co-operation seems to be the result of a combination of rules (values, norms, conventions, etc.). An inductive explanation leads us to go along with the idea that the occurrence of interaction results in individuals developing routines. These routines stabilise members' group interactions as they enable them to acquire essential information to better understand and anticipate what they mutually intend to do. They are coupled with other phenomena (*i.e.* reputation, trust, reciprocity) that reinforce their relationships.

As we have just mentioned, co-operative behaviour underpins collective action. It highlights the set of interpersonal relations within which the agents operate. Analysis shows that value systems govern the relations between stakeholders. These rules normalise their behaviour. They are not necessarily made formal; they can be merely tacit.

These shared rules correspond to a set of "invisible institutions" that facilitate the agents' abilities to anticipate (*i.e.* they enlighten the others as to their intended action) and control their behaviour and action. Because these rules foster better understanding between the

agents and encourage transparency and circulation of information, they make co-operation easier. In addition, they lead to regular behaviour and guard against desertion and opportunistic behaviour. They therefore contribute to stabilising or strengthening the links between agents by encouraging the development of markers that mitigate the problems of lack of information, uncertainty and dissension.

These invisible institutions that initiate the co-ordination put the agents in the position of being able to develop links similar to those that can be seen in community-type structures (solidarity, co-operation, proximity). All that remains is to understand these social relation dynamics from a theoretical point of view. Developments in social capital theories form a suitable framework to analyse these issues.

2.2. The attributes of social ties: the social capital approach

Work on social capital is not new even though it is currently receiving renewed interest⁶. Many definitions are attached to the concept and different words are used to refer to it (community life, social entity, network, social glue, social bond *etc.*). This leads to confusion about what social capital is. Fundamentally, the standard hypothesis concerning social capital's impact concerns the benefits of cooperation. This approach has appeared as a theoretical base of reference to understand non-market co-ordination issues. The social capital approach shows how culture and community matter to economic development (Fukuyama, 1995).

2.2.1. The social capital approach: an analysis of organised social relations

Generically, social capital denotes all the norms and networks that foster collective action (Woolcock and Narayan, 2000). Highlighted by Coleman (1988, 1990), in his theory of rational action, the term refers to social determinants that make action possible. "Social capital is defined by its function, it is not a single entity, but a variety of different entities having characteristics in common: they all consist of some aspect of a social structure, and they facilitate certain actions of individuals who are within the structure" (Coleman 1990:302).

⁶ Work on analysing social capital was first done by Simmel.

This conception of social capital is commonly criticised for only considering its effects. This functionalist definition contrasts with the definitions by Bourdieu (1980, 1986) and by Lin (1995) who both identify social capital by its intrinsic properties: a resource confined within practices of sociability. Social capital is thus a social resource that is produced and developed within a social network.

For Bourdieu (1980), "the social capital possessed by a given agent depends on the size of the network of connections he can effectively mobilise and on the volume of capital (economic, cultural or symbolic) possessed in his own right by each of those to whom he is connected". It is nothing but "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalised relationships of mutual acquaintance and recognition" (Bourdieu, 1980, p. 2.). It is worth remembering that social capital is one resource that agents have at their disposal but it is not the only one. In addition, an individual can be integrated in a dense relational network (substantial stock of social capital) without it being of direct benefit to him. The two conditions essential for the existence of social capital are that the forms of capital are of fungible nature and also that the resources (other than social) that are available are a part of a network of relations.

Lin (1995, 2001) suggested integrating social capital into an overall theory of resources and defines it as potential wealth built into the social structure and one which can be mobilised (but is not necessarily so) if need be. The concept of social capital would therefore encompass both existing and latent resources linked to a stable relational network that is activated to varying degrees. Social capital is "an individual's investment in his relations with others" (Lin, 1995, p. 701).

This netlike conception of social capital prompts a look into the kind of links forged between agents. We refer to the typology of social links advanced by the World Bank in 2000 that describes social ties in terms of *bonding*, *linking* and *bridging*.

Bonding links unite individuals within the same community. These ties are sometimes described as being horizontal. In this type of social structure, agents have an identical status: they belong to the same group. In it are put family and friends, social networks of a community type, organisations, etc. *Linking* ties symbolise interactions between agents

belonging to different groups. These links are also called vertical links. In this type of relationship, agents have different positions (or status). The most commonly quoted example is inter-firm co-operation (*i.e.* businesses in industrial districts or LSP are linked by virtue of their complex relations : competition but also solidarity and mutual assistance). Lastly, in *bridging* relationships, agents are far away from one another. This final point describes both their physical distance (bridging links are outside the region) and an absence of or discontinuity in activating the link (the notion of bridging accounts for the latent nature of social capital, similar in this case to a non-activated resource). Bridging social capital denotes a virtual but potential network. It symbolises actors who play a part in separate areas of action and endorse different norms or values.

This overview of the kind of links can be compared with the dichotomous view put forward by Granovetter (1973) who drew a distinction between *strong ties* and *weak ties*. Bonding and linking social capital can therefore be seen as sets of strong ties, whereas bridging social capital belongs to the category of weak ties.

2.2.2. Bonds, links and bridges in collective action

To be used effectively, social capital must rely on a specific dynamic of social ties. If we refer back to our characterisation of social ties, we acknowledge that bonding and linking social ties need to be continually activated for social capital to be a useful resource. On the other hand, bridging social capital does not involve regular or intense activation of ties. Therefore relational structures are more or less dense and cohesive. The kind of ties developed between agents can thus be understood in terms of proximity (See table 1 below).

Table 1 Kind and density of ties

		Density of tie	Degree of proximity
Kind	Bonding	Strong activation of tie	Strong proximity
	Linking	Weak activation of tie	Weak proximity

	Linking	Strong activation of tie	
	Bridging	Weak activation of tie	Weak proximity

We have mentioned above that social capital needs to be maintained through the activation of social ties. To understand the procedure for activating ties properly we must analyse the determinants that govern relationships between agents.

The distinguishing features of bonding-type ties are affective relations and social affinities. These ties are of a community type and exclude any members from outside the community. They tend towards "relational closure" (Coleman, 1988). Belonging to the same community accounts for the fact that agents support the same system of representation. And in this type of tie, interpersonal trust is high. These intra-group ties convey a greater degree of proximity between agents. Here adherence of shared norms and values prevails and can enforce interactions and co-operation.

Linking social capital calls for regular activation of social ties. These inter-group ties must therefore be constantly reasserted. They imply frequent interactions, requiring continual exchanges and reciprocal transactions. As it can be understood, frequent interaction tends to result in a convergence of representations (working out shared norms) and can thus feed the institutional determinants like adherence of shared norms.

Where bonding and linking ties are based on cohesive relational structures that create and increase a feeling of belonging and solidarity among group members, in bridging-type links, other rationales prevail. The frequency of contacts is not requisite to mobilising social capital. These ties tend to be weaker and more diverse than those involved in bonding and linking social capital. In bridging social capital, the agreement procedure between agents is intermittent. No reciprocal commitment is needed but the temporary recognition of a community of interest warrants the activation of an unusual relationship. A weak degree of proximity works in this type of relationship. Table 2 sums up all these observations.

Table 2 Kind of social ties and logics of proximity

Kind of tie	Motivation for tie	Kind and properties of rules endorsed	Degree of proximity
Bonding	Moral standards Unintentional social investment	Value introjection	Strong proximity (adherence of shared norms)
Linking	Self-interest Intentional social investment	Reciprocity and obligation	Strong proximity (frequent communication, dense social network, practices of reciprocity)
Bridging	Self-interest Intentional social investment	Agreement without reciprocal commitment	Weak proximity (distant connection)

Our analysis of social relations, which is part of our study of sustainable common-pool forest resource management, shows the importance of local social contexts in the emergence and the implementation and survival of an SES. The social organisation and the establishment of rules or of other localised norms form the institutional environment into which the stakeholders are plunged. The social constructs that control the operational rules governing the use of resources and that are in themselves an aspect of the rules – which establish the terms of the collective choices relating to resource management – interact with the biophysical environment (Oakerson, 1992; Anderies, Janssen and Ostrom, 2004). Therefore they contribute to the survival, improvement or alternatively the deterioration of resources.

The discussion on the structuring, in dynamic terms, of the social and ecological dimensions of natural resource management, which we develop below, follows on from

work done by Oakerson (1992), and by Ostrom (2004) on the robustness or resilience of social and ecological systems (SES).

3. Conceiving of the robustness of social-ecological systems: quality of the social ties and sustainability of institutional arrangements for common-pool resource management

Theoretical developments connected with common property institutions are a fitting framework within which to study local systems of sustainable forest management from a dynamic perspective (3.1). We use this term to describe the arrangements which embody the territorial dynamics of integrating principles of sustainability into forest management⁷ We will show how the attributes of the social link (kind, quality and density) contribute to the origin, the smooth running and the sustainability of such local institutional arrangements. By doing this, we will highlight the essential role they play in the resilience properties of SESs of which the localised common-pool forest management systems are an aspect (3.2).

3.1. Relevance of the framework to analyse the commons to explain local sustainable forest management systems

The issue of the methods of integrating the principles of sustainability into forest management at local level refers to work on common-pool resource management (Ostrom, 1990; Bromley, 1992; Schlager and Ostrom, 1992).

As we mentioned, the challenge of integrating the principles of sustainability into forest management has resulted in making the territory (in other words the local level) one of the main places in which to build and deploy public forest policy. In such a context, the multiplicity of stakeholders (managers, users, owners, environmental protection associations, etc.) is invited to take part collectively in working out public action. They therefore carry out a decisive role, in the same way as scientists, in working out what constitutes a "norm", having an influence both on the definition of objectives and the implementation of forest policy. If we use P. Lascoumes' terms (1994), the "*interpretation*

and mobilisation carried out by the various categories of social actors become deciding factors in achieving the objectives” (Lascoumes 1994). We can go further by considering, as Commaille (2000) suggests, that in such a situation "normativeness only exists in the social game” and that means breaking “with an idea of regulation that is far too mechanistic” (Commaille 2000).

In the literature connected with the commons, the emphasis is placed on the rules structuring individual and collective choices, which are defined in each institutional arrangement for common-pool management studied. By rules, we mean "generally agreed-upon and enforced *prescriptions* that require, forbid or permit specific actions for more than one individual" (Schlager, Ostrom, 1992).

Three types of rules can be set apart (Schlager and Ostrom, 1992). Operational rules, which concern the use of common resources in particular the terms of access and withdrawal, make up the first category. They also define control procedures, the kind of information required and the types of remuneration or penalty to be applied. The second category of rules aims to establish the terms of collective choice. They relate to management (methods of appropriating the resource, contributing to its improvement, development, etc.), to exclusion (determining the group to benefit from the resource in question) and finally to the terms of alienation. The third category corresponds to external arrangements dependent upon jurisdiction rules that are broader than the mere sphere of influence of the group owning the resource in question (e.g. public policies, organisation of the market in which the resource is sold, etc.). These three categories of rules are interlinked: the rules affecting action are defined within a set of collective choice rules, itself created within the framework of a set of constitutional rules (Ostrom, 1990).

Operational and collective rules give rise to a series of rights (access, withdrawal, management, exclusion and alienation rights) that contribute to defining the various positions of ownership depending on the different status of the holders of these rights (de facto or de jure owner, claimant, authorised user, etc.) (Schlager and Ostrom 1992).

⁷ For example, objectives documents as part of the implementation of the Natura 2000 network, regional forest charters, a collective dynamic with a view to environmental certification of forests, etc.

The collective action system, defined by interlinking the three categories of rules (operational, collective and constitutional), organizes the methods of using and managing resources the physical and technical attributes of which vary (Oakerson, 1992). Users' actual methods of interaction are dependent upon holders' and users' strategies, which themselves depend on the incentives to which they respond. These interaction methods produce results that can be expressed in terms of upholding or sustaining the common institution and the resource over time (Oakerson, 1992).

It is worth remembering that our aim in studying the emergence of concerted initiatives for the sustainable management of forests is to highlight the central role that social cohesion holds therein. In the second part of our text, we showed why social cohesion was a necessary condition for the local production of institutional arrangements (whether formal or not) aimed at sustainable management of resources. We now intend to show that it contributes to the robustness of the SESs of which these local systems of resource management are a part.

3.2. The vulnerability and resilience of SESs: the impact of organisational and institutional determinants

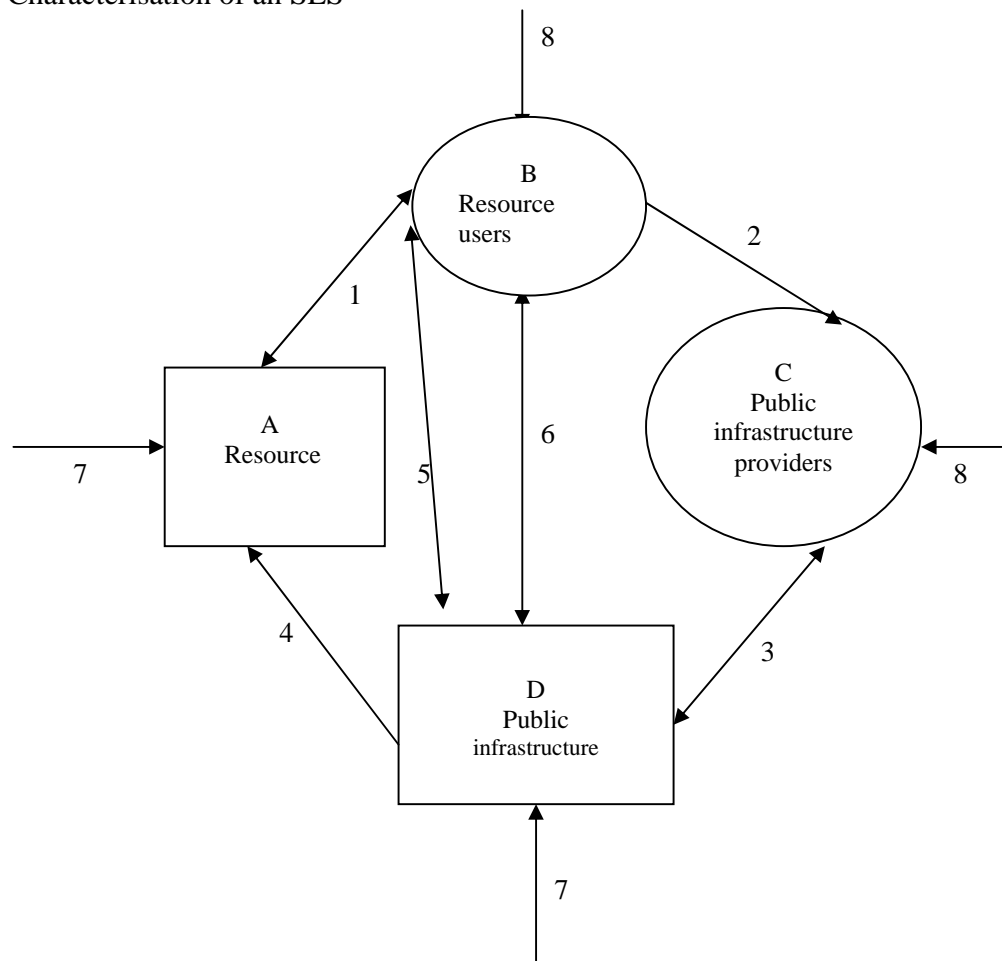
3.2.1. The analytical framework put forward by Anderies, Janssen and Ostrom

Analysis of the sustainability of common-pool resource management institutions and their resistibility and adaptability to external shocks is well placed on the research agenda of the movement analysing the commons. As Ostrom suggests in her recent publications, the aim is to go beyond identifying design principles that have a positive effect on the sustainability of common-pool resource management institutions (Anderies, Janssen and Ostrom, 2004; Ostrom 2004). According to her, the scale of the analysis should be broadened, by reintegrating common-pool resource management institutions into the SESs of which they are an aspect. This would especially help to correct one of the weaknesses of previous theoretical developments by examining more effectively the question of interaction between the rules of collective action and ecological dynamics.

In the terminology used by Anderies, Janssen and Ostrom (2004), an SES helps account for the close intricacy of an ecological system and a social system. This definition recognises

the many interactions that can occur between the biophysical environment and the social framework. So, an SES describes any set of social systems in which interdependent relationships between individuals take shape around and are mediated through interactions with biophysical and non-human biological units. The multiplicity of these interrelations can be described as follows:

Figure 1 Characterisation of an SES



Source: Anderies, Janssen, Ostrom, 2004.

The SES, as a complex system of relations and interrelations between human activities and the physical environment, connects four separate entities: resources, resource users, infrastructure providers (which can be a users' association or an interprofessional committee, or even a public service) enabling access to the resources or their mobilisation, and public infrastructures⁸ (or "capital-intensive environment") to make access to resources easier. This last component combines two forms of capital: physical or material capital (*i.e.* equipment) and social capital. These four entities or components are mentioned in figure 1 (A, B, C, D) respectively.

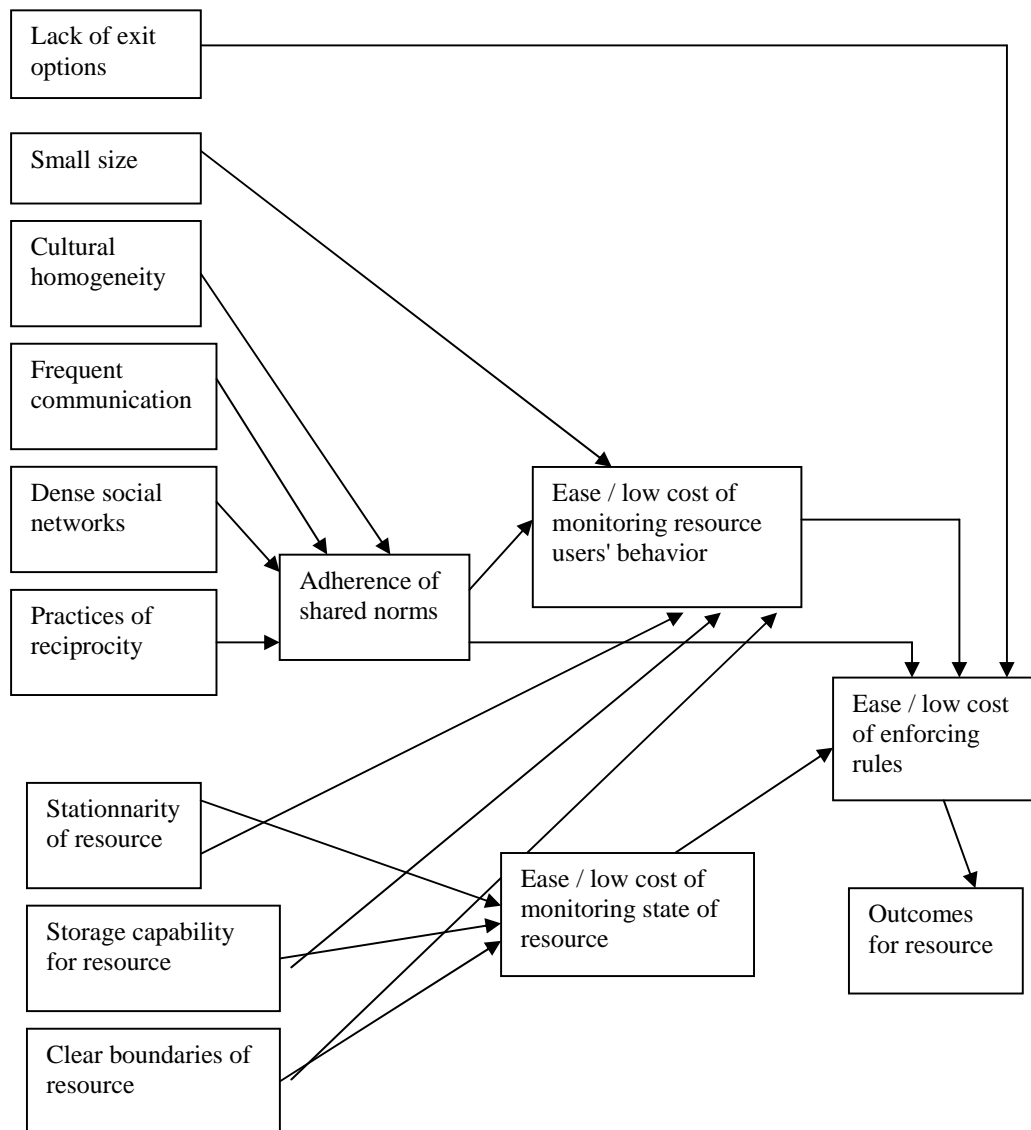
A number of simple connections link the various components. The resources are used by the users (arrow 1). The users maintain more or less direct links with the public infrastructure providers (arrow 2) that contribute to investments and to the upkeep of the infrastructures (arrow 3) that in turn have an effect on the properties of the resources themselves (arrow 4). In certain cases the resource users take part in the co-production of infrastructures, in their maintenance or their supervision (arrow 6). Lastly, in certain cases the dynamics of resource use and withdrawal are conditioned by the public infrastructure (arrow 5).

In addition to showing the internal organisation system of the SES, this diagram also identifies the external forces to which it can be subjected. Two types of external disruption can occur. Shocks can be of ecological (arrow 7) or social (arrow 8) origin. These disruptions affect all the components of the SES. Anderies, Janssen, Ostrom (2004) are interested in the resistibility and adaptability of an SES, in other words in its robustness that they define as "the maintenance of some desired system characteristics despite fluctuations in the behaviour of its component parts or its environment". From this perspective, institutional arrangements – that is to say the rules of collective action that help to strengthen social cohesion and that structure the level of operational (access and withdrawal rights) and collective (rights concerning management, exclusion and alienation) choices – are identified by the authors as being key factors.

In a commented note, Ostrom (2004) clarifies the causal mechanisms that help explain the deciding role played by the operational rules (which guide the linking of agents) and the collective ones (getting agents to agree). Figure 2 shows this.

⁸ Free rendering of the four components of an SES, from the article by Anderies, Janssen, Ostrom, 2004. Among these infrastructures for example are : irrigation canals, dykes or ditches to protect against flooding, etc.

Figure 2 Institutional determinants and survival of resources: causal mechanisms



Source: Ostrom (2004).

Ostrom's conceptual diagram (2004) is retained in full. The term "institutional determinants" is understood to mean both the rules to which agents subscribe for their linking (these relations can moreover be tacit and are embedded in a social matrix) and the effective methods of agreement between agents, which are explicitly expressed (supervision procedures for example).

The diagram proposed by Ostrom (2004) compares the institutional and social factors and the nature and features of the resources at issue. The systemic nature of SESs is thus underscored. The next part of our study looks further into these organisational and institutional determinants (invisible or tacit rules or norms) referring to social capital fundamentals.

3.2.2. *Quality of the social link as a deciding factor in the robustness of an SES*

We propose to look at the types of social relations that foster the emergence and survival of collective action with a view to the sustainable management of a resource. We connect up the forms of social capital, the degree of proximity to which they refer and the stability of the ownership regime.

As previously stated, bonding social capital is based on strong proximity ties. The pre-existence of rules and local norms that are spontaneously shared by agents makes their cohesion easier. Cultural homogeneity fosters an overlap between the agents' representation systems. In a way, the similarity in viewpoints, plans and representations refers to what Livet (1994) calls "domestic trust". This trust – which relies on a principle of mutual recognition and respect – enables the operational rules that govern interaction between users and the resources to be defined in a "naturally" shared, accepted and agreed-upon way. It also makes it easier to work out the collective choice rules that govern interaction between the users and infrastructure providers, the identity of which may, in certain cases, become confused. This ability to endorse local value systems facilitates support for the common-pool resource management institution that results from the acceptance of such rules.

Linking ties, which have as their basis frequent interaction and co-operation among agents, facilitate an *ex-post* construction of local rules and norms via the depth of the relational fabric developing between agents. The agreement procedures are stabilised through their interactions. The agents then find themselves in a mood of compromise and succeed in negotiating and prescribing rules which they jointly agree to subscribe to.

As bonding and linking contribute to a better mutual knowledge of individuals and their behaviour, they also help to better understand – or indeed to anticipate – their rationales of

decision-making and action and to minimise opportunistic behaviour. This social cement is therefore a factor in the adoption of and respect for localised institutions for common-pool resource management and, as such, reinforces the stability of the existing SES endogenously. And yet, in the event of external shocks or pressure – as is often the case with natural resources where demand is subject to erratic fluctuations – the robustness of the SES is put to the test. The rules that underpin local collective action are then challenged. The unusual nature of the configuration that the agents have to deal with can invalidate the previously established system of norms. The challenge then is to know how the existing social structuring can sustain any new initiatives integrating the elements of the unusual context in a satisfactory way for the stakeholders. One might think that the flow of external information contained in bridging social relations helps, in part, to guard against destabilisation of the SES either by contributing to the emergence of new institutional forms that are better suited to common-pool management of the resource in question or by promoting a suitable change to the former collective institutional arrangements.

We therefore posit that bridging social capital, which is a vehicle for external information particularly concerning a change of the context in which agents are engaged, helps these agents more effectively to use referents or knowledge to react to the changes with which they have to cope. Bridging actually promotes better knowledge of the external environment which agents face and with which they have to come to terms (Angeon and Callois, 2005). This information is of diverse kinds and can concern the surrounding political context (local, national or international) just as much as knowledge of the institutional workings in existence on other levels, experiments carried out in other places which local actors can take advantage of, etc. The importance of bridging is clearly seen here – through the mobilisation of external social factors – so as to offer suitable responses with regard to natural resource management. Bridging social capital would therefore be an aspect of the SES' capacity for resilience.

Although there is no denying the importance of bridging, we must however stress that a high level of this form of social capital can also harm local social cohesion. Local social cohesion is essential to the emergence and stability of rules and norms governing the establishment of sustainable common-pool resource management institutions.

From a dynamic perspective, we can see the way social capital affects the robustness of an SES. Where bonding and linking are indicators of strong social cohesion facilitating the adoption of an ownership regime suited to common resource management, too great an influx of bridging can harm this local cohesion by shaking established rules and routines. These first two forms of social capital result as it were in a closure of the social networks and accordingly this increases the community's difficulty in accepting the values which the newcomers bear. If these forms of social ties predominate, they can consequently foster incidents of segregation. And, in a changing context, such an excess of communalism can jeopardise not only the pre-existing social balance but to a greater extent the survival of the SES. Social balance and SES survival depend on the propensity of community members to make a decision on a satisfactory ownership regime (in other words which conveys the principle of common-pool resource management through the mutual recognition of rights, duties and responsibilities of the various categories of actors in relation to the resources).

Similarly, as mentioned above, too much openness can also prove to be detrimental to the minimum social cohesion dynamic required to set up a system of common-pool, sustainable management of resources that is both acceptable and mutually accepted. It is clearly a matter of the balance between the various forms of social relations that is important in collective action processes for resource management. This set of social relations accounts for an SES' resistance to vulnerability, in short its resilience.

All of these observations can be summarised as follows:

Table 3 Impact of forms of social relations on the robustness of an SES

Forms of social capital	Degree of proximity	Characterisation of the common-pool resource management institution	State of the SES	Robustness and survival of the SES
Bonding	Strong proximity (adherence of norms)	Intrinsically endogenous	Stable if no external pressures	Weak
Linking	Strong proximity (frequent	Intrinsically endogenous	Stable if no external pressures	Weak

	communication, dense social network, practices of reciprocity)			
Bridging	Weak proximity (distant connections)	Articulation of endogenous and exogenous norms	Stable if local community 'endogenizes' the input of exogenous social ties.	Strong

Conclusion

Our paper on collective action and sustainable management of forest resources leads us to consider the importance social ties in these processes. Using social capital theory, we explored co-ordination mechanisms. The question of how to locally integrate principles of sustainability into forest management refers to work on common property (Ostrom, 1990; Bromley, 1992, Schlager and Ostrom, 1992).

As part of an institutional perspective, our analysis aims to make a theoretical contribution to the question of sustainable common-pool resource management. We then took this work further from a theoretical angle by integrating our input on social ties. We sought to explain what types of social ties foster the emergence of a robust social and ecological system that guarantees the sustainable management of resources. If there are no external pressures, bonding and linking ties (corresponding to the dynamics of strong proximity) allow for a certain stability of the SES. But strong social cohesion can also bring about segregation and subsequently harm the system's adaptive capacity. Although bridging predisposes the members of a community to openness and contributes to flexibility of local rules, too great an influx of bridging can also shake an SES. A multiplicity of responses to the challenges of sustainable common-pool resource management can be found in the tension between these various forms of proximity. The quality of the social ties thus contributes to the survival, stability and resilience of the SES.

Our theoretical proposal needs to be tested. Confronting our argument with the practical realities will additionally allow us to build some indicators evaluate the impact of the various forms of social relationships in sustainable management of resources.

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