

LiveDiverse – helping to overcome combined biophysical, socio-economic and cultural-spiritual vulnerability through participatory scenarios

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Abstract

Ecosystems are a form of commons vital to human well-being, both through the intrinsic values that they represent and through the ecosystems services that they can provide. The LiveDiverse project examines the interactions between ecosystems and human livelihoods in four parts of the world, India, Costa Rica, South Africa and Vietnam. The case areas, which are focused in and around water and protected areas, represent a variety of cultural contexts, political systems and climates. The project uses an approach based on the combination of biophysical, socio-economic and cultural-spiritual vulnerability. The results so far show that the calculation of biophysical vulnerability for the case areas is problematic, as existing methods such as the Environmental Vulnerability Index (EVI) are based on country scale, and not on smaller geographical regions. The results of the work on socio-economic vulnerability demonstrate that in this case vulnerability is a combination of lack of resources, and of strategies to influence households and communities interaction with their environs. Cultural and spiritual vulnerability appear to be dependent on the interaction of the 'old' and the 'new', the preferences of younger generations, and the level of dependency on traditional methods of production. Through a combination of participatory studies of biophysical, socio-economic and cultural-spiritual vulnerability, the project provides scenarios of alternative future policy options for sustainable development. These include ways of improving rural populations' livelihoods through better management of the protected areas and the development of systems through which local people receive a larger share of the benefits in return for their active engagement in protection activities.

Key words

Livelihoods, biodiversity, scenarios, protected areas

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THE CHALLENGE

Society is faced by a plethora of challenges; from poverty reduction, health improvement, conflict resolution, biodiversity protection, retaining cultural diversity and achieving sustainable livelihoods. In many parts of the world these issues come into conflict with each other, and mechanisms for conflict reconciliation need to be developed. The LiveDiverse project concentrates on the interface of livelihood and biodiversity, and as such it is producing knowledge that will contribute to improving and assessing value-based strategies to promote sustainable livelihoods and lifestyles. It is also contributing to a better understanding of how the vulnerability of livelihoods can be reduced, especially in rural marginal areas, while at the same time conserving and husbanding biodiversity. This includes securing income for people in these areas. LiveDiverse is developing new knowledge on the interactions between human livelihood and biodiversity and has a strong emphasis on dissemination and the constructive engagement of a broad selection of social groups and their governmental and non-governmental representatives. Collaboration with the major stakeholders is a central and integrated aspect of LiveDiverse from its first initiation in order to enable serious consideration and uptake of information generated in the project. The aim of LiveDiverse is to contribute to the design of policies that take into account the true social (economic and non-economic) value of diversity. Society is faced with a wide range of problems and dilemmas that need attention; however, economic, political and administrative resources are limited. It is therefore necessary to improve understanding of and capacity to deal with conflict, including conflict over the multifunctional uses and preservation of ecosystems and components of biological diversity. It is therefore vital to contribute to the development of policy instruments and tools for conflict reconciliation, conflict prevention and conflict resolution. The loss of diversity that we are now faced with is both a biological and cultural issue. Decreases in biological fauna are matched by decreases in cultural diversity. Globalisation has resulted in both improvements and problems for nature and society. Original species and cultures have been threatened by the spread of species from other parts of the world, and by the global cultures that have developed during recent decades. It is therefore important to understand the links between the global and local levels, and to gain more knowledge of how biological and cultural diversity can be retained while at the same time making use of the advantages that globalisation can present. The overall strategy of the LiveDiverse project work is:

- 1) The creation of a multidisciplinary knowledge base and vulnerability mapping. Identification of existing data and of knowledge gaps.
- 2) Construction of suitable scale for identifying public perceptions, beliefs, values towards biodiversity and sustainable livelihoods.
- 3) Identification and mapping of the areas considered vulnerable according to natural science criteria.
- 4) Identification and mapping of the areas considered vulnerable from a socio-economic, legal and political point of view
- 5) Identification and mapping of the areas considered vulnerable from a cultural-spiritual point of view.
- 6) The construction of a GIS data base with information from 3, 4, and 5.
- 7) The identification of the biodiversity and sustainable livelihoods 'hot-spots', that is, the places where there is a high risk (according to the natural science criteria) and

a low capability to manage those risks (according to the socio-economic, cultural-spiritual and political criteria).

- 8) The use of the knowledge gained in these processes to construct biodiversity and livelihood scenarios (Gooch and Stålnacke 2006).
- 9) The formulation of policy recommendations.

BIODIVERSITY AND LIVELIHOODS GOVERNANCE

Society is faced with a wide variety of rapidly evolving and intricate policy problems that demand complicated choices between possible solutions. Unfortunately, important choices in these fields must often be taken under conditions characterised by uncertainty as societies become more and more complex and interdependent. Decisions therefore often have to be taken in a setting where a lack of knowledge of coming conditions is usual and where large numbers of people will be affected. When policies fail to achieve their aims, or where policy-makers are perceived to be inadequate, a lack of public support often develops, and in retrospect, a lack of legitimacy. Research has shown that many societies are in fact faced with problems of decreasing legitimacy, that is, the public now have less faith in government than they did for 20-30 years ago. Decisions made by political leaders, managers, and administrators are questioned more and more, and negative reactions to what are considered sub-optimal policies have become more aggressive. How then to make better decisions, or at least to make sure that decisions are accepted by society and seen as legitimate? If the polity (the political and administrative institutions of government) is unable to solve societal problems by itself, then must government develop into something more? Many contemporary writers feel so, and claim that a way out of the dilemma is to move from government to governance. Governance is seen here as including politics and administration, civil society, and economic interests as three different actors with established formal and informal institutions. Cohen and Arato (1994) describe civil society as being between the state and economic interests, and in line with this typology civil society is defined here as a sphere of activity separate from the politico-administrative and business sectors. Shared decision-making and implementation allows (and may force) formally non-political actors to share responsibility with the polity, and thus possibly increase the perceived legitimacy of decisions and policy. The necessity of increased legitimacy for decisions and policy noted above is especially important in the fields of sustainable ecosystem governance and biodiversity, where the implementation of policies is often dependent on their acceptance by stakeholders and the public. Participation by these groups therefore becomes more and more necessary as problems diversify and become more spatially diffuse.

The future state of ecosystems will be the result of a combination of societal, economic and ecological influences. Yet our ability to predict the future is handicapped by our present state of knowledge, as well as by present values, norms and beliefs. Faced with these dilemmas it is sometimes claimed that *governance*, or even *good governance* can provide possible solutions to problems of ecosystems and sustainability sketched out above. Governance, however, may present advantages, but also creates problems. First, there is the question of definition. As Rhodes has pointed out, *'the term 'governance' is popular but imprecise. It has at least six uses, referring to: the minimal state; corporate governance; the new public*

management; 'good governance'; socio-cybernetic systems; and self-organizing networks (Rhodes 1996). If we content ourselves with the final aspect – self-organizing networks, then we can expect these to be formed by individuals or organizations, probably coming from a number of different spheres. The forms of interaction, if we use the self-governing network metaphor, will then take place in informal contexts as opposed to hierarchical organizations. Social network theory (Ward and Williams 1997) (Rhodes 1986), will lead us to expect that these networks will differ in the number and status of the actors involved, as well as in forms of interaction and the duration of that interaction. Of vital importance in this interaction are the nodal points of the network, actors, organizations or individuals who are able to play a role as communicators and gatekeepers. This leads us to look more closely at the interaction of actors, and at the institutional contexts within which this interaction may take place. Policy choices in sustainable ecosystem management involve trade-offs between alternative uses of scant resources, as well as choices between societal values, norms, and ideologies. Power, and different forms of power, lie at the centre of the debate on government, governance, ecosystem management and sustainability, although this is not always apparent, as power can be exercised in various forms. Steven Lukes has developed a characterisation of three forms of power (Lukes 2005), of which the power to determine a discourse, present or future, can be seen as one. The other forms of power are first-level power over others, exerted through control of decision-making procedures. Secondly, Lukes describes the power to determine an agenda, and thus steer the issues that *can* be discussed. Lukes also analyses a form of power that is exerted, consciously or unconsciously, over the very foundations of society and our thoughts, values and beliefs. This is the power that may prevent us from thinking freely about ways to achieve sustainability, to govern ourselves, or to formulate a future not simply based on present conditions. In ecosystem governance information is often a form of power, and the use of information as a form of power, especially with institutions, is central.

The move to sustainable ecosystem governance also necessitates a greater understanding of the processes of institutions in governance, and involves analyses of the institutions (formal and informal) within which governance can be developed. These may be formal institutions that are created to embody and protect the values of societies, or informal institutions such as liberty, democracy, rights, citizenship, welfare, community and the rule of law. We also need to bear in mind the differences between institutional forms, between formal and informal institutions, and between institutional structures. Young claims that a *'prevalent distinction of institutions is between rules of the game, or settled practices, and the formal organizations who are the players and who have formal hierarchies of decision-making'* (Young 1999). Institutions, in the form of organisational structures or norms and values, are important for sustainable ecosystem governance as this paper will attempt to demonstrate. It will also examine how information is treated in different ways in different institutional contexts. The role of institutions in ecosystem governance is not unproblematic, however, as there is no common understanding of what they are in different parts of the world. The reason for this is perhaps because there is here, as in many areas of policy analysis, a lack of comparative studies (Scott 1995). North claims that institutions create society's structural incitement, and that economic achievements are built to a large extent on economic and political institutions (North 1998). He also states that individual's and group's beliefs, which determine their choices, are a result of learning over time, from generation to generation. Members of

an institution are also considered to hold common values (Peters 1999), which can be '*webs of interrelated rules and norms*' (Nee 1998), p.8). Peters and Pierre (Peters and Pierre 1998) also stress the way that informal institutions (norms, values, rules and practices) shape political behaviour, as do many others (Krasner 1983; Krasner 1993). Rowlinson (Rowlinson 1997) claims that organisations (formal institutions) are *enclosed* by (informal) institutions and social structures, such as laws and state legal systems, and *formal* institutions (or organisations) can be said to be associated with change and action, while *informal* institutions with stability and durability. However, this does not imply that actors within organisations cannot change routines and rules. In some cases they can, and will (Rowlinson 1997) p.89). The study of institutions takes place in a number of different streams, of which perhaps the most important can be categorised as *sociological institutionalism*, focusing on normative and cultural influences, *rational-choice institutionalism*, which looks for strategic, goal-oriented behaviour, and *historical institutionalism*, that stresses the influence of historical aspects of institutions. Knill (Knill 2001), on the other hand, following Mayntz and Scharpf (Mayntz and Scharpf 1975), distinguishes between *institution-based* and *agency-based* approaches. Anthropologists have also examined institutions, mainly in terms of their internal structures, their cultures of organisation, their roles in wider institutions, their relations to other organs of power and influence, their impact on the communities which they serve, and their roles as producers of ideas and ideologies.

Let us now return to the question of ecosystem governance, and attempt to place institutions within this context. Moving from a dialogue between two political actors, or a political actor and a part of an administration, we can visualise governance in the field of sustainability as the possible interaction between actors from three spheres; the ecological, economic, and societal spheres. Another way of putting this is to say that all three aspects must be taken into account if sustainable ecosystem governance is to succeed. We can also envisage this as an imaginary network-based interaction between three points of a triangle, and interaction would then occur, not as a dialogue between two spheres, but as a *Triologue* between three spheres (Gooch 2004). These three pillars of the sustainability Triologue would then be *environment*, *society*, and *economy*. The problem with biodiversity governance (and that is what human dimensions of biodiversity are, among other things, about) is that it is notoriously difficult to measure. To paraphrase Lord Kelvin, the inability to measure it will mean that improvements in governance are difficult to assess, and this realisation has led to a profusion of indicators designed to assess the quality of governance in place at the national level. Despite this abundance of indicators, it has been suggested, most recently in the 2nd World Water Development Report, that their level of robustness is seldom adequate for the task of monitoring environmental governance properly. Similarly, the UNDP Water Governance Facility notes that, [t]he recent centre-staging of governance as the most important challenge to improve water management and services provision has not been matched by developing robust indicators that can monitor and assess trends for national water governance reform. Our aim in LiveDiverse is to contribute to the development of indicators that can be used in biodiversity and livelihoods governance. The World Water Crisis is often described as a crisis of governance. It is argued that improving the way in which water is governed at the local, national and international levels can yield the greatest potential gain in addressing the current global water crisis. At the political level, governments have therefore voiced their strong support for improved

governance through numerous international policy documents, such as the 2000 Ministerial Declaration of The Hague on Water Security in the 21st Century, the 2001 Bonn Keys of the International Conference on Freshwater, the 2002 Plan of Implementation of the World Summit on Sustainable Development, and the 2003 Ministerial Declaration of the Kyoto 3rd World Water Forum. The 2001 International Conference on Freshwater, for example, highlighted the fact that: *'The essential key is stronger, better performing governance arrangements. National water management strategies are needed now to address the fundamental responsibilities of Governments: laws, rules and standard setting; the movement from service delivery to the creator and manager of an effective legal and regulatory framework. Effective regulatory arrangements that are transparent and can be monitored are the way to effective, responsive, financially sustainable services.'*

VULNERABILITY

The analysis of biodiversity values, sustainable use and livelihoods (biodiversity governance) within the project adopts vulnerability as a unifying concept. This combination of perspectives represents a major step forward in vulnerability studies. A forthcoming review of EU funded research states that out of a total of 48 projects on water management, only a minority appeared to have some interest in vulnerability and even fewer systematically targeted the concept and its different interpretations. Most of the projects that did mention or deal with vulnerability followed the dominant view according to which vulnerability equals exposure to the natural event whereas other dimensions are ignored. In fact, the review identified only two projects that offered or promised a more integrated view of the subject, incorporating especially the human and social dimensions (David Sauri, 'Vulnerability and exposure to shocks and stresses in river basins: a review of EU research and some avenues for the future', (commissioned *Newater* project report). UNEP has defined human vulnerability as 'the interface between exposure to the physical threats to human well-being and the capacity of people and communities to cope with those threats' (UNEP GEO3). In the LiveDiverse project vulnerability analyses take their point of departure in the concepts of biodiversity and livelihood vulnerability. Vulnerability is considered from a combination of bio-physical, socio-economic and cultural perspectives, where human ability to conserve and husband biodiversity while at the same time achieving sustainable livelihoods is of vital importance. The chart below shows one of the points of departure for LiveDiverse; however, the project will innovatively also include cultural/spiritual vulnerability and diversity into the framework for analysis. The ecological criteria, needs and threats to biodiversity are relatively well-known, and in many places data exists on this aspect of biodiversity. Much less is known about other aspects of sustainability, such as socio-economic sustainability, which includes livelihoods, especially for rural populations, and cultural, social, and spiritual aspects. LiveDiverse is increasing knowledge of all of these aspects through an integrated study of the ecological, socio-economic and cultural/spiritual vulnerability of aquatic and riparian biodiversity in 4 case studies. The case areas are:

1. The Ba Be / Na Hang Conservation Complex in northern Vietnam
2. The Warna River in India
3. The Terraba River basin in Costa Rica
4. The Greater Kruger Area in South Africa

LiveDiverse case areas are riparian and aquatic; the motivation for limiting the studies of biodiversity and livelihood to aquatic and riparian environments are the following:

- Threats to sustainable livelihoods are often most acute where conflicting interests exist over water and in riparian areas.
- Riparian areas often play a dominant role in supporting a diversity of species.
- Water is a basic necessity for rural marginalised populations and without access to water sustainable livelihoods cannot exist.
- Water is necessary for irrigation, fish production and household needs in rural marginal areas, while at the same time competing interests from energy production, urban areas, industrial use and last but not least biodiversity needs, result in conflicts over water use.
- In-depth studies of all three aspects of biodiversity vulnerability necessitate a spatial and ecological focus. By concentrating on water, that is, on water courses, lakes and their closest environs, LiveDiverse is able to conduct thorough studies of the interaction of ecological, socio-economic and cultural aspects of biodiversity and livelihood vulnerability.
- International law and policy - such as the EU WFD, EU Water Initiative, Dublin Principles, Agenda 21 - has recognised that the river basin is the most appropriate level in which to link social and economic development with the protection of natural ecosystems and biodiversity through catchment management of both land and water interactions.

The overlying methodology for the project can be exemplified in the following way. A region may be faced with significant problems of biodiversity loss, yet because of a good economy, competent management systems, and political will, the potential threats can be managed without major problems for the population. On the other hand, biodiversity in an area may be considered less threatened than in the first example, yet constitute a much larger challenge if the area does not have the capacity to respond to such threats in an equitable and sustainable manner. A third form of vulnerability focuses on areas which are considered sensitive and valuable from a cultural/spiritual perspective; for example, in parts of the world trees, water bodies, mountains etc. are seen as vitally important from a religious and cultural perspective. Three forms of vulnerability assessment therefore need to be considered, and to be combined to produce an integrated biodiversity analysis. These are:

- i) A bio-physical analysis of the case area through which biological diversity can be assessed;
- ii) A livelihood (socio-economic) analysis, through which human capacity to both manage biodiversity threats while at the same time providing livelihoods for the local population, is assessed;
- iii) A cultural/spiritual analysis, through which human perceptions of the cultural/spiritual value of biodiversity are assessed.

The bio-physical based analysis (i) of vulnerability involves the evaluation of existing data on areas considered vulnerable according to natural science criteria. Key variables here include land use, land cover and topography, the location of nature protection areas, data on biological diversity and non-human population levels,

existing species and existing and possible future threats. The livelihood (socio-economic) vulnerability assessment (ii) involves an assessment of population of the region, including ethnic groups; administrative divisions and maps; education levels and training programmes; economy (distribution of wealth and income, employment); literacy; urban-rural divisions; economic policies; ownership patterns; activities of civil society (levels of participation); infrastructure (roads, trains, canals, river navigation); possible future developments; recreation and tourism. An analysis of the relevant laws and policies – as well as the mechanisms in place to implement such instruments – also forms part of the livelihood vulnerability assessment. Here existing data is complemented by research activities that are resulting in the identification of areas that are vulnerable from a livelihood perspective.

PUBLIC BELIEFS

Studies of environmental beliefs, values and attitudes are complicated by the ambiguous meanings of both the objects of study, and of the instruments used. The environment is, after all, technically speaking, anything that exists outside of the self (Heberlein 1981), and, conceptually, the environment can range from the very local to the global. Although the term has recently come to be mainly associated with the bio-physical, or "natural" world, it has also been used to apply to a multitude of varying spatial and psychological surroundings and circumstances. The study of the urban or "living environment", for example, has a long tradition in European social science, where it is used to describe the physical and social territory occupied by an individual or group. These two concepts, that of the "natural environment", and that of the "living environment", complement each other, but are not always defined in studies of environmental beliefs and attitudes. The differences are, however, significant for an understanding public belief systems concerning biodiversity. There is a substantial disparity between concern grounded in apprehension for the immediate living space, and in worry caused by perceived degradation of the planet as a whole. One way of examining environmental values and beliefs is by using the notion of "social paradigm". According to Thomas Kuhn, "paradigm" is a term that can be used to describe a group's way of looking at the world, its "entire constellation of beliefs, values, techniques, and so on" (Kuhn 1970). Paradigmatic change involves the fundamental reorganisation of an individual or groups basic ontological beliefs. Although the concept was originally formulated to describe changes in scientific "world views", the idea of paradigm and paradigmatic change has also been applied to societal perceptions of the relationship between society and the physical environment. Used in this way, "paradigms are not only beliefs about what the world is like and guides to action; they also serve the purpose of legitimising or justifying courses of action" (Cotgrove 1981; Cotgrove 1982). The orthodox, Western anthropocentric view of the human-nature relationship is one in which humans are seen as above and exempt from the rest of nature, in which there is a belief in economic growth and material abundance, and a faith in science and technology. This has been termed the Dominant Social Paradigm (DSP) (Pirages 1974; Catton 1978; Catton 1980; Dunlap 1984). This socio-cultural DSP is not necessarily held by all members of a community, it is instead the "collection of norms, beliefs, values, habits, and so on that form the world view *most commonly* held within a culture" ((Pirages 1974) or held by dominant groups in the society. It is transmitted from generation to generation by institutions, socialisation and through learning. While considerable research has been conducted into examining Western paradigms, and significant work has been conducted by anthropologist into human-nature

relationships in some developing countries, the combination of perceptions of ecological biodiversity, socio-economic vulnerability and cultural-spiritual vulnerability that will be used in the LiveDiverse project is innovative. After the upsurge of environmental awareness in 1970, social scientists increased their efforts to examine the ecological attitudes connected with this interest in the human-nature relationship. Early attempts to construct scales aimed at measuring ecological attitudes (Maloney 1975) used a large number of questions in their scales, and often focused on specific aspects of environmental issues. The construction of the "New Environmental Paradigm Scale" (Dunlap 1978) represents an important although now somewhat dated step forward, in that it attempts to explore "primitive beliefs" (Rokeach 1973; Gray 1985). The earth is seen as being delicate and limited in resources, the possibilities for human economic growth are restricted, and human efforts to dominate the physical environment are believed to lead to serious environmental problems. While the NEP may provide a useful point of departure for the construction of the LiveDiverse Biodiversity and Livelihoods Scale (BLS), it cannot be used as it stands as it does not sufficiently take into account the necessity to achieve livelihoods. Building on earlier work of Kluckhohn and Strodtbeck (Kluckholm and Strodtbeck 1961) and Ashmore and Tumia (Ashmore and Tumia 1975), Gray stresses the importance of primitive beliefs such as those described by the NEP in his theoretical model of the "Ecological Attitude Domain". The first of these primitive beliefs is that humankind is above and apart from nature, and that nature should be utilised by humans. The second is that "progress and growth are natural, inevitable, and good" (Gray 1985). Primitive beliefs are "thought to be some of our most deeply internalised and most determinative of behaviours" (Ibid.: 32). According to Gray, these primitive beliefs, together with general environmental concern, with beliefs about the costs and benefits of individual or societal actions on the environment, and with beliefs about individual responsibility and rights, are "primary beliefs". These can be placed at the base of an environmental belief system, and lead in turn to derived beliefs concerning conservation, pollution, and population, and to general environmental attitudes. The importance of primary beliefs in a person's belief hierarchy has also been stressed by Fishbein and Ajzen (Fishbein and Ajzen 1975), and, according to Heberlein (1981a: 248) a series of beliefs, which can be both cognitive or evaluative, can combine to create an attitude. Beliefs are also important in the formation of a value, which is an "enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable" (Rokeach, 1973: 5). Attitudes and values differ in that "an attitude refers to an organisation of several beliefs around a specific object or situation. A value, on the other hand, refers to a single belief of a very specific kind" (Rokeach, 1973: 18). However, Gray's (1985: 46) taxonomy places environmental concern at the base of his "Ecological Attitude System" (EAS) and treats it as a primary belief. While general environmental concern is undoubtedly an important aspect of an environmental belief system, it may be expedient to treat such concern as a derived belief, and to examine its sources. Another interesting research tradition that will be incorporated into the LiveDiverse work into perceptions and beliefs is Mary Douglas' work on schemas, which has later been developed by herself and others (e.g. (Douglas 1982; Thompson, Ellis et al. 1990; Douglas 1992) and proponents of "cultural theory" have proposed that schemas can constitute coherent systems that include both societal and environmental values and beliefs. Using these and other classic studies as a starting point, and building upon them with the results of more recent studies, LiveDiverse has constructed and used a Biodiversity and Livelihoods Scale (BLS), which consists

of 6 variables in the form of perceptions, beliefs etc. concerning biodiversity and the connection with livelihoods. The results of the surveys using this scale are now being analysed using SPSS (Statistics Package for the Social Sciences) which enables statistical correlations and factors analysis to be performed.

PUBLIC PARTICIPATION

Although shifts in environmental management in various countries and parts of the world may be very different in character, they do however seem to have one thing in common, which is that the scope and ambitions of environmental management has increased. This implies that management is now concerned with more issues, and affects more people than it did in the past (i.e. management involves not just farmers but also industrial interests, nature conservationists and ordinary citizens, as well as the perceived rights of future generations, human and non-human). Environmental management has increasingly become concerned with risks and benefits, and has therefore moved more and more into the realms of politics, where the traditional definition of what politics is can be formulated as 'the authoritative assignment of values' (or who gets what, when, and how). In the course of their profession, environmental managers have in fact always engaged in the assignment of values and their actions have therefore always been to a large extent political. However, whereas environmental management has traditionally been considered a predominantly technical field in many countries, the increase in scope, and new demands on management, make the political character of the field very clear, even to the most superficial observer and even in places where this might least be expected. These developments and the move in environmental management from the primarily technical to a combination of technical and political-social spheres has led to an increased interest in public and stakeholder participation in environmental issues. As a result, the relevance and saliency of public participation in environmental management has increased in the past decades. There are many reasons for this development. Some of these are on what one may call the 'demand side' of public participation: because there is more societal attention to environmental goods such as clean water and land- and waterscapes, the desire to participate on the part of the public has increased. Similarly, environmental management is increasingly touching upon politically sensitive issues such as land use planning, flood control, irrigation, biodiversity and aesthetic uses of water. On the 'supply side', we may observe an increase in the number of institutional venues for public participation. This interest in public opinion was not however simply based on a perceived means of defense; environmental managers also began to realize that they could learn from members of the public. The usefulness of contributions from the public to environmental management processes may vary, yet even without the benefits of a technical or natural science education, citizens often possess 'local knowledge' or 'ordinary knowledge' related to their being on their land that managers need to incorporate in order to make accurate decisions. Faced with an increasingly complicated and uncertain environment, there is also a realization of the need to learn to work together in order to successfully manage environmental issues (Ridder, Mostert et al. 2005). Yet while the issue of public participation in environmental management has come to be seen as more and more important, systematic studies of different types of participation, and of the outcomes of participation, seem to be few. The LiveDiverse project therefore identifies the most suitable participatory methods for our case areas and implements them in the areas management.

ECOLOGICAL VULNERABILITY

Sustainable development involves the integration of environmental, economic and social aspects (Brundtland, 1987). Developing tools to measure the vulnerability of these three components has become increasingly important to promote sustainability. The ecological vulnerability can be defined as the potential of the natural system to respond adversely to events, which may consist of natural hazards or anthropogenic pressures. Ecological vulnerability is the local result of a synergy of natural and human factors and should be taken into consideration in the management plans. However, environmental management is often focused on the environmental effects of individual development projects, while a better knowledge is needed on the cumulative effects of multiple management actions over different spatial and temporal scales (Jackson et al., 2006). The use of rapid and effective indicators that can synthesise these various environmental aspects and that can be integrated with the economical and social indicators may contribute to improve the environmental sustainable management. The Environmental Vulnerability Index (EVI), developed by the South Pacific Applied Geoscience Commission (SOPAC), the United Nations environment Programme (UNEP) and their partner (<http://www.vulnerabilityindex.net>, Kali et al., 2003), provides a rapid and standardised method to measure the environmental vulnerability of a country. EVI is a single indicator that has been designed to reflect the extent to which the natural environment of a country is prone to damage and degradation. It was conceived to be easily integrated with economical and social indexes. EVI summarises in a unique figure a wide range of conditions and processes, but it is built on the bases of 50 environmental vulnerability indicators, related to weather & climate, geology, geography, resources & services and human population. For this reason EVI provides an overall estimation of vulnerability together with the possibility to identify specific problems through the 50 indicators. Moreover, it provides a series of policy-relevant thematic sub-indices. In the EVI, three aspects of vulnerability are included: hazards, resistance and acquired vulnerability (damage). Among the 50 indicators, 32 are indicators of hazards, 8 of resistance and 10 measure damage. The EVI scale is standardised allowing the comparison of different indicators within the same country but also among various countries. This aspect is particularly relevant, as there has been significant recent attention to implement measures of vulnerability that are comparable across time and location (Adger, 2006). EVI allows an estimation of the level of risk in the present status, informing at the same time on how the environment will be likely to cope with future events, as the environment vulnerability is considered depending also on the results of past natural and anthropogenic hazards (acquired vulnerability). Concerning the spatial scale, EVI was designed for use at the national scale. However, also other geographic scales could be relevant for the assessment of vulnerability. Recently, there have been innovations in methods to capture the spatial distribution of individual variables of concern (Adger, 2006; Luers, 2005) and in evaluating the vulnerability based on spatial extrapolation (Jackson et al., 2006). These studies aim to highlight within a region the priority areas, and often rely on techniques of overlay between spatial models and data to reveal geographic coincidence (Abbit et al., 2000). These approaches can be combined with the EVI concept to develop spatial environmental vulnerability indicators. In the LiveDiverse project the EVI has been adapted to the individual case area needs.

SOCIO-ECONOMIC VULNERABILITY

There is an increasing amount of literature on the concept of socio-economic vulnerability to environmental risk. Generally, vulnerability is seen as the outcome of a mixture of environmental, social, cultural, institutional and economic structures and processes related to poverty and (health) risk, not a phenomenon related to environmental risk only. Definitions of vulnerability focus on risk and risk exposure on the one hand and coping and adaptation mechanisms on the other (e.g. Pelling, 1999). Besides risk exposure, adaptive capacity is seen as a key component of the concept of vulnerability (e.g. Adger, 2000; IPCC, 2001). Empirical studies focus more and more on variations in both exposure to natural hazards and people's capacity to cope with these hazards (Few, 2003, p.48). Adaptive capacity is considered a process of adaptation (over time) to structural and/or incidental sources of environmental stress (e.g. Nishat et al., 2000), consisting of distinct social, economic, technological, institutional and cultural adaptive mechanisms (e.g. Cardona, 2001). Social mechanisms refer, for example, to social networks of relatives and neighbours, economic mechanisms to livelihood diversification or savings, technological mechanisms to technical measures to reduce environmental risk, institutional mechanisms to (in)formal political-organizational structures and associated collective action to ameliorate vulnerability (including for instance access to productive assets or community micro-credit systems) and cultural mechanisms to perceptions and beliefs about the nature and avoidance of environmental risks. It is therefore important to pay attention to the whole range of adaptive mechanisms and explicitly focus on the influence of poverty on socio-economic vulnerability and adaptive capacity. Poverty is both an important determinant of (endogenous) environmental risk - and hence (in)directly of socio-economic vulnerability - and an important constraint of adaptive capacity. Poorer people tend to be more (often) exposed to environmental risk than wealthy people. The latter are furthermore able to take protective measures or are able to avoid certain environmental (health) risks, i.e. the endogenous component of risk. Besides, often it are the poor that depend most for their livelihood on the environmental resource base (Scherr 2000) and when the environmental resource base is degraded the asset base of poor households deteriorates as well. Whether individual households and communities have the adaptive capacity to reduce socio-economic vulnerability to environmental change generally depends on the fit between the levels at which the problem is experienced and caused. For instance, local communities cannot influence the rate of climate change worldwide but they can sometimes reduce the deforestation rate locally. Two factors are important in determining whether individual households and communities have the adaptive capacity to respond to environmental change. First, they need to be able to cooperate in sustainable resource management or to organize themselves against the environmental threat in groups or networks. Whether households are likely to cooperate depends for instance on the costs and benefits of cooperation and the extent to which free rider behaviour can be effectively controlled (Ostrom 1990) but also on higher order variables such as the level of trust in the network and the importance of reputation in societies. If some households or groups of stakeholders can easily free ride on the efforts of others, a sustainable solution is less likely to be found. Our analysis will focus on the relative importance of social capital, informal institutions, and the wider socio-economic environment in which local resource management takes place. The wider socio-economic environment determines the costs and benefits of cooperation and the extent to which the costs and benefits are equally shared (Agarwal 2001). (In)formal institutions are required to monitor free rider behaviour and punish defectors effectively (Baland and Platteau 1996). While

the exact definition of social capital is subject to debate, most analysts treat it as a characteristic of communities, and describe it in terms of trust, norms and networks that enable collective action (e.g. Putnam 1993, Fukuyama 1995, Woolcock and Narayan 2000, Bowles and Gintis 2002). Most empirical work – be it based on cross section analysis or case studies – suggests a positive correlation between social capital, the quality of governance and economic growth (e.g. Putnam 1993, Knack and Keefer 1997, Knack 2002). Second, there needs to be a supportive institutional environment to facilitate cooperation but to also coordinate natural resource management, specifically at the national and international levels. Here we can connect to the emerging literatures on adaptive governance and adaptive co-management (Folke et al., 2005; Olsson, 2006; Huitema et al., 2007) and the literature on the institutional dimensions of global change (e.g. Young, 2002; Gupta and Huitema, forthcoming). Starting point of this literature is the contention that the relationship between ecological and social systems is so strong that many propose to study them collectively, as ‘social-ecological systems’. This has occurred in an economic context, which is increasingly globalized and interwoven (Young et al., 2006). Because of this social-ecological systems’ behaviour is so complex and unpredictable that rather than managing for an optimum condition, attention should be paid to the development and maintenance of managing capacity in the governance system, and the adaptive capacity of that system (Young et al., 2006, Folke et al. 2005; Olsson et al., 2006; Huitema et al., 2007). Some have argued that such a capacity will be provided by social networks (see for a discussion Janssen, 2006), others have more broadly illuminated institutional prescriptions for governance systems such as the willingness to experiment, the presence of high levels of public participation and collaboration (see eg. Lee, 1998; Imperial, 2002), and the presence of shadow networks, effective leadership, flexibility, and connectedness between various governance levels (Olsson et al., 2006).

CULTURAL-SPIRITUAL VULNERABILITY

Though it is now increasingly recognized that cultural diversity and biodiversity are deeply linked, mainly because biodiversity hot spots are also locations occupied by diverse indigenous peoples who have had a living interaction with the biodiversity of their surroundings as part of their living, the first UNEP volume of biodiversity (Heywood 1995) rarely if at all took any account of cultural diversity and especially that of the indigenous people. The UNEP assisted volume on cultural diversity that appeared four years later (Posey 1999) bends the stick backward, a little too backward according to some reviewers (for example, see Westing 2000 and Foltz 2001). The clearest example of this connection that has been cited and studies the most is that of sacred groves and in India Madhav Gadgil has done pioneering work in this respect. (See for example Gadgil 1974 and Gadgil 1981) Though the relevance of cultural and spiritual diversity is often seen as restricted to indigenous and traditional people and attributed special vulnerability because of Western lack of understanding of the value of indigenous people’s concepts, there are now attempts to apply it in more general situations (Cocks 2006). Drawing on the fact that ecosystem fringes are often the richest sources of biodiversity Turner *et al* combine ecological and cultural edges to argue for a composite ‘living at the edges’ as a major source of resilience, that is coping with social and ecological vulnerability (Turner 2003). This provides an important analytical framework that however has elements that can be utilized for a general approach to resilience as coping mechanism for vulnerability. Culture is often taken as a non-material concept, but perhaps in respect

of biodiversity, material culture and material practices are as if not more important. For one such study see (Hani 2005). There have been a number of conventions centred around indigenous people and their rights that have implicated cultural and spiritual vulnerability issues, but now there is more explicit recognition of the issue. The latest such convention is the Tokyo Convention 2005 that among other things calls for the implementation of UNESCO/IUCN Guidelines for the Conservation and Management of Sacred Natural Sites (See below). However, the field of study of vulnerability of cultural and spiritual biodiversity must be considered a fledgling field in so far as independent methodologies and their development are concerned. Most of the literature brings to bear on the problem the framework of their parent disciplines, including ethnography, ethnobotany, culture studies etc. There is a need for further interdisciplinary study of the interconnections between the cultural and spiritual practices landscape and biodiversity landscape before we can begin to talk about generalized methodologies and approaches. This will be a major task for the LiveDiverse project.

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