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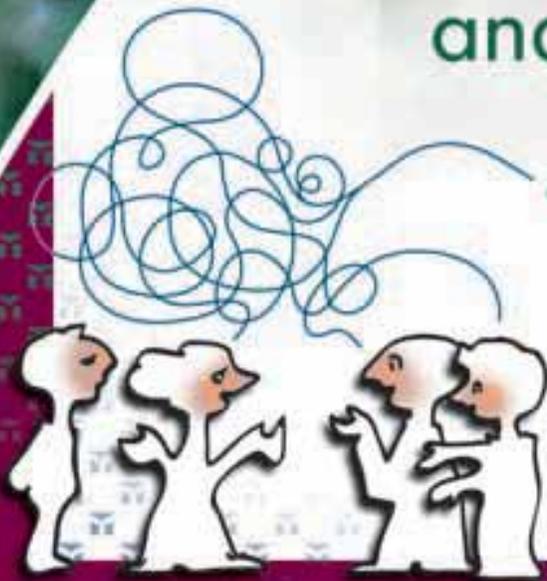
# Biosphere Reserves

**TECHNICAL NOTES**  
1-2006



## Biodiversity and stakeholders

CONCERTATION ITINERARIES



Ecological and Earth Sciences in UNESCO

**'Concertation':** process

of active dialogue between different stakeholders working together in concert to develop a unified proposal or common focus in terms of visions, objectives, points of view, concerted actions building components together to project into the future collectively.



BIODIVERSITY and STAKEHOLDERS:  
CONCERTATION ITINERARIES



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**F**or thirty years, the MAB Programme, particularly through its World Network of Biosphere Reserves, has initiated and supported studies on the interactions between human societies and natural resources in various cultural and socio-economic contexts. A biosphere reserve is a multi-objective (conservation, economic development, scientific research and training), multi-use and multi-stakeholder territorial space, which relies on a zonation system to fulfill its functions. The stakeholders and institutions intervening in this space may have different interests and relationships to time, property and nature, which may conflict. The Seville Strategy seeks to promote the management of each biosphere reserve essentially as a 'pact' between the local community and society as a whole.

More particularly, Goal II of the Seville Strategy ('Utilize the biosphere reserves as models of land management and of approaches to sustainable development') recommends, at the international level, to 'Prepare guidelines for key aspects of biosphere reserve management, including the resolution of conflicts, provision of local benefits and involvement of stakeholders in decision-making and in responsibility for management'. (II.1.1).

In light of the many objectives assigned to a biosphere reserve and the diversity of stakeholders, institutions and their interests, biosphere reserves are research and training laboratories for the prevention and management of conflicts linked to the challenges of conservation and sustainable use of biodiversity. It was thus deemed strategic to share experiences, cultural approaches, practices and methodologies for dialogue and concertation in the creation and management of biosphere reserves in the World Network, in different socio-economic and cultural contexts.

This technical note is intended to stimulate discussion about the challenges of reconciling conservation and development within biosphere reserves and the different means of governance set up on the sites and their capacity to evolve. The researchers' contributions are divided into four chapters: the first addresses challenges concerning the conservation and sustainable use of biodiversity in biosphere reserves; it identifies the different sources and types of conflicts. The second chapter raises the question of the role of scientific knowledge, suggests the creation of gateways between researchers and managers, and offers an initial assessment of the participatory approaches. The third chapter introduces the use of innovative tools which have been tested in several biosphere reserves in Europe and Africa to facilitate dialogue and concertation among different stakeholders. Finally, the last chapter suggests proposals for research and training, favouring a comparative and dynamic approach in order to better understand changes, factors of innovation and learning in biosphere reserves.

These considerations must be enriched through the contributions of our partners and explored in greater detail in the coming years through comparative case studies throughout all regions of the world, based on the richness and diversity of the experiences and practices of the biosphere reserves that are part of the World Network. The Division of Ecological and Earth Sciences, through its intergovernmental MAB Programme, thus wishes to make a substantive contribution to the challenges of biodiversity management in multi-use spaces, with an objective of sustainable development.

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### **On 'Concertation'**

The word 'concertation' is used in this technical note to describe a process of active dialogue between different stakeholders, working together in concert, to develop a unified proposal or common focus (in terms of visions, objectives, points of view, concerted action, ...).

The term indeed involves dialogue, but means much more than dialogue, since it implies building components together.

It gives participants access to a real collective construction, based on active exchange of opinions and perceptions leading to a shared outlook.

And a means to project into the future collectively.

# Chapter 1

## Challenges

'One challenge in creating and managing a biosphere reserve is to reconcile in the same space conservation and economic development objectives and foster the convergence of the long-term interests of the stakeholders involved. Biosphere reserves are privileged study sites for landscape dialogue between different actors and institutions, through specific concertation processes and mechanisms.'

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Source: Working document 'Development of the World Network of Biosphere Reserves: a. Proposal for a MAB strategy on conflict prevention and resolution in biosphere reserves.' MAB Bureau, 8-11 July 2003. SC-03/CONF.217/6.

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## Dialogue and concertation in biosphere reserves: issues and challenges

JEAN-EUDES BEURET

### Why is biodiversity a source of conflict?

Nature is a source of life, yet the use and the conservation of nature are at the root of numerous conflicts. Biosphere reserves, which within a specific regional landscape aim to reconcile objectives for conservation of biodiversity and development, are privileged sites to better understand these sources of conflict. This is especially true given that, in some sites, the conservation measures put in place are often perceived as significant limitations on the development – and, at times, even the continuation – of certain economic activities. Several factors explain the existence of such conflicts.

### Between conservation and utilization: when biodiversity is subject to competing uses

Stakeholders<sup>1</sup> may have conflicting interests when the same resources are put to conflicting or even incompatible uses. Several scenarios are possible (Pennanguer et al., 2004).

Conflict due to absolute incompatibility may appear between two mutually exclusive activities, when the development of one of them causes the disappearance of the other. This is the case, for example, when a material extraction quarry is set up on a natural site of major ecological value. The stakeholders promoting the economic project do not have the same interests as the environmental stakeholders. Negotiations concerning access to the resource are especially conflictual because a 'middle ground' can hardly exist.

1. Any person whose actions affect a biosphere reserve, as a user of the resources or the areas it covers, as a person making a claim on certain of the environmental resources it supports, or as an entity taking institutional action, is a stakeholder in this biosphere reserve. Such persons interact in a 'stakeholders' game' that influences the fate of the reserve.

A group made up of individuals or legal entities characterized by the same actions relating to the reserve and the same behaviours and positions in the 'stakeholders' game' is considered a category of stakeholders.

Two individuals or groups that perform the same activity but do not defend the same position, due to divergent interests, perceptions or opinions, belong to different categories.

**Conflict due to conditional compatibility** concerns practices and uses that are compatible only under certain conditions. The conservation of a species can, for example, be compatible with its utilization, on the condition that off-take is limited in such a way as to allow the species to reproduce itself at an identical pace. The conflict may concern the definition, application and respect of rules concerning the use of the resource.

**Conflict due to relative compatibility** arises when one activity modifies the conditions for carrying out another activity. External negative effects then come into play: due to a lack of coordination among those who generate these effects and those who are subject to them, conflicts may remain dormant until a triggering factor causes them to be expressed, at times brusquely. For example, the quality of the Mer d'Iroise Biosphere Reserve, in France, which covers marine and coastal areas, is affected by polluting discharges from neighbouring land. Environmental conservation activities clash with the effects of other activities. These activities are relatively compatible but conflicts may arise due to the existence of uncontrolled external effects.

### The environment subject to divergent positions, whether real or supposed

Stakeholders may then oppose one another on the basis of divergent positions, whether these are the actual positions of this or that party, or suspected positions, which one stakeholder anticipates and attributes to another.

**Conflict due to divergence** is characterized by a real, deep-seated difference concerning the way in which the protagonists contemplate the management of the area and its resources and the purpose of such management. The stakeholders do not necessarily have divergent interests but they have conflicting opinions.

**Conflict due to anticipation** is caused by imagined interactions. It is tied to a lack of information, rumours and fear. If stakeholders' questions about an event are

left unanswered, they are transformed into fears that gradually crystallize into certainties. This type of conflict is often associated with a public action and historic antecedents: for example, people may fear the government will ban access to resources, even if it claims the opposite is true, because at a specific time and place it has already done so.

Within the biosphere reserves, several of these types of conflicts may co-exist. The same conflict about the same issue may lead to both a conflict due to anticipation ('You are going to block access to our forestry resources', even when the management authority has no intention of doing so), one due to conditional compatibility (consisting, for example, of respecting a certain quota for collecting wood in order to allow the forest's self-reproduction) and one due to divergence (with disagreement about the means for managing the forest).

**Divergent representations of the same environment, a source of incomprehension and conflict**

Conflicts may also arise from a failure to understand and/or the existence of several representations of the same reality. For example, around Pendjari Biosphere Reserve, in Benin, one group considers certain animals to be endangered wildlife species, while others see them as a potential meal or trophy (UNESCO, 2003). The existence of several representations may prevent local stakeholders from understanding one another, even though they are talking about the same thing. In France, there are conflicts between farmers who work plots of land at the edge of the sea and oyster farmers who raise oysters in the sea, near the shore. Agriculture-related pollution, in particular caused by spreading manure from farm animals, disturbs oyster-farming activities. The analysis of the initial discussions between these stakeholders has shown that the first group considers manure a fertilizer, while the second sees it as simple waste; for the first group, pollution is understood only as nitrate pollution, while the second group is concerned above all by bacteriological pollution. These conflicting representations of the same phenomenon create a lack of understanding.

This is an instance where one stakeholder does not have an objective vision of the other stakeholder's reality, but in other instances, these representations are simply different, without one being more 'right' than the other. For example, in the Sahel zone, villagers perceive land in a way that is vastly different from the way it is represented in positive law. While this type of law and those who make reference to it

define the limits of territories and their boundaries, the villagers see land according to a topo-centric vision in which resources and activities are organized around a specific point: this may be an especially important resource, such as a watering place. Both representations are legitimate, each one for different social groups and institutions. The topo-centric representation is that of customary institutions; it has authority in the village and on the scale of traditional 'territories', while the geometric representation is that of the central or decentralized State and customary authorities. There are, however, interface organizations where the two representations either co-exist or compete: such organizations play a major role in devising a possible compromise between these representations.

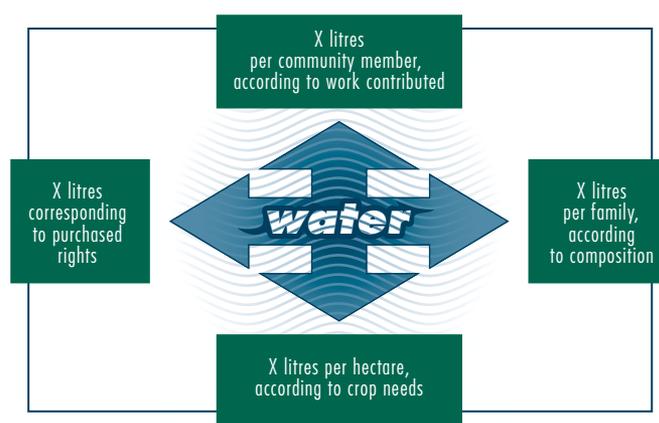
**In the background, what each person considers to be legitimate, fair and right: a matter of 'orders of magnitude'**

Underlying these representations are 'orders of magnitude' (Boltanski and Thévenot, 1991), different ways of perceiving what is appropriate and what is not, which support different ways of justifying or lending legitimacy to a position. For example, concerning the sharing of water in irrigated areas of Ecuador, various proposals for water sharing were put forward, each one considered to be the most effective and the best one in the eyes of its advocates. Distribution based on family composition makes it possible to respect a principle of equality among citizens, according to a civic justification that emphasizes equality and the general interest. Distribution by surface unit and even, at times, based on needs for each type of crop, aims for optimum efficiency based on an industrial type of justification. Distribution solely to members of the community, on the condition that they contributed work during the building phase, following community-based principles, appears to be the fairest according to a domestic-type justification that values proximity, trust and community interests. Finally, those who have purchased rights make claims based on a trade-type justification that is not the one used by the local community (Fig.1).

Each of these proposals is legitimate from the viewpoint of the person who supports it, and nothing enables us to say that one is better than the other: they represent differing notions of justice, fairness and the common good, which correspond to different orders of magnitude. There are other justifications in addition to those mentioned above, and each society has its own benchmarks. Such a reading in terms of 'orders of magnitude' is useful because it makes it possible to understand a number of disagreements and to encourage the protagonists to get



beyond the initial reaction that the other party is acting in bad faith. Such orders of magnitude are often present in the background of environmental conflicts in which the protagonists do not have the same reference to time (short-term trade opportunities vs. the long-term conservation of nature for future generations), to nature (the villagers' familiarity and empirical knowledge vs. the scientists' distanced relationship), to property (some emphasize private rights, while others refer to community or collective<sup>2</sup> rights, or even future generations). None of these perceptions can be considered more 'right' than another: their diversity explains a number of conflicts, and each stakeholder must make an effort to better understand the other's viewpoint in order to reach an agreement together.<sup>3</sup>



**Fig. 1. Several modalities for sharing water, several orders of magnitude.**

It is thus essential to identify these orders of magnitude. In the event of disagreement, each individual can refer to one of these orders of magnitude to justify his or her position: this makes it possible to understand diverse viewpoints and how they are determined.

2. At the heart of controversies between certain biosphere reserve stakeholders, contradictions come up often between groups that assert the right to private property, those who claim that certain animals and environmental resources belong to a social group characterized by a cultural, identity-based, social and/or geographic proximity (community-based appropriation), and those who assert that these resources belong to a larger community, or even all of humankind, and to future generations (collective appropriation).
3. See suggestions in Chapter 3 devoted to tools for dialogue and concertation.
4. See Cibien et al., this chapter, pp. 22-24.

## Preventing conflicts and forging a shared sustainable development perspective: public participation

### The challenges of participation and concertation in biosphere reserves

Dialogue and concertation among the stakeholders concerned by an area and its resources appear to be one of the favoured approaches to managing biodiversity from a sustainable development perspective and in order to prevent the outbreak of multiple conflicts mentioned above. This approach also provides a means for improved compliance with rules implemented in a given area, and even for the prevention of the routine violation of certain rules that public authorities impose on resource users who do not recognize the legitimacy of such rules. In the biosphere reserves, this means that opportunities for dialogue and public participation must be provided for.

In each country, the biosphere reserve management authority<sup>4</sup> requires two types of entities in its dealings with the local stakeholders: first, entities for conflict management and, second, measures providing for concertation. This may mean a single, all-encompassing entity, or separate ones. The measures for concertation, in any event, play a role in conflict prevention and also enable those who want to conserve resources and those who live off these resources to reach compromises and build a future, a common perspective, around the goal of sustainable development. Such measures may be ongoing or temporary, and concertation may concern the biosphere reserve in its whole, for example, when a management plan is drawn up, or the management of a particular resource or area (see Boureima, this work).

Within the biosphere reserves, the objectives and challenges of concertation will include the following in particular:

**Between the management authority and resource users, knowing one another and mutually recognizing one another's legitimacy:** the legitimacy of the biosphere reserve management authority is conferred upon it by the State; often it is recognized for its skill and knowledge, in particular scientific. It may at times consider itself to be the only legitimate entity to manage the area that has been entrusted to it, but other stakeholders also make a case for their own legitimacy: the access to resources as an immediate vital need, prior presence in this or that area of the biosphere reserve, and at times the existence of sacred ties with this 'territory', this land, and a particular social group. Dialogue and concertation

must make it possible for each party to go from seeing the other as a competitor to be excluded, to reaching the point where each one understands and recognizes the merits of the other's presence and their right to express their needs, wishes and proposals: recognizing the legitimacy of the other is a *sine qua non* condition for establishing constructive dialogue.

**Make public participation effective:**<sup>5</sup> most biosphere reserves offer the means for the public to be represented and participate, as is recommended by the Seville Strategy and the Statutory Framework of the World Network of Biosphere Reserves. In West Africa, we have observed a gradient in the ways local communities are involved in the co-management of the biosphere reserves, depending on the structures already in place. These range from a simple information chain to pass along the requests of local communities to the management authority, to participation in decision-making bodies (participation in the steering committee, for example, at Pendjari Biosphere Reserve in Benin). Regardless of the level of participation offered, agreement must be reached on how the representatives are chosen for the categories of concerned stakeholders, to ensure that they are as representative as possible (they may be determined by geographic sector, socio-professional category, elected, appointed) and that their participation has an impact.

**Optimize compliance with rules and decrease the cost of enforcement:** the fact that the rules have been either referred to, discussed or determined together, depending upon the desired level of public participation, will increase the public's degree of information, acceptance and group control. Such control is exercised individually, with people being able to control their own actions, and with greater personal commitment if one has taken part in defining the rules. Yet it is also collective: this is an instance of social control, exercised by all the members of the group that determined or approved a rule, on each of its individual parts. Public participation must make it possible to increase the probability that rules will be complied with and proportionally decrease the costs related to the enforcement or bypassing of these rules.

**For an optimum compromise between conservation and development:** A rule's effectiveness must be measured not only in light of its conservation effects, but also based on the relations between its impact and the constraints it imposes. If the same outcome for the conservation of a plant or animal species can be obtained by forbidding access to local populations, or by autho-

rizing the reasonable use of these resources, the second solution will be chosen as being the most cost-benefit effective. The effort to find the best possible compromise between conservation and development requires the participation of the core stakeholders in local development, who are especially well-informed and, based on a given conservation objective, know how to lessen the constraints they must bear.

**Prevention and autonomous conflict management:** Involving the public in the definition of the biosphere reserve's rules of management naturally contributes to preventing conflicts that may arise from the implementation of such rules. This is not, however, sufficient given that conflicts can develop due to a change in the quantity and location of the resources or users of these resources. Therefore, when the rules are defined, provisions must be made for ways to revise them if such events should occur, as well as mechanisms for conflict management. Generally speaking, one of the results of public participation will be learning an approach to dialogue and exchange and acquiring skills in this area, both for the stakeholders of the zone and the managers of the biosphere reserve.

**The means: different kinds of public participation in the management of a biosphere reserve**

Public participation may take several forms. The different types of participation (Fig. 2) range from communication, where there is no actual participation, to negotiation, where decision-making power is shared among public authorities and their discussion partners. Markedly different levels of participation are possible between these two extremes. It is important to be very clear about what one means because it is common for certain stakeholders to use a term that indicates a high level of public participation to describe practices that, in reality, are very limited, thus creating a certain degree of frustration among stakeholders.

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5. With the exception of the reserve's management authority and organizations to which it is connected through relationships of superiority/inferiority, all the other stakeholders in the biosphere reserve represent what we refer to here as 'the public.' They may invest a public space in which they can express themselves and/or attempt to influence and propose rules and actions aiming to manage the biosphere reserve based on a common ambition. The notion of public space, as defined by Habermas (1978), is based on citizens' freedom and autonomy to reasonably develop an opinion and a collective will that should influence the production of laws: in this case, an impact on the management and fate of the biosphere reserve. This public space may be fully independent of the reserve's management authority, or it may be suggested and organized by the authority.

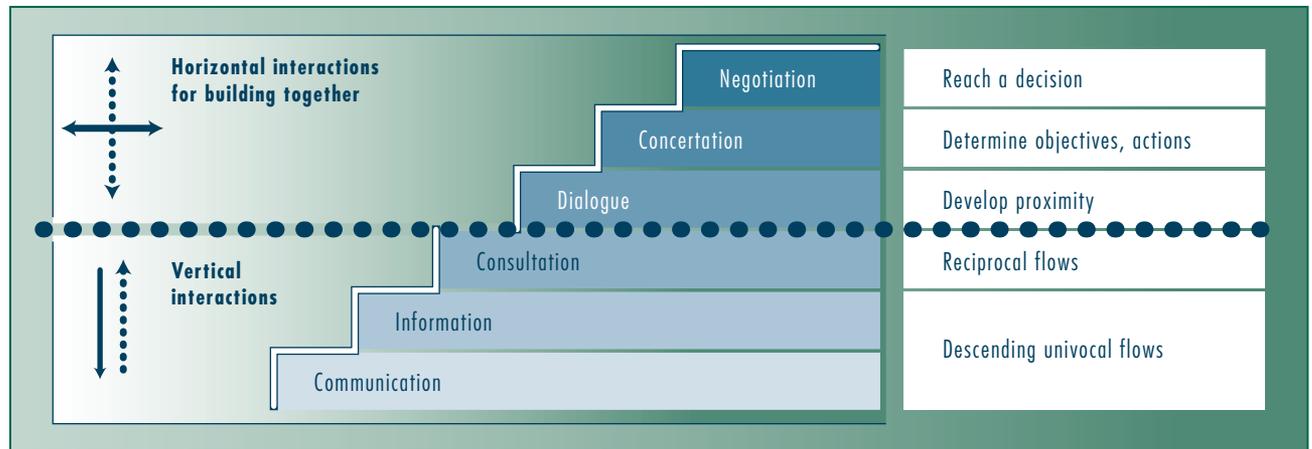
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**In communication**, the management authority wants to convey a message and obtain the target public's approval of what it asserts, suggests and decides. Communication is univocal and does not really involve public participation.

**The same is true for the information** given to keep a target group abreast of intentions or decisions taken, by attempting to provide the bases of understanding, without expecting a particular reaction from this group; unlike communication, however, information is intended to be objective. It is very important and enters the

**With dialogue**, we enter the field of horizontal interactions between stakeholders who are positioned as equals. There is no precise purpose, other than to better know and understand one another, but this can represent a major accomplishment. For example, in the Sahel zone, when bringing together Peul transhumant livestock keepers and sedentary populations who live in the same areas but do not have the same language, culture or lifestyle, a phase of dialogue and becoming acquainted is a prerequisite to effective concertation. Creating a sense of proximity and mutual understanding is the first step toward concerted management.



**Fig. 2** Types of participation in debates or decisions concerning the management of the biosphere reserves

field of concerted management because it confers upon citizens the power to react to decisions and take a position with full knowledge of the facts.

**Consultation consists** of an exchange during which the management authority collects the opinions of the consulted stakeholders, yet there is no guarantee that the opinions expressed will be taken into account (Dziedzicki, 2001). In addition, the person holding the consultation is in no way obliged to open up the debate among stakeholders: we have observed consultation processes in which the manager left no room for a debate which, by encouraging horizontal exchange among the participants, would allow them to forge a common vision and acquire more power. We shall thus make a distinction between bilateral consultations (a manager - a stakeholder), and consultations based on exchange and dialogue with a group, which are more constructive.

**Concertation** goes further than dialogue because it implies building components together with a view to better management of the biosphere reserve, whether in the short or long term. It goes much further than consultation because it gives participants access to a true collective construction. First, in the collective construction of the questions that are raised: with consultation, the person who is consulting asks the questions. With concertation, the question itself is developed collectively, which offers a much larger field of action to participants. Next is the collective construction of visions, objectives and projects. Making decisions is not at the core of concertation, and having forged a common vision and shared objectives for the common good can pave the way to much more lasting changes than an immediate decision. Concertation is a voluntary process: the individual plays an active role in the process, whereas he or she 'undergoes' a consultation in a relatively passive way. Lastly, it is an induced or autonomous process: concertation can develop among local stakeholders whose goal is to adopt a common position to defend before decision makers, or whose goal is to act collectively, independently of public authorities. Finally, concertation is born of a horizontal dialogue among participants whose goal is the collective construction of a shared focus (points of view, repre-

sentations, objectives, projects) with a view to acting or deciding together. Decision-making power is not necessarily shared among the participants and a decision is not the primary objective of the concertation: its value lies above all in working together to develop a common focus.

**Finally, negotiation** is defined by Dupont and Audebert (1994) as 'an activity involving the interaction of several stakeholders who, faced with both divergences and interdependencies, choose to voluntarily seek a mutually acceptable solution.' It may bring together stakeholders over the sharing of natural resources, or biosphere reserve managers and certain stakeholders over rules of access and the use of resources. It is valuable insofar as the decision is made jointly and thus constitutes the form that gives the most power to the public, but it has the disadvantage of limiting debate about an issue that may be poorly formulated or too restrictive: in this sense, it is less useful than concertation, which opens a broader field of action to the concerned stakeholders.

#### **The role of the reserve's management authority: initiating or facilitating concerted management approaches**

These different forms of public participation are feasible and may be combined in one or more approaches to concerted biosphere reserve management. By concerted management, we mean a process in which the stakeholders make a commitment to jointly manage one or more resources, areas or territories that they have in common or to influence actions and decisions that will be decisive for the future of these shared resources. Concerted management develops around a concertation process, understood as the collective construction of issues, objectives and/or joint actions through a horizontal dialogue among participants who are involved of their own free will and mutually recognize one another's legitimacy to participate. Concerted management may, however, also include moments of simple dialogue, negotiation, consultation of certain social groups, and information for participants.

The biosphere reserve management authority may initiate the process, or it may be the simple receiver of proposals resulting from a process undertaken by certain categories of stakeholders. For example, fishers and farmers may organize a concertation with a view to reducing pollutants from farming that affect fishing activities: this may give rise to certain proposals that converge with biosphere reserve conservation objectives. Different categories of users may come together to suggest ways to ensure the sustainable use of specific resources loca-

ted in the core area and, on this basis, demand access to these resources: formulating these proposals interests the biosphere reserve manager, who can encourage such processes of reflection and concertation.

We will examine top-down approaches, initiated by the management authority, and bottom-up approaches, initiated by local stakeholders. The management authority may implement a dynamic strategy for implementing top-down approaches, or it may express an offer of support to encourage bottom-up approaches. It may then accompany these approaches to facilitate the development of proposals and agreements among the stakeholders: it will be receptive to such proposals while at the same time preserving its own judgement.

#### **The emergence of public concertation spaces: 'local hybrid forums'**

Such processes develop in public spaces. The concept of public space is based on citizens' freedom and autonomy to form a collective opinion, using reason, and a collective willingness that will have an influence on the production of laws (Habermas, quoted by Candau, 1999). The biosphere reserve management authority, while keeping in sight its prerogatives, will initiate or facilitate the emergence of public spaces in which stakeholders attempt to agree upon rules or actions aiming to manage a resource that has multiple, at times competing, uses, according to a common will. These spaces may be seen as local hybrid forums, qualified as forums 'because they are open spaces where groups can come together to discuss technical choices involving the community' and hybrids 'because the involved groups and the spokespersons who claim to represent them are heterogeneous: they include experts, politicians, technicians and laypersons who feel they are concerned' (Callon et al., 2001, after Callon and Rip, 1992). Their hybrid nature also comes from the topics of discussion that combine economic, ecological, social and other issues. These forums 'help call into question, at least partially, the two major divides that characterize our Western societies: that which separates specialists from laypersons, and that which distances ordinary citizens from their institutional representatives' (Callon et al., 2001).

## Acting at the heart of concertation: facilitation practices

Among the success factors is the involvement, at the heart of the concertation, of one or more stakeholders who, regardless of their role in the events (participant, development agent, biosphere reserve staff ...) work to facilitate dialogue so an agreement may be reached. They take a step back from the stakeholders' interactions to play the role of third party facilitator. Below we outline the features of this facilitation function and compare it to other forms of intervention.

### Facilitation, conciliation, mediation

A systematic analysis of the interventions designed to support efforts to reach a decision and/or an agreement among stakeholders with differing viewpoints leads us to differentiate between the field of intervention strictly speaking and that of facilitation: several forms of actions are presented in Figure 3.

In the first column of Figure 3, the stakeholders resort to a third party who will 'act on their behalf' both in terms of defining the issues to address and finding answers and deciding. In this case, we are quite far from concerted management. The second column presents interventions in which stakeholders place their fate in the hands of a third party, while entrusting him or her with a mission they intend to manage. The biosphere reserve management authority and representatives of the population can request an expert's report, for which they clearly draw up the terms of reference, or even request an arbitration, i.e., a decision taken by a third party that they agree to comply with. Taking such a step 'at the request of' enters the field of concerted management as long as it concerns occasionally resorting to this solution in connection with concertation among the stakeholders: the third party is given a mandate by the stakeholders to intervene and support the stakeholders' joint actions.

In the last two columns, we enter the field of facilitation by optimizing the stakeholders' autonomy, responsibility and appropriation of the process: they are the ones who define the issues they wish to address and who will be involved in the debate. The facilitator's role is to be part of a conciliation process or part of a mediation process. In either case, the goal is to help the participants reach an agreement, or at least define a 'common good' (such as the establishment and management of a biosphere reserve at the territorial level, or the management of an ecosystem or resource used collectively within the reserve), which may be:

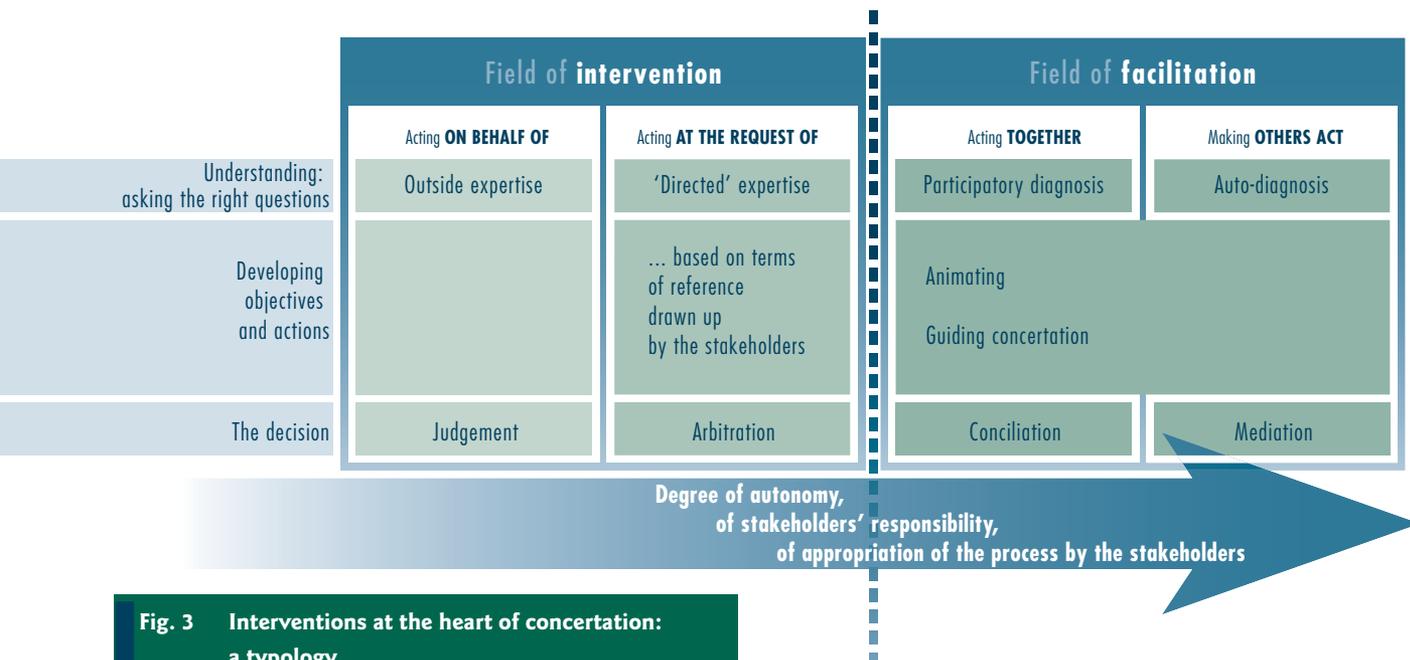
- An approach, i.e., a way to perceive and understand the common good;
- A common language: using the same terms or assigning the same meaning to terms that are used to speak about the common good;
- Issues, i.e., a selection, a ranking and a way to define our concerns about the management of the resource and the problems we will attempt to solve;
- Shared meaning, goals: this is a future-based perspective, a joint project that will give form to the objectives relating to the management of the concerned good;
- Rules, systems of organization, that will support the concerted management of the good in the long term.

The facilitator is committed to the objectives of all concertation and may act in one of two ways: either he allows himself to offer opinions and suggestions to the participants, in which case he acts as a conciliator, or he avoids this approach and leaves defining the common focus entirely up to the stakeholders: in this case, he plays the role of mediator. It is essential to differentiate between the two, because although the goal may be the same, the rules of the game are not. The facilitator's approach is, in some ways, similar to what is suggested by practices in heritage management (Ollagnon, 1974). The facilitator can adopt certain tools described by this author concerning an assessment of the situation and an analysis of the stakeholders' role: he will convey this image of reality to the concerned stakeholders and will use it to support a dialogue that he will try to stimulate and assist.

### A close-up look at certain facilitation practices: 'mirror mediation' and 'bridging mediation'

We will take as examples two types of practices within concertation facilitation, which we refer to as 'mirror mediation' and 'bridging mediation.' There are naturally other types, but these give an initial idea of the forms that facilitation may take.

A first commonly used practice consists of projecting to stakeholders in conflict an image of their own reality: this image may be a photograph, a map, or even a theatre skit. It may be situated in the present, or represent the future outcome of this or that decision. This image will constitute a support for dialogue that will stimulate discussion, prompting stakeholders who have remained silent to express themselves. It also aims to demonstrate that the concerned stakeholders are interdependent and cannot do without one another, which will motivate them to find a compromise. Such practices may be qualified as mediation, since they do not attempt to influence



**Fig. 3 Interventions at the heart of concertation: a typology**

but rather to facilitate dialogue so that local stakeholders can find solutions. Since this is a matter of representing the local situation and presenting it as neutrally as possible to the protagonists of concertation, we will refer to it as 'mirror mediation'. This image is a means to open up dialogue or, further along in the process, an informative base that can be used to develop an agreement. This type of involvement most often comes from outsiders.

By comparison, bridging mediation is practiced by stakeholders who are part of the territory and are rarely independent: they may belong to a category of stakeholders involved in the concertation, but often these persons play a role in more than one group. This might be, for example, in Mali, a tribal chief who is also president of the Local Chamber of Agriculture: he is familiar with the tribal world as much as with State institutions, knows how to speak the language of each one, and is held in esteem by both groups. He thus represents a natural connection between these two worlds. Generally speaking, belonging to more than one group allows stakeholders in a situation of bridging mediation to act as a link between the participants, to themselves become a link. When such an individual can serve as a bridging resource, dialogue can develop on the basis of the trust that all parties invest in this person. This makes it possible to skip the initial trust-building phase among the categories of stakeholders. Bridging mediation feeds the connection between the participants and ensures consistency and continuity in the concertation process: the mediator himself constitutes a link that will assume less importance when other, less personal connections have been established. He is a pivotal player that takes

on – formally or tacitly – a leadership role by restating questions and encouraging each individual to find a response.

These two practices do not involve the same type of stakeholders. By all appearances, they have nothing in common, except for their goal, which is to facilitate dialogue without influencing the content of discussion, and except for the efforts of each of these mediators to act as a catalyst, stimulating without initiating, creating links that initially depend on them but ultimately will continue to exist without them. We will refer to territorial mediation practices, defined as actions aiming to encourage several categories of stakeholders to reach an agreement: this involves catalysing the forging of an agreement (or a series of agreements) during a more or less formalized concertation process, without influencing the content of such agreements. The goal of territorial mediation is to support and assist local stakeholders to work together for the concerted management of shared resources, in order to ensure the balanced development of the territory (Beuret et al., 1998). This does not entail providing a solution nor choosing among the solutions proposed by each party, but supporting efforts to find a compromise solution as the result of concertation, which is thus invented by local stakeholders.

'Territorial' mediation and, more generally, concertation facilitation, do not always require a third party, an outsider to the stakeholders' game. Indeed, it is very rare to find a facilitator who is a third party and who has been solicited as such. Those involved in concertation, whether institutions or citizens, are rather used to 'getting by with what they have', either participants who are able to distance themselves from the category

they belong to, or development agents who implicitly assume a facilitator's role. These are always people who demonstrate a clear capacity to distance themselves from the situation at hand and those involved, in order to gain a sense of perspective. Facilitation is not a profession: it is primarily a set of practices used by very diverse stakeholders that can alter the course of events by enabling dialogue to progress.

### **The biosphere reserve management authority: whether to facilitate or mobilize facilitators**

The biosphere reserve management authority can position itself as a facilitator in the conflicts between categories of stakeholders, who are users of the 'territory' that it is in charge of managing. It is, however, difficult to be a conciliator or mediator when one has power and substantial means of coercion. It is even more difficult to play this role when one is involved in these conflicts. In this case, the management authority will make an effort to find facilitators. It will identify local and outside resources for mediation and facilitation - often they exist locally - and will attempt to support them so they can play their role in total independence.

### **Some points of reference for action, based on observing actual cases**

We have studied a number of concertation processes in France (Beuret, 2005), Africa and Latin America (Beuret and Lasbennes, 2004). Our analyses gave rise to the points of reference outlined below, which we believe are especially useful for both action and the analysis of such processes.

### **Concertation itineraries are long processes**

The length of the concertation processes we studied were generally measured in years rather than months. In France, when a local administration declared its intention to obtain the signature of an agreement between all the users of a vast coastal territory in two years, it was entirely reasonable to doubt the quality of the agreement and whether this objective was realistic: this was five years ago! In Madagascar, contracts addressing the management of forestry resources and involving the population, the Water and Forest Department, and local authorities were drafted in two weeks. The signatories, however, did not appropriate the approach or the agreement: this can hardly be called concertation. As a result, we would like to revisit certain notions that are - at times - preconceived:

- Concertation is not an isolated operation where 'everyone comes to a meeting and we all come to an agreement'. Operations of this type are destined to fail because the participants do not have enough time to understand and mutually recognize one another's legitimacy, or to develop a common language for discussion.
- Concertation is not a static operation during which participants simply identify the points on which they agree. Although the areas of consensus among the participants may constitute a point of departure, they form the basis for a collective construction carried out within the framework of a dynamic process: concertation creates 'added value'.
- Concertation can never be reduced to a procedure. It never follows a pre-defined plan, except when the participants are not committed to the approach, which in itself is a predictor of poor results. It takes place in the contexts intended for this purpose and in formal and informal 'arenas' not provided for by the procedure. Concertation is always a moving process that follows its own dynamic.

This leads us to define the concept of concertation itinerary. Just as there are technical itineraries for crop production, marked by the steps of plant growth and the farmer's involvement at various moments, a concertation itinerary is marked by the advancement of dialogue (positive or negative), outside 'events' that impact it, and possible actions designed to help it progress, which are referred to as 'operations'. It can be broken down into phases that may overlap for a time, or succeed one another: the number and type of participants, the topic of discussions, the development of agreements and their scope are all factors that make it possible to characterize each step in the process. Each itinerary is unique and can in no case be likened to a procedure, defined as a set of rules and formalities that must be observed to obtain a result (Candau, 1999): in the case of formalized processes, a procedure sometimes sets up a framework and a skeletal structure that the itinerary respects while going much farther. A concertation itinerary represents the progression actually made during concertation in terms of form and content. It includes steps that are formalized and others that are not, such as informal discussions that may take place at the edge of a field, under a tree or while having coffee at the bar; these are spontaneous discussions that may turn out to be decisive.

**Building a space**

**for concertation: legitimacy, representativeness, proximity**

Before getting to the heart of the matter, it is important to provide a space in which each individual will be able to express himself or herself and each will be recognized as legitimate. This does not mean that people agree with others' opinions, but that they will listen and try to understand others' needs and languages. This does not happen automatically, and particular attention should be paid to the following points.

**Legitimization of the participants:** the main obstacle to genuine dialogue is often the legitimization of the other party. It is more difficult for some park managers to recognize the legitimacy of certain villagers who are excluded in an authoritarian way from a protected area than, once the stakeholders' legitimacy has been recognized, to come to an agreement with them: acknowledging the other as legitimate means accepting that he or she has something to say and that it is legitimate to take his or her view into account. Similarly, in the area at the edge of a park in Europe, it is often more difficult for a farmer to acknowledge the legitimacy of an environmentalist who intends to influence his farming practices, than to reach an agreement with the environmentalist once the farmer has accepted that he may have something to say about what the farmer does with his land. Certain participants will be recognized as legitimate contributors to the dialogue, and others will not. Furthermore, acknowledging the other's legitimacy, including needs and wishes, takes time. This mutual legitimization among the participants must be helped along, a *sine qua non* condition for real dialogue to take place.

**Given proximity, created proximity:** legitimization especially depends on improved and mutual understanding among the participants. In some cases, participants already know one another well, in which case a 'given proximity' exists. In other cases, proximity must be created; this is what persons in the position of leaders and mediators will attempt to do. Merely being neighbors is not a guarantee of proximity: in France, farmers and oyster farmers in conflict about water pollution will discover that they know nothing about the others' work or experience. They will organize 'land farmer-sea farmer' encounters to establish a sense of proximity in the work they do. Generally speaking, developing proximity among the participants means each group will visit the other and opportunities for socializing or working together will be organized. We observed an extremely complex example in Mali when attempts were made to find an agreement between Peul transhumant livestock

keepers and sedentary farmer-breeders. Certain resources were used by both groups, who do not speak the same language or share the same culture. An NGO began by creating 'family portraits' which were shown to both groups. This enabled them to get to know one another and realize they had points in common in their day-to-day life, the problems they faced, and the way they dealt with difficult weather conditions. This is the seed of a proximity that makes dialogue possible.

**Developing a common language:** Even when the involved parties speak the same language, it is futile to have a discussion if words do not have the same meaning for each group. The example of farmers and oyster farmers in France, mentioned above, is especially revealing. The two groups came to realize that when the farmers speak of pollution, they are thinking of nitrate pollution – for which they are publicly held responsible – whereas the oyster farmers are thinking of bacteriological pollution, which actually creates a problem for their activity. Similarly, when the farmers talk about manure, which is the main source of bacteriological pollution from farming, they think of it as a fertilizer, while the oyster farmers think of it as waste. Since words do not have the same meaning for the two groups, the discussion could have continued on the basis of a misunderstanding. It is thus necessary to ensure that two groups speak the same language, and to develop this language.

**The critical issue of 'absent third parties':** some stakeholders do not wish to take part in concertation, either because they do not see it as useful, or because they prefer confrontational strategies rather than cooperation. Others are key stakeholders whose legitimacy is not recognized by the other stakeholders. These are 'absent third parties' that the concertation leader must not overlook, in particular to attempt to include them at a later point. One of the main risks of concertation is for individuals to come to an agreement 'among themselves' at the expense of other categories of stakeholders who have been excluded from concertation. This may cause major problems. In Madagascar, when groups that had been left out of an agreement concerning the management of forestry resources that they used, they deliberately destroyed these resources in order to discredit the agreement so it would be cancelled. Another type of 'absent third party' may be a stakeholder without whose consent one of the concertation participants cannot actually commit himself. In West Africa, after spending a week in training about dialogue and concertation, a park manager finally explained that although he agreed with our proposals, they were not applicable for him without the consent of his superiors and concertation with other



administrations: in this case, concertation within the biosphere reserve depends on inter-institutional concertation.

**The choice of spokespersons and their ability to convey information:** a more classic issue has to do with choosing spokespersons who are truly representative. We observed a case in Ecuador where the results of an entire phase of negotiations about managing water resources were temporarily denied because the users of this water resource did not actually identify with the persons who were supposed to represent them, and rejected the agreement that had been drafted. Particular attention must be paid to the representativeness of spokespersons. Representatives' ability to convey information is another important issue. At times we have observed the repetition of a completely sterile cycle, during which the representatives develop their positions and make progress thanks to genuine confrontation and exchange with other stakeholders, but they were then seriously 're-oriented' by the group they belong to, which was not present during the discussion. At that point the group either selects a different representative or demands that their representative goes back to defending their initial position... and the discussions have to start all over again! Therefore, the ability of representatives to explain to those they represent how events unfold during concertation constitutes a major challenge: either they have this ability or they must be assisted and supported in reporting the experience.

**Adapting the action formats:** finally, it is necessary to adapt the action formats to all categories of concerned stakeholders in order to allow all involved to express themselves and appropriate the actions that are taken. By 'action format', we include everything that characterizes the form taken by a collective action in its different components: the exchange of ideas and debate about possible options, the representation of groups of stakeholders, the transmission of information, decision-making, programming the actions to carry out and at what pace, codification of rules, control exerted on members to ensure the respect of each one's commitments. It is possible, for example, to have written, verbal or tacit rules, control exerted by a specific authority or social control exerted on the members of the group by the other members, a chronological programme for actions and ongoing, day-to-day management, decisions taken by superiors on the basis of consensus or an absolute or relative majority, a timetable for actions based on the calendar year or farming campaigns. The classic action format that characterizes an administration or a project may often be very far from the action formats with which local stakeholders

are familiar. It will be necessary, in particular if temporary or permanent concertation entities are set up, to come as close as possible to the local action formats, after clearly identifying them and understanding how they work. In more general terms, the reserve management authority should seek a compromise between its own requirements (for example, with regard to budgeting and decision-making) and a necessary adaptation to local action formats.

**The logical approach:  
from acceptable to desirable**

Finally, the comparative analysis of concertation itineraries shows that the general approach always consists of going from what is acceptable for all participants toward what is desirable: this means starting with what is acceptable for local stakeholders to begin discussion (in terms of topic, discussion partners, and scale) in order to move toward what is desirable and actually find a solution to the problems at hand.

Discussion can take place only on the basis of what is considered 'acceptable' by all the stakeholders involved in a first network of participants. It is futile to want to 'bring everybody together' from the outset, if this means bringing together stakeholders who are unable to speak and listen to one another. This is a commonly committed error that leads to a dialogue of the deaf or concertation processes that are over before they get started: since concertation is voluntary, individuals who are summoned without being open to discussion will leave. Dialogue can work only with stakeholders who are open to mutual recognition of legitimacy and to mutual acceptance. The same is true in terms of topics for discussion and scale: for instance, when the oyster farmers and farmers start to discuss water pollution in the above-mentioned example, they are doing so at the level of the township, which is not pertinent with respect to the problem at hand: yet it is at this level that they can have a discussion. The socially acceptable scale at this point is not the relevant scale from an environmental viewpoint, yet it is the one to focus on for dialogue to begin. In terms of discussion topics, the stakeholders will at first avoid 'sensitive' subjects and will come back to them only later: at this point, they limit discussion to subjects that may be addressed without causing division between the participants. In such a way, oyster farmers and farmers in conflict about a problem caused by pollution from farming will first discuss all kinds of pollution coming from a nearby village: in such a way, they avoid the problem in order to get to know one another and develop common knowledge, making it possible to address the core conflict subsequently. In Mali, during concertation concerning rural land, the participants alternately mentioned

customary law and new provisions under positive law that make it possible for new townships to appropriate certain areas: participants did not initially address the contradictions between these two types of law.

This is not a matter of definitively avoiding sensitive subjects, but rather temporarily ‘suspending’ a conflict-ridden debate that has no chance of succeeding. Later on, when the network of concertation participants has been stabilized, it will be necessary come back to the subjects causing conflict. The general approach consists of enlarging what is ‘acceptable’ for each participant so that the ‘greatest acceptable common denominator for each person’ will be vast enough to address core issues, involve all the key stakeholders in the dialogue, and move to a relevant scale: once this has been accomplished, it will be possible to progress toward the ‘desirable’. This is the general direction taken in all the concertation itineraries.

Although a common mistake at the beginning of the itinerary is to address controversial subjects too early on, a common mistake in the subsequent phases is to never address them at all! Once the dialogue is underway, the protagonists may tend to avoid all conflict, either because they have an interest in maintaining the situation as it is, or because they wish to reach an agreement that avoids the essential issues but which they believe that can turn to their own benefit. We have observed two strategies, in a case in Mali, which allowed concertation to go on without addressing the points of major divergence. These strategies consist, first, of avoiding any explanation of differences by compartmentalizing the debate, and second, by preventing the stakeholders at the heart of the controversy from meeting one another because they would, invariably, bring up and discuss their differences. At times, concertation participants not only have a limited interest in reaching an agreement, but certain may have an interest in prolonging the concertation process, in particular when concertation represents a source of funding for those leading or taking part in the process. Concertation may be a way to fill the space devoted to public debate, thus becoming both the outcome and the instrument of avoidance strategies. Cases have been observed in Madagascar where the protagonists avoided conflict not because they wanted concertation to continue, but in order to conclude as quickly as possible, even if this meant reaching an agreement of no actual use. Thus a mediator told us: ‘I know how to manage conflicts, but I don’t have the time...’ His employer obliged him to achieve a specific result, giving him a very short timeframe, so he chose to avoid anything that slowed the process. If it wishes to promote concertation, the biosphere reserve management authority must ensure favourable conditions for the person leading the concertation

process. They must have time and be able to intervene in the long term. Their work must not be evaluated solely according to whether an agreement was reached. Like the participants, mediators must not be put in a situation where they have an interest in keeping the process going for as long as possible, a situation sometimes created by a specific funding provision.

It is therefore necessary for the management authority to have the means to support and assist the process while respecting the overall logical movement in the approach: in essence, being able to go from what is acceptable for the stakeholders toward what is desirable, in terms of concertation participants, subject of debate, scale ... and ultimately reaching an agreement.

### Three types of ‘translation’

In examining the operations that ‘facilitate’ concertation, we have come up with a systematic inventory of ways to be involved that enable the debate to move forward in the concertation processes we have studied. We have observed that both at upstream and downstream levels of mediation or conciliation are needed other, equally necessary operations that ensure reality will be accessible to dialogue or that convert the results of dialogue into rules, plans and actions that will make it possible for dialogue to have an actual impact on reality. We refer to these instances as translation, since they consistently deal with ‘transforming a particular problematic statement into the language of another particular statement’ (Callon and Latour, 1991): this involves transposing reality into the language of the stakeholders, the language of one category of stakeholder into the language of others, or the collective production of the group into a regulatory language that will determine the actions of certain stakeholders.

**Scientific translation** is designed to ensure that reality can be grasped by all participants in concertation, in a language and format that will be as familiar as possible. This means agreeing on a language and representing reality in such a way as to go beyond divisions. Translation may touch upon the physical or the human environment; in the latter case, it is, in particular, a matter of representing interactions among stakeholders with respect to the subject of concertation. Translation may concern the present, or the past when it determines the present, and even the future, with scenarios for change that express the consequences of the participants’ choices. It consists of making reality accessible to dialogue.

**Cross translation** aims to make one party’s position understandable to the other party, and encourages the development of links between stakeholders. In this ca-

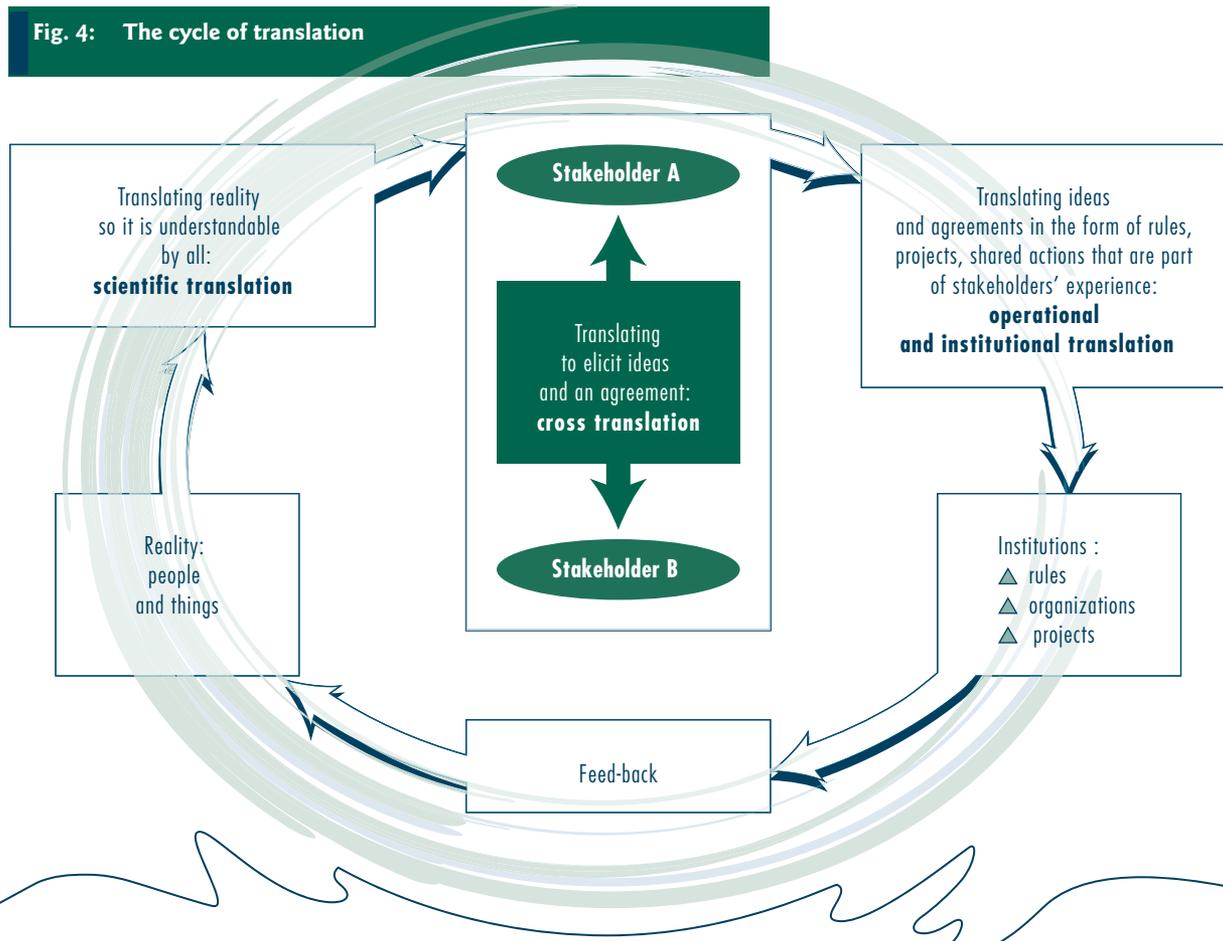


tegrity, we find conciliation and mediation efforts and, in particular, the two forms of mediation mentioned above.

**Institutional translation** aims to transform the ideas expressed during debate into collective actions and economic institutions, i.e., rules, organizations. This entails, first, supporting participants in their choice of the solution that best suits their needs, among the proposed solutions. In some instances, it is possible to use multi-criteria assessment tools that will allow participants to compare several proposals according to several points of view. At times, an operational translation is necessary: this involves experimenting with the solutions under consideration and assessing their feasibility so that stakeholders may choose the best one with full knowledge of the facts. Next, ‘formatting’ operations are designed to translate the selected ideas and proposals into formats that will ensure their lasting impact in the actions of each individual as well as on the institutional landscape. This may involve drawing up contracts, association status, or plans.

These various types of translations are part of a cycle, represented in Figure 4. ‘Cross translation’ takes place downstream of a scientific translation that makes the reality of people and things intelligible and, in doing so, makes them more ‘debatable’ and easier to address during dialogue. Cross translation is located upstream of institutional translation that converts ideas and proposals put forward during dialogue into collective actions and institutions. These ‘outcomes’ of the dialogue, and the subsequent institutional translation, will contribute to allowing individuals and events to move forward to a new state that may be the point of departure for a new cycle of concertation and translation. The concertation process clearly has a linear dimension (problem, concertation, agreement), yet it goes forward via a translation spiral. The necessary condition for this cycle to operate effectively is that the three types of translation are actually carried out. Conducting concertation thus assumes that all these translation functions are properly filled by one or more translators.

Implementation of these three translation functions requires soliciting a person or an organization capable of providing this service, or of organizing and coordinating the work of several translators: the reserve management authority is well equipped to play this role.



## Conclusion

Within the biosphere reserves, dialogue and concertation allow the participating parties to know one another better, to acknowledge one another's needs and wishes, and to create rules together (or improve existing rules) with a two-fold goal: optimum effectiveness and the appropriation of the rules by those who have defined them together. Whether rules determined in this way are effective can be measured against the biodiversity conservation and sustainable development objectives within the biosphere reserves and in terms of optimizing the ratio between this effectiveness and the limitations imposed on local stakeholders with respect to their economic, social and cultural activities. These stakeholders are capable of providing relevant indications and proposals with a view to taking full advantage of this ratio. Concertation between the heads of the biosphere reserve and these stakeholders must make it possible to revisit, together, all the proposals put forward by the various parties with a view to determining a common approach. Allowing citizens to participate in discussions or even, at times, the definition of the rules of the game, is essential for the legitimization of these rules and their appropriation by those meant to follow them, and to ensure that social control is exerted by all those who defined the rules over those who are meant to respect them.

What can the management authority do to facilitate dialogue and concertation? It can organize and lead concertation processes. Through such processes, the representatives of the local population will be invited to take part in managing the reserve, in an informative, advisory or even decision-making capacity. It can also encourage the development of forums for concertation among local stakeholders, so that they will put forward proposals concerning conflict management or biosphere reserve management from a sustainable development perspective: in such a way, it displays an offer of support and assistance for such initiatives. Lastly, at the heart of the ongoing concertation processes, it can play the role of facilitator or identify and mobilize local conciliation and mediation resources. All these actions require a degree of expertise and knowing one's place in the dialogue, not replacing stakeholders but, to the contrary, stimulating their creativity. We have made suggestions on how to support dialogue and concertation: these are merely points of reference that have been observed in several actual cases. On the ground, certain stakeholders have useful skills and experience that can be capitalized on to enrich these references. These are not intended as recipes for success or all-purpose methods; rather, they give

each individual certain benchmarks or reference points for organizing public participation in the management of the biosphere reserves and for ways to catalyse, support and assist the dialogue process.

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## Implementing the biosphere reserve concept at the landscape scale: diversity of structures and stakeholders

**B**iosphere reserves are 'areas of terrestrial and coastal/marine ecosystems or a combination thereof, which are internationally recognized within the framework of UNESCO's programme on Man and the Biosphere (MAB)' (Statutory Framework of the World Network of Biosphere Reserves, UNESCO, 1996).

Launched at the end of the 1960s by UNESCO, the Programme on Man and the Biosphere (MAB) was designed to provide scientific bases for the efficient management of natural resources. It quickly confirmed the importance of basing nature conservation strategies on knowledge, on the one hand, but also on the economic and social development of local populations, respectful of their culture, on the other. A strong determination to put this into practice was made tangible when the first biosphere reserves, later to constitute the World Network, were established starting in 1976, within the framework of this programme. Initially areas of conservation and monitoring for researchers and naturalists, the biosphere reserves are, in their current form, complex landscapes of interaction between biological and social dynamics, where scientific activities continue to play an important role. The definition, means of action, and selection criteria for the biosphere reserves have changed over time and integrated new dimensions. In 1995, the World Network of Biosphere Reserves was subject of international reflections, which led to the elaboration of two framework documents:

- The Seville Strategy (UNESCO, 1996) defines the objectives and recommends actions to be undertaken at the international, national and local levels for the development and implementation of the biosphere reserves.
- The Statutory Framework (UNESCO, 1996) sets out the conditions to fulfill for the World Network of Biosphere Reserves to operate smoothly. It was formally adopted by the UNESCO General Conference and is the only legal framework at the international

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level. As they are currently designed, the biosphere reserves must meet three major groups of functions that should be integrated and put into practice:

- Conserve natural and cultural biodiversity,
- Test sustainable development approaches,
- Be areas for research, education, training and local participation.

In order to be designated by UNESCO, the sites must be important for the conservation of biodiversity and of suitable size to fulfill these three functions.

Today the biosphere reserves are no longer protected areas but land management projects built around protected areas. They are sites for sustainable development experimentation and locations that serve as laboratories where researchers from various disciplines can study the conservation sciences in the broad sense. They are 'territories' for man and nature (MAB France, 2000). They are also territories where citizen participation is encouraged. Due to their integrative approach, the biosphere reserves respect the principles of the ecosystem approach adopted within the framework of the Convention on Biological Diversity (UNESCO, 2000).

In order to implement the biosphere reserve concept, appropriate structures are essential in terms of technical and political aspects. They must make it possible to translate the three functions of the biosphere reserve into reality. In France, it is generally to an entity governed by public law that UNESCO, through the intermediary of the State, gives the designation officially. This entity makes a commitment to accomplish what is necessary locally to implement the Statutory Framework of the World Network.

### Dialogue, management and coordination

There is great diversity in the composition and status of biosphere reserve support structures worldwide (Batisse, 2000; UNESCO, 2002). This structural diversity reflects the wide variety of roles that the structures

may play, ranging from implementing activities in the different fields of research, conservation, scientific monitoring, education and economic promotion, to coordinating the tasks of stakeholders, organizations and associations that are active in the territory, with activities such as animating a population participation process, consensus building, conflict management, political lobbying and seeking financial resources. Depending on the context, country and date of creation, the support structures fulfill the functions of management and/or coordination. Since the Seville Strategy, the emphasis has been placed in particular on stakeholders' coordination and land use planning.

In reality, the breakdown of 'management-coordination' activities is directly dependent on the context of the biosphere reserve. For example, when on a given 'territory' there are research laboratories interested in the 'territory's' natural resources and their management, associations or other dynamic organizations in the field of environmental education and citizenship, and organizations to promote tourism, then it is not necessary for the biosphere reserve support structure to develop these actions. It is essential, however, for the biosphere reserve to benefit from their presence, knowledge, educational activities, skills, and financial and human resources. It is up to the structure supporting the reserve to establish the necessary relationships and to formalize this through, for example, partnership contracts. It must also find the means to support and assist entities and individuals, or secure the means to ensure that it is able to intervene directly in these fields. The main thing is for the diversity and complexity of the biosphere reserve's functions to be clearly recognized and adapted to the local context. The coordinator/manager, designated as the reference person for the biosphere reserve, must have sufficient legal, human and financial means to fulfill these functions and enjoy recognition and legitimacy in the eyes of partners and stakeholders.

### Combining technical capabilities and decision-making power

There must be political support for scientific, educational and economic development orientations and projects designed on a technical level. Associated to the technical structure, there is a management committee (which may at times have a different name), which decides whether or not to approve choices.

The regional natural parks in France have many points in common with the biosphere reserves. They are considered to be well suited to serving as support structures for the biosphere reserves, even if the functions are not completely covered. For example, the biosphere reserve must include protected areas, as core areas, which are not required for the establishment of the regional natural park according to French legislation. Another difference: the role of science is more important in the biosphere reserves and is set out explicitly in the framework texts. The decision-making body of the regional natural park, the management committee (Comité syndical), is made up exclusively of local elected representatives. The biosphere reserve invites the participation of other landscape stakeholders, economic ones and associations in particular, which are included in advisory bodies.

The regional natural parks establish charters that are renewed every ten years:<sup>1</sup> elaboration of a joint development project by different associated communities (Gruau, 2002). Based on an inventory and analysis of the situation, the charter defines future directions and actions to be undertaken, a map of the park that can be based on biosphere reserve zonation principles. The charter is a negotiated document and the communities are free to become signatories or not. It is elaborated and coordinated by the 'Region', but the actual creation of the regional park can take place only if the State, guarantor of the quality of the project, accepts it and declares its existence by interministerial decree. This process gives an important role to local negotiations, while also being validated in compliance with national regulations designed to guarantee quality. It is close to the spirit of the biosphere reserve.

By contrast, although this practice was rather widespread in the past, it does not appear wise to entrust the coordination of the entire territory of a biosphere reserve to a conservation agency, or to a protected area with strict regulations such as a national park. From a legal point of view, a park is not designed to fulfill all the functions of the biosphere reserves (in particular, local development and participation). The park's function as space manager does not allow the required neutrality, and a certain legitimacy to ensure the coordination of stakeholders and mediation functions. Similarly, one could ask whether a State administration or public entity are appropriate to lead a sustainable development project in a context of decentralization, as they do not easily lend themselves to participatory democracy.

The World Network of Biosphere Reserves has gradually become established since the end of the 1970s. The sites are not always supported by structures that

1. This timeframe is the same as for the periodic review process for biosphere reserves.

would be considered perfectly suited by today's standards. Some biosphere reserves nonetheless accomplish interesting work, in particular through the partnerships they develop locally. It is important to renovate them from a structural point of view, taking care not to harm existing dynamics, which are at times driven by strong local willingness. Reviews are necessary insofar as they would make it possible to anticipate the departure of individuals who play a key role through their dynamism or their interest in the territory or the biosphere reserve tool. Every ten years, the periodic review provided for in the Statutory Framework of the World Network thus offers the opportunity to make such revisions.

For the creation of new biosphere reserves, it is essential to identify the legal and institutional forms that are best adapted to the implementation of the concept within the local context. Each country should be encouraged to make use of its legislation as wisely as possible and to ensure that degrees and statutes of conservation, in relationships to zonation, are adapted to fit regional and economic development structures.

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# What knowledge and what approaches?

## Chapter 2

'One must admit that much remains to be done to improve exchanges and cooperation between researchers who are not sufficiently involved in management problems, and managers who do not always state their questions clearly or who want an immediate reply from the scientists. There is no easy solution to bridging the gap between these two worlds, although each one is concerned with biodiversity conservation, each in its own way. It is sometimes a matter of mutual trust, common interest and curiosity.'

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## Researchers, managers and other biodiversity stakeholders: building partnerships

ROBERT BARBAULT

**T**he international conference on Biodiversity: Science and Governance held in Paris in January 2005 clearly demonstrated that managing biodiversity from a sustainable development perspective concerns everyone: scientists, politicians, militants, nature conservation managers, industry representatives and citizens. After reiterating that biodiversity represents a natural heritage and vital resource for all humankind, one that it is undergoing irreversible erosion due to human activities, the appeal launched by scientists during the meeting 'The Paris Declaration on Biodiversity' underlines the need for 'major efforts to discover, understand, conserve and make sustainable use of diversity in the living world' (see Barbault and Chevassus-au-Louis, 2004; Barbault, 2006).

In order to move closer to this objective, and to respect the commitments made by nearly all the countries of the planet when they ratified the Convention on Biological Diversity, we must overcome various obstacles – something that protectors of nature and specialists of ecology and biodiversity science have not fully accomplished and cannot successfully achieve alone, working separately.

I would like to note here that starting in the early 1970s, UNESCO's Programme on Man and the Biosphere (MAB) had identified the strategy to promote and launched a World Network of Biosphere Reserves conceived as 'exemplary territories' to undertake with all the stakeholders of the concerned territories an experiment in what is today referred to as sustainable development (see the Seville Strategy, UNESCO 1996). In the context of this vast undertaking and collective experiment, I will emphasize once again what clearly appears to be the primary condition to successfully meet the dual challenge facing us (to ensure sustainable development and preserve the dynamics of the diversity of the living world): cooperating to build operational partnerships between all concerned stakeholders – and, in particular, for the sake of simplicity and to stay within a field I know something about, between scientists and nature conservation managers (Barbault, 2000). From this perspective, two points need to be emphasized: the

research priorities to be promoted and the challenge represented by the necessary development of a truly interdisciplinary culture.

### Conserving and managing biodiversity: obstacles and challenges

Ideas about the protection of nature and the management of natural resources have changed significantly since the creation of the first national parks at the end of the 19<sup>th</sup> century. Catherine Larrère (1997), who has studied environmental philosophies, offers an excellent account based on a history of utilitarian and conservationist ideas in the United States. As a complement to the philosopher's viewpoint, we can also look for a moment at the presentation of conservation biology given by Bertie J. Weddell (2002) in her manual 'Conserving Living Natural Resources'. The titles she uses to define the tonality of the three parts of this work are explicit:

- Part One: Management to maximize production of featured species – a utilitarian approach to conservation;
- Part Two: Protection and Restoration of Populations and Habitats – A Preservationist Approach to Conservation;
- Part Three: Management to Maintain Processes and Structures – A Sustainable-Ecosystem Approach to Conservation.

With these three approaches, Bertie J. Weddell nicely sums up the major trends that have marked the history of ideas in the field – and which remain relevant today. The essential point, which marks the appearance of modern conservation biology in the 1980s, may be found in a double epistemological break that various authors clearly highlight by proclaiming that conservation biology is a response from the scientific community to the sixth extinction crisis: the theoretical and methodological background for conservation biology is provided by ecology in the second half of the 20<sup>th</sup> century; conservation biology is an action-based science devoted to preserving biodiversity, safeguarding its potential to evolve and anticipating the disasters that threaten it (Barbault, 1993).

This double conceptual revolution creates new areas of awareness, which lead to the identification of four complementary necessities:

1. To move from approaches that are too strictly population-based to approaches that are more broadly ecological, ecosystemic, and macro-ecological – of the order of landscape ecology;
2. To place oneself in the context of a planet that has been strongly modified by humans directly or indirectly;
3. To approach reflection and action from the perspective of sustainable management;
4. To develop exchanges and partnerships among scientists, park managers and other users of space.

This is the challenge that must be met today by ecology and its stakeholders, whether professionals or amateurs, scientists, militants or park managers. In this light, the three main approaches developed by conservation biologists appear to be insufficient. Let us review them briefly, as set out by Mace et al., (2002).

The first, called ‘the declining population paradigm’, emphasized an analysis of the reasons for such a decline and measures to correct it.

The second, labelled ‘the small population paradigm’, greatly contributed to the development of our understanding of the genetic and demographic functioning of small populations and their consequences.

The third approach, developed a short time later, combined empirical data and computer processing to address the ‘definition of priority areas on which to concentrate conservation efforts’.

Although these approaches are without a doubt valuable, they appear to be insufficient and limited; in particular, they suffer from a double ‘gap’: between the scale of the analysed mechanisms and processes, and the scale on which threats to biodiversity are played out (and on which the conservation strategy should focus); and between the issues they address and the issues actually faced by park managers.

In reality, park managers are increasingly concerned with protecting ecological interactions and evolving processes: what should one do when in charge of modest size reserves? How can one anticipate the way protected areas will be affected by phenomena that are both natural and anthropic, occurring or likely to occur on the scale of more vast landscapes, whether due to agricultural policy decisions or climate changes? This concern converges with the warning issued by Perrings and Gadgil (2002): ‘Biodiversity conservation has a local dimension and a global dimension. For it to be effective, it is necessary to clearly understand the link between these two spatial scales’.

On this point, conservation biologists admittedly have very little to say. It is undoubtedly time to look to broader ecosystem approaches in the context of landscape ecology or macroecology. And this quite logically leads, in the minds of the park managers mentioned above, to increasingly take into account the strongly anthropogenic context in which we live and from which we attempt to isolate ‘protected’ areas – with the humans who live there and who have other interests at stake, beyond the conservation of nature.

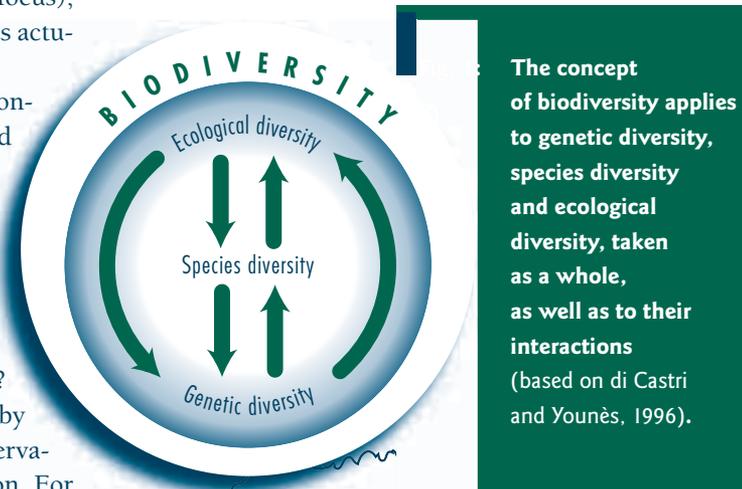
This call for a broader framework in both geographic and conceptual terms (speaking of a strongly anthropogenic planet implies the contribution of disciplines other than ecology), which is very logically extended today by the third need mentioned above, namely, being part of a sustainable development perspective – with its three components (*economic efficiency, social fairness, and ecological viability*) – obviously requires an interdisciplinary approach and the building of partnerships.

### Interdisciplinarity at three levels

It is useful to view such rich and complex interdisciplinarity on three levels.

Starting with the first aspect of the definition of biodiversity given in Figure 1, there is clearly a strong appeal to *interdisciplinarity among biologists* – specialists in systematics, geneticists, ecologists, physiologists, ethologists. Such interdisciplinarity approach is practically assured, the result of recent developments in biology and ecology – whether in terms of integrative biology or biodiversity dynamics.

Referring to *biodiversity dynamics* nonetheless entails going one step further, calling for an *enlarged interdisciplinary approach encompassing all the natural sciences*



The concept of biodiversity applies to genetic diversity, species diversity and ecological diversity, taken as a whole, as well as to their interactions (based on di Castri and Younès, 1996).

– geodynamics, paleontology, paleoclimatology. The arrival on the scene of modern humans who are hunters, farmers and later on workers in industry begins to invite a new partnership, this time between the natural sciences and the humanities and social sciences.

The full impact of the *third level of interdisciplinarity*, which necessarily includes this new field of research, was felt in Rio de Janeiro, and partially formed the background for the Convention on Biological Diversity. This Convention was ratified by a very large majority of countries around the world, with the notable exception of the United States: this fact alone plainly demonstrates that it is no longer a matter of science alone as it is conceived somewhat naively in academic settings (Aubertin et al., 1998).

Clearly, it is this sort of interdisciplinarity that is the most revolutionary, the most promising, and the most challenging, the kind that arises when one addresses *management issues*.

In this field, from the outset the implementation of operational interdisciplinarity comes up against a semantic misunderstanding conveyed by the use of the terms ‘reserve’ and ‘protected area’. The same obstacle can be found in dialogues with other stakeholders of land use management policies.

In the field, if one speaks with local farmers, foresters, hunters and elected representatives – as well as with anthropologists and economists – about the biosphere reserve, for example, one realizes that it is the word ‘reserve’ that causes a problem – and not the concept and what it refers to, once these have been explained. For some, the term awakens fears that imposed regulations will prohibit certain practices, while for others it calls up the spectre of policies designed to protect nature, such as those in force at the beginning of the 20<sup>th</sup> century when the national parks were created (see Larrère, 1997; Rossi, 2000).

Today it is too late to replace the universally known and accepted expression ‘biosphere reserve’ with something less loaded, more ‘innocent’ – and in any event should one really make concessions to this form of demagoguery? Yes it is indeed necessary to take protective measures and impose restrictions – although they should be the result of prior negotiated agreements.

Lastly, we should recall that in France the relevant divisions of the Ministry in charge of the environment agree to refer to all those ‘territories’ where protective measures are applied as protected areas, even if they concern or are limited to fractions of such ‘territories’.

Indeed, whether one is speaking about natural regional parks, national parks, biosphere reserves, hunting areas, or wilderness reserves, in all cases there is the goal of conservation.

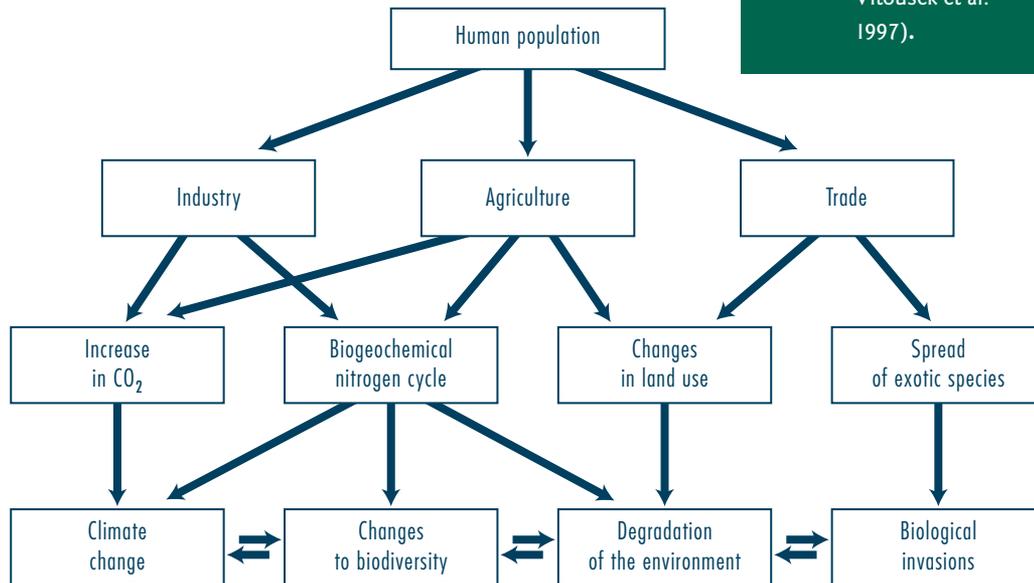
### Facing management constraints

The type of question facing a land manager includes: What part of my conservation efforts should I devote to replanting, regulating predators, strengthening fragile populations, combating invasive species? In terms of the entire geographic area to be managed, where should protection efforts be focused? Which habitats, and where, should be restored? What scope should be given to the protected areas?

In addition, to successfully carry out their mission, ecologists and conservation biologists must do more than produce integrative scientific theories and principles. Specifically, they must stop thinking in terms of exclusively biological sciences to include more economics, more management science, and more decision-making theory (Possingham et al., 2001) – even though it is clear that ecology is central, as a science of integration and a way to observe and understand a complex world that must be managed. Clearly, park managers and other practitioners of biodiversity conservation need information about how ecological systems function, about the interactions among species that determine their functional properties, and the spatial and temporal scales on which they operate. They need to know, for example, what type and what proportion of disturbances can and should be absorbed by the ecological communities that interest them; what may be the consequences of ecosystem fragmentation; how and why, and to what extent, this or that introduced species may alter the entire ecosystem (Soulé and Orians, 2001). In other words, the need for research and its role in areas that are protected or managed remains imperative (see Parsons, 2004).

In this field, the development of population ecology (Pimm, 1991; Barbault, 1992) and landscape ecology, as is true of what is referred to as ‘macroecology’ (Brown, 1995), should be decisive. In fact, one of the important changes that has taken place within conservation biology over the last two decades has been the growing awareness of the complexity of the interactions that make up the functional framework of the biosphere and the various spatial and temporal scales and contexts in which they operate. Increasing attention is paid today to the complex feedback phenomena at every organizational level of biological systems, between regions that are relatively distanced from the earth, between cultivated lands and ‘wild’ lands, and between human beings and other species (Soulé and Orians, 2001).

**Fig. 2: The main ecological changes caused by human activities** (adapted from Vitousek et al. 1997).



This is a conception of a world in which we are dependant on ecosystems, through the natural resources and ecological services they provide, and where we have become the primary force driving changes to biodiversity (Fig. 2).

This figure, which has been adapted from Vitousek et al. (1997), indirectly highlights how human activities are changing the biophysical world. In particular, it shows the main threats to biodiversity: the destruction and fragmentation of habitats, as well as pollution, which result directly and indirectly from the way that land is used; the introduction of exotic species (the success of which is likely facilitated by the above mentioned point); the effects of climate change. All that remains to be added is overexploitation and the cascades of extinctions caused by all these changes, and we have the four ‘demons’ identified two decades ago by Jared Diamond – which become five with the addition of climate change.

These changes take place today on a scale that is so vast they could affect the functioning of numerous ecosystems, numerous species, as well as the quality of life of numerous human societies, with a cost that is growing just about everywhere in the world. But that’s not all! If the changes to biodiversity affect human well-being, humans will react. So we must also take into account such feedback phenomena – something that is not limited to the expertise of ecology alone.

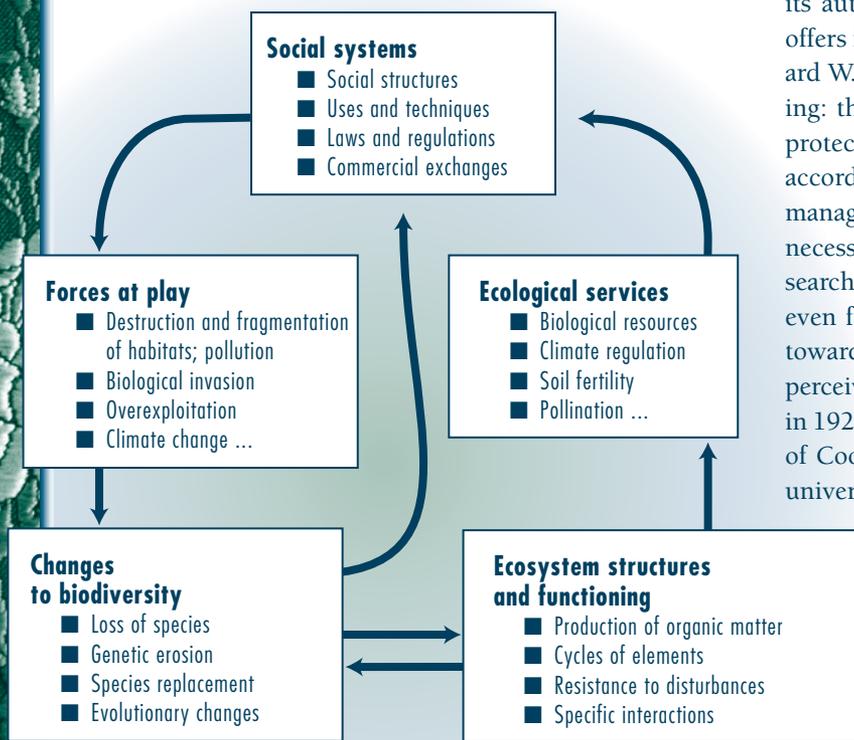
Two examples illustrate this point.

Many of today’s international directives and conventions, local and national instruments of regulation, have not led to the sustainable management of biodiversity, generally because they do not recognize and do not address the underlying motives of the various stakeholders. To go further in biodiversity management, we must evaluate existing conservation measures to see how they affect incentives for humans to conserve biodiversity. For example, do protected areas encourage or prevent nature conservation? This depends largely on the human context: how such conservation measures were negotiated and how they are enforced. Indeed, if populations are refused access to nature, this often increases rather than decreases the threat (Babin, 2003).

An important step in the practice of ecological sciences is the implementation of restoration plans for species that are endangered or threatened with extinction. To be effective, such programmes must include measures to restore habitats and reduce factors that pose a threat (building roads, urban development, agriculture, changing the course of waterways, pollution), managers are faced with societal issues.

Consequently, serious consideration of the entire ecological context is not sufficient: we must also look at the cultural, economic and social context. Along the same lines, it is not enough to study what happens inside

protected areas; the role of the matrix of inhabited and utilized areas surrounding them is just as important. In order to meet such challenges, academic ecology must demonstrate greater openness and depth. (Fig.3)



**Fig. 3: The fundamental role of social systems must be explicitly taken into account.**

To make useful contributions to management issues, it is also necessary to develop the scientific bases for conflict management and decision making – which are not ecologists’ specialty.

**What research priorities to better respond to conservation problems?**

‘National parks protect some of our nation’s most important natural resources. The long-term preservation of those resources requires a thorough understanding of park ecosystems and the ecological processes that influence them. National parks also provide unique opportunities to learn about natural ecosystems and serve as important baselines against which to assess the influence of human activities. Yet, despite the clear importance of science for parks and parks for science, there continues to be a lack of basic scientific information available on

many park ecosystems. *This can in part, be blamed on a historic lack of support for or interest in scientific research within the National Park Service.* [Emphasis added.]

Surprisingly, this paragraph was not written about the situation in France: it refers to the United States and its author is David J. Parsons (2004). The analysis he offers follows a historical assessment published by Richard W. Sellers in 1997. The central diagnosis is interesting: the National Park Service, the agency in charge of protecting natural resources, developed a culture that accorded no value and no role to science in its land management decisions. It therefore did not develop the necessary infrastructures and incentives to support a research policy that is... inexistent. Richard Sellers goes even further, describing a degree of unspoken hostility toward research. This is, at least, what many scientists perceive. That being said, various initiatives were taken in 1929 and especially starting in 1970, with the creation of Cooperative Park Studies Units, designed to involve university scientists and their students in the national parks’ research needs.

The interesting analysis synthesis put forward by David Parsons will not be discussed here, although its reading is strongly commended to those in charge of protected areas as well as persons who are interested in nature conservation also to all those involved in developing or implementing biodiversity strategies today.

The French Institute for Biodiversity has published a brochure that sets out the research needs to be taken into account with this strategy in mind, with the objective of sustainable development as backcloth. This obviously concerns protected areas and, of course, biosphere reserves and the network they make up – reserves and networks explicitly referred to in this document. It includes the four focus areas presented by the international programme Diversitas and the European Platform on Biodiversity Research:

1. Characterizing and evaluating biodiversity;
2. Understanding the dynamics of biodiversity and predicting changes therein;
3. Evaluating the ecological, economic and social impacts of changes to biodiversity and relationships between science and biodiversity, which makes up their dynamic backdrop;
4. Developing sustainable working and conservation practices for species and their habitats.

The biosphere reserves are concerned by all of these themes, whether in terms of the development and implementation of methods to estimate biodiversity (focus area 1), long-term monitoring to analyse fluctuations and their causes (focus area 2), evaluation and manage-

ment of society/biodiversity interactions (focus area 3) or strengthening the network of operators involved in conservation and sustainable development strategies (focus areas 3 and 4).

In more concrete terms, let us take the example of the vast field referred to in point 2. In a chapter entitled ‘How relevant to conservation are studies linking biodiversity and ecosystem functioning?’ Lawler et al. (2001) emphasize that it is not sufficient to declare that because biodiversity research helps advance ecological theory and improves our understanding of how ecosystems work, it will be beneficial to conservation. It would be useful to ask more specific questions that could help the preservation and management of ecosystems.

For example:

- In the dynamics of communities or ecological processes, are there signs that announce future damage linked to the loss of a species or a functional group – which would enable us to react? There is a need for research to develop tools to predict the type of ecosystem crisis that could lead to such losses.
- Are the systems we plan to protect sustainable? We have invested a great deal in the analysis of population viability: what we most need today is not just a theory of the viability of communities or ecosystems, but a real theory to define sustainable regional development! Theories and experiments concerning the relationship between biodiversity and the functioning of ecosystems must include the role of disturbance patterns (fire, for example) and exotic species – which are omnipresent phenomena.
- What factors or circumstances (community structures, disturbance patterns, spatial scales) can have a major impact on diversity loss?

To respond to all these questions, there is a pressing need for modelling and experiments facilitating interactions among species, as well as between landscapes and societies, in order to better identify the mechanisms at play.

For more information on the subject, I recommend a book edited by Michael Soulé and Gordon Orians: ‘Conservation Biology. Research Priorities for the Next Decade’ (2001). Each chapter includes a box that summarizes, in the various identified fields, research and management priorities presented as questions. It is a pity, nonetheless, that this work is not sufficiently open to the viewpoints of the social sciences.

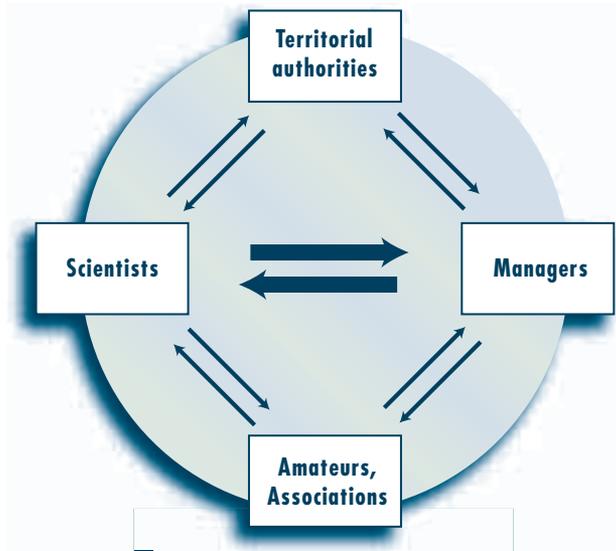
Coming back to Parsons’ comments, quoted at the beginning of this chapter, and in particular to his last sentence, I believe it would be useful to complete the diagnosis: although it is true that there has generally been, and not primarily or only in the United States, a lack of interest in research among those in charge of natural areas, we must also regret – in a symmetrical way – the

research community’s lack of interest in the problems posed by the conservation, management and optimized use of these areas.

### Building partnerships

To adopt a more operational framework, defined by the goals of sustainable conservation and management of biodiversity, it is important to point out that nothing can be decided from the viewpoint of the ecologist alone, nor from that of a single category of researchers, regardless of their discipline: the problems that arise are within an area that is clearly ecological but also human, i.e., social and economic. This space involves other stakeholders, and not just scientists, as shown by the illustration in Figure 4. Note that the ‘managers’ category includes managers of protected areas as well as farmers, foresters, hunters and fishers.

In other words, the ecological systems about which we should ask questions concerning biodiversity dynamics are first of all the land occupied by people, fields, forests and prairies, protected areas and urban settings – in a word, surface areas that come with the ambit of what is referred to as land management or land use planning.



**Fig. 4: Strengthening exchanges and partnerships between the research community and those in charge of managing habitats and species is an imperative that must inform the entire strategy to be implemented.**

From this viewpoint, it would be a pity not to take advantage of the experience accumulated by the World Network of Biosphere Reserves which covers three decades (see also the lessons of another interesting experience, that of the natural regional parks in France: Moulinas, 2004).

In 1971, when the Man and the Biosphere Programme was launched by UNESCO, it marked a major break in policies for the protection of nature: the biosphere reserves that were to be created, at the initiative of State governments on the basis of prior local concertation among public authorities and those who used and occupied the area, were the result of questions and considerations about the relationship between human societies and their environment. The biosphere reserves

were designed to answer one of the central questions in what is today known as sustainable development: how can we reconcile the conservation of biodiversity, and the biological resources it represents, with the social and economic development of the populations who are dependent on such biodiversity? These biosphere reserves must fulfill three interdependent functions: a conservation function; a sustainable development function on the local scale, with its three components (social, economic, and cultural); and a logistic function for research, monitoring, training and education. Naturally, the results obtained have at times fallen short of the goal — prompting UNESCO to conduct an in-depth assessment and renewal in 1996: The Seville Strategy.

## The Seville Strategy (UNESCO, 1996) highlighted **four goals**

### Goal I :

#### Use biosphere reserves to conserve natural and cultural diversity

- I.1: Improve the coverage of natural and cultural biodiversity by means of the World Network of Biosphere Reserves
- I.2: Integrate biosphere reserves into conservation planning

### Goal II :

#### Utilize biosphere reserves as models of land management and of approaches to sustainable development

- II.1: Secure the support and involvement of local people
- II.2: Ensure better harmonization and interaction among the different biosphere reserve zones
- II.3: Integrate biosphere reserves into regional planning

### Goal III :

#### Use biosphere reserves for research, monitoring, education and training

- III.1: Improve knowledge of the interactions between humans and the biosphere
- III.2: Improve monitoring activities
- III.3: Improve education, public awareness and involvement
- III.4: Improve training for specialists and managers

### Goal IV :

#### Implement the biosphere reserve concept

- IV.1: Integrate the functions of biosphere reserves
- IV.2: Strengthen the World Network of Biosphere Reserves

Although I will not review here the argument that considers the biosphere reserves to be the privileged instrument of a sustainable development strategy, I would emphasize one point that I feel is essential: provisions concerning protected areas must be at the heart of a sustainable biodiversity management strategy and the main-spring of conservation with regard to research, education, communication, training, and conservation in the strict sense of the word.

This, however, implies at least two types of developments that remain either insufficient or lacking: the strengthening of the relationship between the world of research and the world of land management; and the implementation and development of long-term monitoring mechanisms coupled with comparative and experimental research projects.

Implementing an effective, sustainable system for monitoring biodiversity or one of its components is a complex and difficult task, and an upsetting one. Ecological thinking becomes subversive when it meddles with orienting management or conservation practices. It becomes subversive when it asks questions beyond the realm of scientific disciplines; and it is even more deeply subversive when it brings up issues that touch upon the functioning of the scientific-industrial complex, politics, and established beliefs concerning economic and social development. Because we are involved here in a social debate, it is absolutely necessary to be able to rely on precise analyses. For this reason, the development of research and the implementation of long-term inventory and monitoring mechanisms are doubly necessary.

Kay et al. (2002) recommend an *'adaptive ecosystem approach'* to monitoring designed in support of public policy. These authors show, in particular, that the development of monitoring programmes is too often considered to be synonymous with production indicators, as if there were a clearly established set of things to measure. The shortcoming with this type of inventory is that it is disconnected from the context of humans and their concerns and interests. We are dealing here with complex systems for which suitable instruments are lacking: new approaches are required, which incorporate complexity into the monitoring programmes and make it possible to address sustainability issues.

What is included in monitoring designed for management purposes, directly or indirectly (i.e., monitoring that provides information about the evolution of a habitat, communities or a population)? It must be designed to meet objectives and address issues that are defined as clearly as possible and established in conjunction with users of the information being sought. Based on such targeting and existing knowledge about the structure and functioning of the system under study – a natural

area, with its fundamental components, situated in an ecological and socio-economic context – this requires: deciding which variables to monitor and measure, attempting to define relevant sets of indicators that are as simple and dependable as possible; determining a strategy for sampling and measuring that is suitable in all its spatial and temporal dimensions; and standardizing measurement methods to reduce individual bias and increase the comparability of the measurements obtained.

This explains why it is necessary to create lasting ties between the research community and the world of park managers, ties that imply broader interactions (Fig.4) since the associations and amateur networks are essential components of such observatories.

Lastly, two characteristics must be taken into account in scientific monitoring designed for the management of natural areas: national and continental measurement-taking must be included in the networks; and efforts must be ranked in order of importance.

By way of conclusion, through such an approach we are in the spirit of what will logically enter into a national sustainable development strategy – invited to work in coordinated networks of scientists, associations and managers who, although they may not always act together, are at least aware of what each one is doing – and to do so in the overriding interest of nature conservation that is ... sustainable!

### Conclusion

Thus, conservation biology, on the one hand, and the strategic objective of sustainable development, on the other, are driving ecology toward deeper insights and new directions.

To meet this challenge, ecology must not only enlarge its sphere of action by taking advantage (to use a horticultural metaphor) of the diversity of its 'offshoots', – conservation biology, landscape ecology, human ecology, industrial ecology, restoration ecology – but must also open up to participation in other scientific dynamics that, alongside ecology, are central to the field of the environment, even though they belong to other scientific fields: geography, anthropology, sociology, economics.

Ecology must also accept the limitations on the ground, such as they are experienced by other stakeholders of nature conservation – referred to here, for the sake of simplicity, as park managers.

In other words, taking into account the 'human element', as advocated by supporters of modern conservation biology, must not be limited to recognizing the capacity for management or for deterioration. It must be expanded to embrace all its dimensions, in order to make research, modelling, and experimentation opera-



tional, and to facilitate the necessary dialogue with other research sectors and other stakeholders in the sustainable development strategy. For this, the experience of conservation stakeholders, 'amateurs', NGOs, and park managers will be extremely valuable.

This is one of the fields where research and management activities are the most promising. Yet if I had to single out one and only one priority to make a lasting impact on the mobilization of new resources, and based on discussions involving those in charge of parks and biosphere reserves (which can be found in the article by Parsons), I would willingly defend an incentive-based programme of research into strategies for the sustainable conservation of species and habitats that would favour: (1) joint involvement of stakeholders involved in research and park management; (2) the development of interdisciplinary approaches including, in particular, a humanities and social sciences point of view; (3) a way to take into account a context marked by global changes (including climate change) and (4) the ambition to create an observatory for research on the environment (Observatoire de Recherche en Environnement, ORE) for the 'monitoring, inventory and understanding of biodiversity dynamics' and designed on the network principle.

In this framework programme, which would make biodiversity research a *genuine priority* (and not a cosmetic priority), we would be able to identify the four main focus areas set out in the French Institute for Biodiversity report. And the World Network of Biosphere Reserves could then help ensure that these areas are accorded their full importance, as expressed by the MAB Programme and recommended in the Seville Strategy.

This is a challenge worth taking up.

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## Management of biodiversity and participation: elements for stocktaking and reflections

RAPHAËL BILLÉ

### Ancient notion and practices but a culture to be developed

The abundance of research and experience in participatory approaches that has marked the last decade might suggest a sudden and recent paradigm shift. The notion of participation in public decision-making, however, is ancient, as well as attempts to implement it in numerous countries. In the context of development aid, historians and anthropologists date the first formal efforts in this field to the 1920s (Chauveau, 1994). Having become a principle of public action, participation is not really new, whether in terms of research or in terms of practice – although clearly these two dimensions have evolved considerably over the years. The dominant impression of permanent novelty is therefore probably a sign of the weakness of the *culture* of participation. For this to change, it must become a matter of standard practice.

More specifically, it might be said that reflection about participation has been part of environmental conservation almost since its birth as a sphere of public action. An example of this, going back to 1964, is the debate organized by the DATAR<sup>1</sup> and the French Ministry of Agriculture that led, in 1966, to the Lurs-en-Provence seminar where architects, land use planners, ministers, biologists, civil servants, leaders of associations, poets and others combined their ideas to devise the concept of regional natural parks. Another example is the 1971 creation of the Man and the Biosphere (MAB) Programme at UNESCO, which provided the conceptual and practical foundations for natural resource management and continues to be fully relevant in 2006.

The participation of local stakeholders in biodiversity management has nevertheless always been, and remains today, very uneven depending on the sociopolitical context. When assessing the current situation, it is important to recognize that conservation stakeholders are in general neither more nor less reluctant to embrace participatory approaches than players in other major fields of public action. When, generally speaking, the needs and wishes of numerous stakeholders, in particular the poorest among them, are not taken into account, when their rights to land or to participation in decisions

that concern them are flaunted, conservation actions are unfortunately like any other field. Participatory democracy<sup>2</sup> is noticeably developing at the same pace in the sector of the environment as in dam building or urban planning, for example. It requires the support of a State governed by the rule of the law, and a certain degree of decentralization.

As a subject that has been the focus of public attention for several decades, but whose implementation has been mixed, participation today requires an analytical examination, both critical and constructive, rather than a schematic vision. Thanks to the perspective that has been gained through a very large number of examples of participation, whether still tentative or already soundly imbedded, it is possible to identify a number of recurring issues. Making explicit the history of participation and promoting analysis and discussion of its strengths and weaknesses and the issues to which it gives rise are crucial to building this common culture that, it seems, is still lacking. With this goal in mind, from 2000 to 2005 the French Ministry of the Environment, ADEME<sup>3</sup> and ENGREF<sup>4</sup>, held a series of seminars on a regular basis to discuss ‘Concertation, decision-making and the environment’ (see box, page 37). Although the seminars did not focus exclusively on biodiversity, below are listed some of the recurring discussion topics that, based on our experience, we feel offer useful insights about conservation and biodiversity management in general, and about biosphere reserves in particular.

1. DATAR: Délégation à l'aménagement du territoire et à l'action régionale (Regional Land Planning Administration), France.
2. Participatory democracy is not opposed to but, on the contrary, complements representative democracy though which citizens elect their representatives and delegate their decision-making power. It implies the direct involvement of the people, independently of electoral processes, regarding a certain number of decisions concerning them, through neighborhood associations, public debates, concertation meetings, steering committees, etc.
3. ADEME: French Agency for the Environment and Energy Management.
4. ENGREF: French Institute of Forestry, Agricultural and Environmental Engineering.

### **A fundamental tension: participation, end or means?**

From the outset, the development of a participatory culture comes up against a fundamental tension between the end and the means that characterize this notion. Is participation an end in itself, or a means to improve project performance? Must it raise the question of the validity of choices that have been made upstream, or limit itself to more or less marginal adaptations to be made with regard to local interests and concerns? The management of such tension creates recurrent and very real practical problems: for example, can the participatory management of a protected area result in its declassification as a protected area? Under what conditions?

There is no simple or general answer to these complex questions. An ongoing discussion, however, is especially necessary as we observe the rapid development of environmental policies, programmes and projects that are more focused on procedure than on substance. The first category provides formal means of organizing relations among stakeholders but leaves them significant freedom as to objectives and means for action. Among these, mention should be made of two examples: GELOSE (Securing Local Management) in Madagascar, which organizes the contractual transfer of renewable resource management to rural communities (Babin et al., 2002), and most of the agri-environmental systems in France, such as the 'fertilize better' initiatives that are part of local efforts to combat diffuse nitrate pollution caused by farming (Busca and Salles, 2002). The second category highlights goals and means for action: it typically includes national parks, land acquisition policies and pollution standards for natural habitats. Although there is no question that both categories, procedural and substantial, rightfully belong to the range of public actions, the automatic systematic and *a priori* reliance on the first category is a problem.

### **Participation and decision-making processes: changing rules and practices**

The development of concertation<sup>5</sup> has relied to a large degree on legal measures that set new procedures and obligations, from the Aarhus Convention<sup>6</sup> at the international level, to local regulations governing the management of biosphere reserves. And yet changing procedures is not sufficient to bring about an in-depth transformation of processes and practices. The regulatory moments in concertation, the 'regulatory participation' of local stakeholders, should be put in the context of the overall management and decision-making process

(Mermet et al., 2004). This process, rather than the procedures, is what the impetus of participation basically seeks to transform.

This tension between evolving procedures and changes in processes may be seen, for example, in social science research on biodiversity. A very large number of research projects today focus on procedures, when in fact there is a pressing need, on the contrary, to put observations back into their context, to connect them to the social, political, economic, and technical systems that are the focus of debates and decisions. Experience has shown that isolating the procedures from their decisional context and their purpose generally amounts to siding, *de facto*, with the stakeholders who seek to limit the analysis of new situations to better inhibit the changes fostered by participatory approaches (see, for example, Brower and al 2001; Barthe, 2003).

Participation is a strategic issue that may in fact be instrumentalized. It does not eliminate power struggles or the use of influence but represents an additional instrument that stakeholders can use to bring such relationships into play. The better the quality of a participatory approach on the ground, the more likely it is to bring about changes (which may have a negative impact on the interests of some stakeholders), and the stronger the resistance to such an approach – whether expressed or silent.

### **A tendency for public action situations to become more complex**

As democratization and decentralization allow participation to expand, the field of environment illustrates the extent to which public action situations are growing more complex. The development of participation is both a consequence, since it becomes necessary when a given stakeholder can no longer act alone, and a cause: the implementation of concertation processes is itself highly complex and leads to debate and action that strengthen the polycentrism of the public sphere and the difficulty of acting autonomously.

One of the results of this growing complexity is that conditions for action are often more cumbersome. Whereas in the past, a single person would have quickly made a decision based on a technical-economic study and rapid behind-the-scenes negotiations, today it takes

5. In line with the title of the programme and the 'Concertation, decision-making and environment' seminar, we understand the notion of concertation here in the broadest sense of the term, to designate all public action practices that promote exchanging viewpoints and seeking agreement. It is not used to define a given type of practice that can be set in opposition, for example, to public debate, negotiation, participation, or consultation (Mermet, 2005).

6. Convention about access to information, public participation in the decision-making process, and access to the judiciary system regarding environmental issues.

Seminar series

## Concertation, decision-making and the environment

In light of the growing number of approaches – often experimental – to decision-making, which are based on negotiation, participation, mediation and concertation, and with regard to various topics (water, agriculture, protection of nature, waste management, infrastructure, etc.) and concerning various levels of decision-making, from national to local, at the initiative of public authorities and private stakeholders, in 1999 the French Ministry of the Environment introduced a research programme entitled Concertation, decision-making and the environment (CDE). It was designed to mobilize a wide range of social science disciplines to analyse these new approaches and new concertation practices in the field of the environment, with a view to acquiring useful references for decision-making and public debate\*.

Within the framework of this programme, the cycle of quarterly CDE seminars was organized in partnership with ADEME and ENGREF. Its purpose was three-fold:

1. to offer a forum for debate among practitioners and researchers on issues concerning ‘concertation, decision-making and the environment’;
2. to ensure exchange among the disciplines that work in this area but rarely have the opportunity to compare approaches;
3. to mobilize new researchers and teams on these issues.

Each of its 15 sessions brought together about one hundred participants: representatives of associations and the private sector; researchers in the social sciences and biology, physics, and chemistry; various national and

local administrations that deal with these issues and citizens. Emphasis was placed on the French context, with significant, although more sporadic, discussion on other developed or developing countries. Each session was structured around a specific topic or issue. A few examples:

- Interventions and procedures for the concerted management of streams, rivers and waterways
- Development challenges for new information and communication technologies in the field of concertation and decision-making
- Which evaluation frameworks for concertation systems?
- Nature and water in rural areas: should they be regulated or negotiated?
- Critique of concertation: initiating a review based on thirty years of research
- New concertation systems: what opportunities and challenges for associations?
- From North to South: participatory experience in environment and the development of territories

The detailed proceedings of each of the 15 sessions, including presentations, round tables and discussions with the public, were published by La Documentation française (see Billé and Mermet, 2003 ; Billé et al., 2006).

\* For more information about the CDE Programme, see <http://www.inra.fr/sed/environnement/pr-cde.html>.

years if not decades of dialogue, thousands of pages of reports, and hundreds of public meetings in many cases prior to the adoption of a management plan for natural resources or the creation of a national park.<sup>7</sup>

Unfortunately, such complexity cannot really be reduced. It poses a problem for the protagonists in concertation when they have a simplified and utopian idea of how concertation takes place. Stakeholders are at times confused with the extreme complexity of the legal and political frameworks for action, requiring all involved to learn to evolve within this partially new configuration for action, without losing their points of reference, their legitimate concerns, and by better accepting others’

concerns. The biosphere reserve managers may otherwise feel a genuine shock when faced with a diverse public and divergent perspectives, far from feeling united behind the hypothetical ‘general interest’ they thought they represented.

7. See the contrasting examples of the diagram for improving the value of the coast in Charente (France) and the Menabe coastal region (Madagascar) sustainable development plan in Billé, 2004, or the description of the process for the creation of a marine park in the Iroise Sea since 1989, in Pennanguer, 2005.



## Who participates?

### The question of the public, from citizens to international NGOs

The image of a public<sup>8</sup> that is hoped for, theorized about, and expected in fact rarely corresponds to the participants who actually take part in concertation. From the viewpoint of the person responsible for public action (a civil servant in charge of preparations to set up a protected area, biosphere reserve manager, technician in charge of an especially conflict-ridden project, such as the presence of a large predator), these participants are generally not qualified enough – or perhaps overqualified, not focused enough on the community's interests, not concerned enough about protecting biodiversity, not representative enough; they are too few in number or too present, too apathetic or overly involved, too indifferent about the debate or too blinded by their ideological convictions.

Who is the public thus appears to be a central issue. How does it emerge? Who participates? Who does not participate? Who is recognized and appointed as 'civil society', 'concerned stakeholders', 'beneficiaries', 'the local population'? Even if one has a sound sense of perspective when addressing these questions, they remain as important as they are sensitive. A participatory management process in a biosphere reserve may, for example 'overlook' local players who are marginalized and poorly represented. It can just as readily leave out stakeholders whose power is such that it would appear there is nothing to negotiate with them. What is participation worth under such conditions? One of the many lessons experience has taught us is that often a stakeholder is absent because an issue considered to be of minor importance at the beginning of the participatory process later becomes decisive. This means that the participatory management of a biosphere reserve requires frequently renewing the process of identifying conflicts, issues, stakeholders, and their representatives, rather than considering that this step has been taken care of once and for all. Provision needs to be made for the representation of local stakeholders on the steering committee or the board of directors of a biosphere reserve to evolve as negotiations take place.

Lastly, local and international NGOs, whether they have a specialized or general focus, play a key, although complex, role in participation when it comes to biodiversity conservation, from the day-to-day management of protected areas to international negotiations. They are valuable spokespersons for civil society, often con-

8. By public here, we mean all stakeholders who take part in a concertation approach, whether by participating in concertation meetings, public debates, etc., or by protesting actively from the outside.

tested and inevitably imperfect. Their legitimacy stems in part from their participation in concertation, which they themselves encouraged and which would not be able to take place without them. Depending on the circumstances, they fulfill various functions: representing sectorial interests, offering expert and second expert opinions, lobbying, managing projects by delegation of public powers. They represent an essential, but not neutral, component in the participation of the public.

## Developing individual and organizational capacities

Changing practices, changing culture: participation requires new competencies from stakeholders involved in biodiversity management. One thus observes a growing demand for training, methods and references, which gives rise to two comments.

First, it is essential to capitalize on past experience, both positive and negative, from all over the world. This poses certain problems of method, for example, to usefully share knowledge gathered in contexts as different as those of industrialized nations, countries in transition and developing countries. The World Network of Biosphere Reserves is a unique and precious tool in this respect.

Second, the viewpoint that places researchers, who contemplate, on one side, and practitioners, who act, on the other, must be petitioned. Researchers indeed entertain close relations with the world of action. For many of them, these relations are useful not only to validate their work and the value of their findings: they are also a matter of scientific practice and a way to leverage research. Similarly, practitioners and stakeholders are also broadly involved in reflection, and the mobilization of their experience is an essential factor in collective learning. There are, in addition, many intermediary roles: experts, consultants, advisors, teachers, trainers and others facilitate exchanges between these two worlds on a daily basis, and such exchanges should always be reinforced.

Developing individual capacities is, however, not sufficient as long as the impetus of participation brings with it numerous internal management challenges for organizations. If it cannot adapt, the administration in charge of national parks in a specific country, for example, may trap its personnel between the imperatives of a hierarchical and centralized system and the obligations of concertation.

## A central question: the assessment of participatory processes

At the same time as participation, evaluation has developed over the past decades to become an imperative both in terms of democracy and effective public action. Making value judgments about participatory processes, however, gives rise to numerous specific difficulties, including the need for careful work to elaborate a system of benchmarks: against what standards is one to measure the participatory management of a protected area? Can agreement be reached about one or more objective references for evaluation, between the rationale inherent to public action (conservation of biodiversity) and the various (and legitimate) objectives of participating stakeholders? In particular, assigning its rightful place to the issue of the environmental effectiveness (Mermet et al., 2005) of protected areas and, more generally, of participatory environmental policies, programmes and projects is a major challenge in the assessment process.

Once the question of benchmarks for evaluation process has been addressed, the no less thorny question of indicators, between process indicators and results indicators, must be addressed. Depending on whether one considers participation to be an end or a means, the indicators are, naturally, not the same. Even then, the resulting system of indicators must not be too complex or too expensive, or else it will be impossible to put the system into practice and it will, in any event, never be immune from the inevitable dissatisfaction.

## Towards a culture of participation

Clearly, most of the questions raised in this discussion of some of the factors for assessment and reflection remain unanswered. If they continue to come up so often and so forcefully, it is because they cannot be answered in a general or definitive way. They deserve to be discussed and re-discussed, however, in constantly changing contexts: in such a way, individuals can gradually build their own theoretical and practical points of reference when it comes to participation. In such a way— and not by making generalizations about the ‘recipes’ for how procedures should be conducted – a culture of participation develops and gains ground, little by little.

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## The approach to identifying eco-functional zones: the example of the 'W' Biosphere Reserve in Niger

BOUREIMA AMADOU

**L**ocated at the junction of three countries—Benin, Burkina Faso and Niger—the W Transboundary Biosphere Reserve<sup>1</sup> represents the northernmost part of the vast Sudanese savannas that cover the entire intercalated eco-climate area between the humid savannas announcing the dense forest to the south and the sparse, arid Sahel to the north. The creation of the 'W' Biosphere Reserve answered a two-fold regional and national biodiversity conservation goal. The conservation function was clearly expressed with an area of approximately 10,000 square kilometers for the entire region, of which 220,000 hectares are located in Niger (the 'W' Park). The fact that more than 80% of Niger's biodiversity<sup>2</sup> is found in this region supported this conservation effort.

Before its classification, this area was occupied by rather diverse ethnic groups. The earliest evidence of the presence of humans in the 'W' region are stone arrowheads dating from the Paleolithic era. Humans<sup>3</sup> appear to have lived here by hunting, already making use of bush fires, and gathering wild fruits and seeds. In 2002, the Nigerian archeologist Boube Gado discovered a protohistoric terra cotta statuette baptized 'the Venus of "W"', which has become an emblem of sorts of the age-old presence and legitimacy of humankind in the 'W' Park. Currently the 'W' Biosphere Reserve transition area is populated primarily by communities of farmers and livestock breeders from the Say, Kollo and Boboye regions.

Since the 1980s, reserve managers have been alarmed at the illegal exploitation of the grazing areas in the central area of the Niger 'W', which is caused in particular by Peul pastoralists who move their herds here during the dry season. Each year, thousands of cattle come to the area and are thought to cause the deterioration of the grazing land at the expense of wildlife.

The current context, in which natural resources are growing increasingly scarce, puts pressure on the Niger 'W' Biosphere Reserve and results in an expansion of the appropriated areas. By attempting to preserve certain resources in a unilateral way, the State creates the conditions for misunderstanding and, consequently, elicits negative reactions from the other stakeholders. At that

point, the local populations' incomprehension manifests itself in a number of heritage-related claims and conflictual behaviors. Compatibility between the conservation of the spaces and fauna in the 'W' Reserve and the practices and demands of the agro-pastoral community thus represents a major challenge for its future.

The biosphere reserve is under the authority of a reserve manager appointed by the Office of Wildlife, Fisheries and Aquaculture with the Ministry for the Environment and Combating Desertification. The reserve manager works closely with State forestry agents and agents from the ECOPAS project.<sup>4</sup>

The characterization of the socio-territorial units in the villages located in the transition area<sup>5</sup> of the biosphere reserve is a fundamental step in understanding the dynamics of their functioning.

The approach used consists first, of undertaking a global analysis of the situation in the villages. The analysis focuses on physical and socio-economic determinants and the flow of exchanges, both internal and external, among the villages. It accounts for the pressure exerted on the core area by the villages at the periphery of the biosphere reserve, in particular with respect to the collecting of spontaneous plant resources (dead wood, straw). The analysis makes it possible to identify the basic territorial organization structures, which explain the strategies for the land occupation in the two transition areas, the associative and community dynamics within the villages, and relationships between villages.

1. The 'W' Park in Niger, which forms the central area of the 'W' Biosphere Reserve, was created in 1954. The Niger portion of the 'W' Biosphere Reserve was designated in 1996 and the 'W' Transboundary Biosphere Reserve in 2002, becoming the first transboundary biosphere reserve in Africa.
2. Enormous troops of antelope, elephants, African buffalo and, generally speaking, large and emblematic land mammals that characterized the Continent less than one century ago.
3. Numerous groups of baobabs found in the Park are associated with ancient inhabited sites.
4. ECOPAS: Conservation of Protected Ecosystems in Sudano-Sahelian Africa, a regional project financed by the European Commission.
5. There are two sorts of transition zones in the Niger part of the 'W' Reserve: the near periphery (Tamou total wildlife reserve set up by Decree 62-188 of 8 August 1962, and modified by Decree 76-141 of 12 August 1976) and the distant periphery (the partial reserve of Dosso, Decree 62-189 of 12 August 1962).

The way in which resources are used depends on the pressure exerted by the villages on the core area and the types of links among villages. Determining the pressure index is very important for the choice of actions to be implemented in the transition areas. This pressure index can be established, based on the headcount of the population and livestock in the transition area, on the degree of concentration of inhabited zones, and the kinds of land speculation occurring within the area. Links among the villages may be functional or hierarchical. The second step in this approach therefore consists of identifying the groups of villages that work as a network and determining the type of network.

A hierarchical basis for village networks is evidence of an active traditional system, whereas the absence or weakening of hierarchical networks indicates that basic structures have been undermined due to the introduction of modern territorial-based approaches. This method of analysis provides an idea of the typology of status and ties of dependency among the villages (those created by process of separation, enlargement or new installation), as well as the traditional political systems for managing power. The notion of village networks can be fully grasped at this level. The study of the traditional status of the villages on the edge of the 'W' Biosphere Reserve, tested by the 'W' Park/ECOPAS Regional Programme, offers the advantage of identifying the authorities which would need to be referred to for all the processes related to natural resource management and population participation in the transition area.

The eco-functional network resulting from this network of villages is, by definition, 'a group of villages and village lands whose relationship is conditioned by common natural resources (pastoral, agricultural, hunting and fishing)'. The eco-functional network approach is based on the hypothesis that managing a natural resource based on the common interests of the stakeholders and villages ensures the viability of this resource and, even better, its 'appropriation' by local communities. This, moreover, makes it possible to retrieve information on 'homogenous' zones where use and management rules are established on consensus basis, taking into account basic territorial logics and legal requirements in force.

The concept of eco-functional networks applied in the 'W' Biosphere Reserve is based on this principle. One example of such networks is that of the villages along the Niger River that practice the same main activity and share the same resource: 'water'. They all feel concerned by the management of this resource, and are ready to establish an association or interest group to ensure its sustainable management. The example of Kerawfity offers a rather effective illustration. This association of fishers, which is present in several villages, was created with the

support of the forestry administration. Working with the fishers and the 'harikoye' (masters of the water), its aim is the concerted, responsible management of halieutic resources.

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# Tools for dialogue and concertation

## Chapter 3

‘The key to success for a biosphere reserve is, however, found elsewhere, namely in the formulation and the implementation of an overall management plan, which assumes that it has been defined through concertation among all the stakeholders within the framework of an appropriate mechanism. It is not always easy to follow such a procedure, yet it is the only way to succeed in a democratic and feasible way within any undertaking that aims to foster sustainable development.’

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## Companion modelling: a tool for dialogue and concertation<sup>1</sup> in biosphere reserves

MICHEL ÉTIENNE

**T**he integration of simulation models to assist in collective decision-making for the management of natural resources is one of the particular features of adaptive management (Holling, 1978; Walters, 1986). The utilization of such models to stimulate the participation of stakeholders in building land management scenarios is, however, much less common (Costanza and Ruth, 1998; Bousquet et al., 2004). A group of researchers belonging to the ComMod network (Etienne et al., 2005) decided to develop this approach and to test it in the management of natural areas (d'Aquino et al., 2003; Etienne et al., 2003) and forest management (Etienne, 2003; Purnomo and Vanclay, 2003). To do so, their approach emphasized the aspects of multi-functionality, concertation and monitoring (Subotsch-Lamande and Chauvin, 2002) and used multi-agent models and role-playing games as mediation tools based on a democratic model (Chauvin, 2002) stimulating the implementation of new ways to build and to share information.

Following a brief presentation of the foundations and possibilities for the utilization of companion modelling, the use of the approach in biosphere reserve implementation is described and discussed. Emphasis is placed, in particular, on three ways to use multi-agent models and role playing in biosphere reserves: as an educational tool to increase awareness of the interactions between stakeholders and resources, as a mediation tool among users of the biosphere reserve, and as a decision-making tool in the implementation of a concerted land management plan.

Three examples in France and West Africa illustrate the potential applications of this approach. The first was developed to help stakeholders involved in the creation or during the periodic review of a biosphere reserve to formalize the main interactions between ecological dynamics and social dynamics on their territory, and to spatialize the issues at stake. The main purpose of the second is to offer an original method to address use conflicts that arise between naturalists and local stakeholders, by working on representations and scales of value.

1. The term 'dialogue' as used here refers to a means to foster improved mutual understanding with a view to decision making. The term 'concertation' is intended as a means to project into the future collectively.

The third aims to improve exchanges between researchers and reserve managers, and to develop a teaching tool that is able to stimulate the development of possible scenarios for the concerted territorial management of biosphere reserves.

### Context

Companion modelling applied to the management of renewable natural resources is based on the principle that any land management document reflects a way to organize and manage interactions between ecological dynamics and social dynamics. Therefore, it must be based on an ability to visualize probable changes within a territory in terms of structure, composition, juxtaposition or overlapping usage. The biosphere reserve must then be considered as a combination of ecological processes (regeneration, growth, population dynamics) and social processes (usage, economic value, history), so that the products of this territory represent a range of resources coveted by one and all.

Multi-agent systems constitute a particularly powerful tool to represent such complex systems and to account for the various environmental components, relations among social groups, and interactions between the practices of the stakeholders in the system and the primary ecological dynamics. They will consider the biosphere reserve territory as a group of objects about which agents make decisions on the basis of their perceptions and exchanges with other categories of agents (Fig. 1). Multi-agent systems are also able to represent this range of perceptions by offering viewpoints on the system created by using a palette of indicators that the various stakeholders concerned by the land management project consider to be relevant.

Finally, the complexity of situations addressed in a biosphere reserve is such that the decision-making process is necessarily evolving, repeated and continuous, and should be built according to an approach that makes it possible to facilitate collective decision making. Companion modelling is designed to meet this challenge by providing tools that make it easier to understand different viewpoints and the subjective criteria to which various stakeholders refer implicitly, or even unconsciously

(Etienne et al., 2005). It goes farther than traditional participatory approaches and recent concertation support systems (Auvergne et al., 2001) insofar as the functional diagrams commonly used in such approaches are dynamic and interactive.

### Approach

The first step in the companion modelling approach consists of collectively identifying the main stakeholders concerned by the existence of the biosphere reserve, their management entities and the main dynamics at play. To accomplish this first step, the group taking part in the co-construction of the model must answer the following four questions:

- What are the main resources on the territory and the essential information needed to guarantee their sustainable use?
- Who are the main stakeholders that seem to be able to or need to play a decisive role in managing this territory?
- What are the main ecological dynamics at stake, and how are such dynamics impacted by these stakeholders?
- How can each selected stakeholder use the desired resources?

The answers to these questions are represented in simple diagrams, which are structured to be readily translated into computer language. Four diagrams are thus drawn collectively and consecutively:

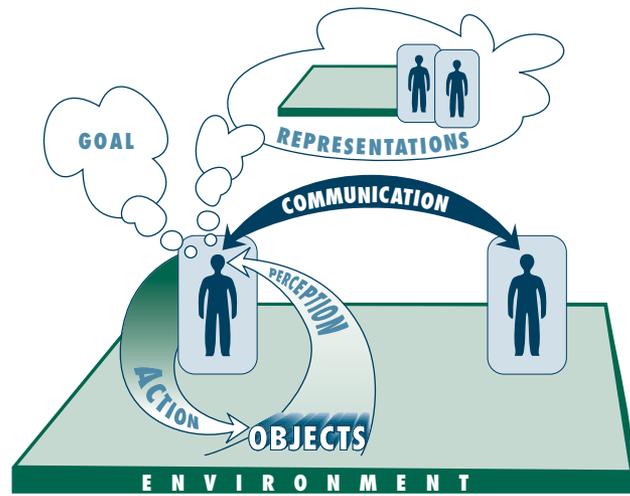
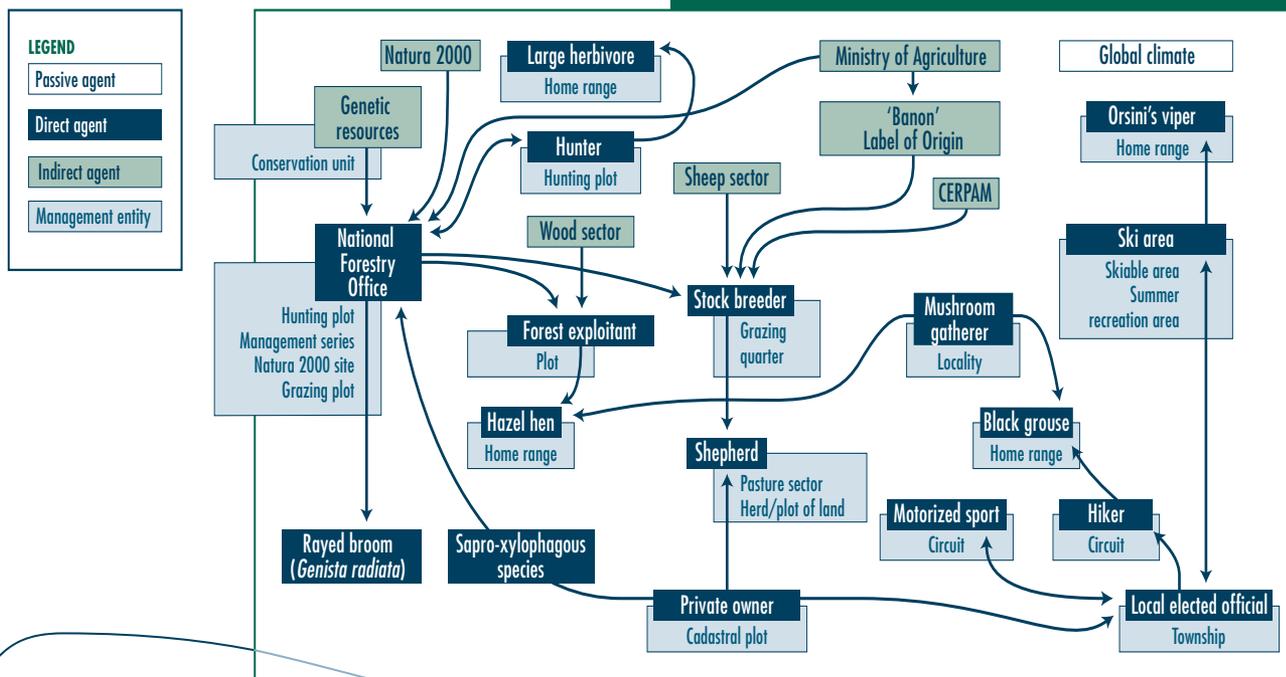


Fig. 1: Architecture of a multi-agent system (based on Ferber, 1995)

- The diagram of stakeholders and management entities (Fig. 2) makes it possible to list all the stakeholders who play a key role in the biosphere reserve, and to distinguish direct stakeholders (whose practices have a direct impact on the dynamics of certain resources) from indirect stakeholders (whose actions will encourage the direct stakeholders to change their practices). Each direct stakeholder is associated with one or more management entities that may be spatial (a plot of forest, a grazing area), or not (a herd). Predominant external variables such as

Fig. 2: Diagram of stakeholders (in this example, Ventoux Biosphere Reserve)



climate variations are also indicated. Lastly, arrows are used to show the main interactions between the various stakeholders represented in the diagram.

- The diagram of resources (Fig. 3) shows the main types of resources used, which are often divided into five major categories (construction, water, stone, plant, animal).
- The diagram of ecological dynamics (Fig. 4) shows the successive states that vegetation may go through and the factors triggering the change from one state to another, as well as the time required for this transition to take place. It makes a clear distinction between dynamics linked to anthropic actions and natural dynamics (when usage is abandoned). When

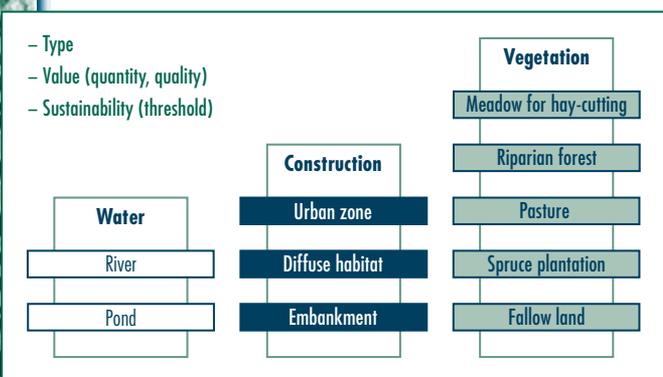
issues related to fauna are clearly shown, there are as many diagrams of population dynamics as there are issues.

- Lastly, the diagram of interactions (Fig. 5) summarizes the previous diagrams by highlighting the relations between users and resources. The arrows symbolize the interactions between stakeholders and resources or interactions among stakeholders about resources. They are associated with verbs that specify the type of action that results in interaction and the indicators that correspond to information used by the stakeholders in making decisions. This phase is often the most informative and the most interesting in the modelling process.

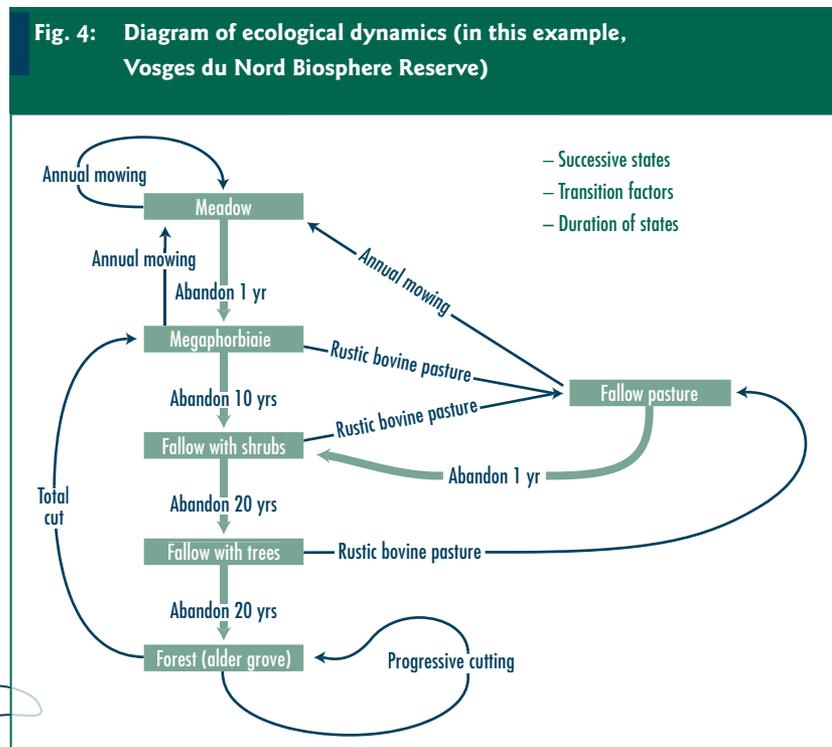
Once the ecological process, the territory and the main management entities have been properly represented and 'implemented' in the computer model, it is possible to use the resulting companion tool in two ways. If the objective is mediation<sup>2</sup>, it is preferable for the modelling of how user interactions function to be easily accessible, in order to facilitate the rapid sharing of representations of one or more processes at work in land use planning, while leaving the participants free to invent an action or negotiation strategy (d'Aquino et al., 2001). The mediator will then organize the simulation by having them take part in a role-playing game that reproduces the context of the territory subject to land management (Bousquet et al., 2002). If the objective is conciliation, it is preferable to represent the interactions between stakeholders and resources as accurately as possible

and to facilitate the visualization of the impact of such interactions, based on a range of viewpoints that is as broad as possible. The conciliator will then suggest that they react to a series of simulations developed on the basis of their individual opinions and encourage them to use the multi-agent model to build and compare alternative scenarios, drawn up and assessed collectively.

In the role-playing game, in order to build local stakeholders' awareness of natural dynamics, both current and future, participants are subject to rules of vegetation dynamics that are simple but precise enough to accurately take into account the impact of management methods. They are also obliged to spatialize their activities and devote a specific amount of time to discussion and exchange about

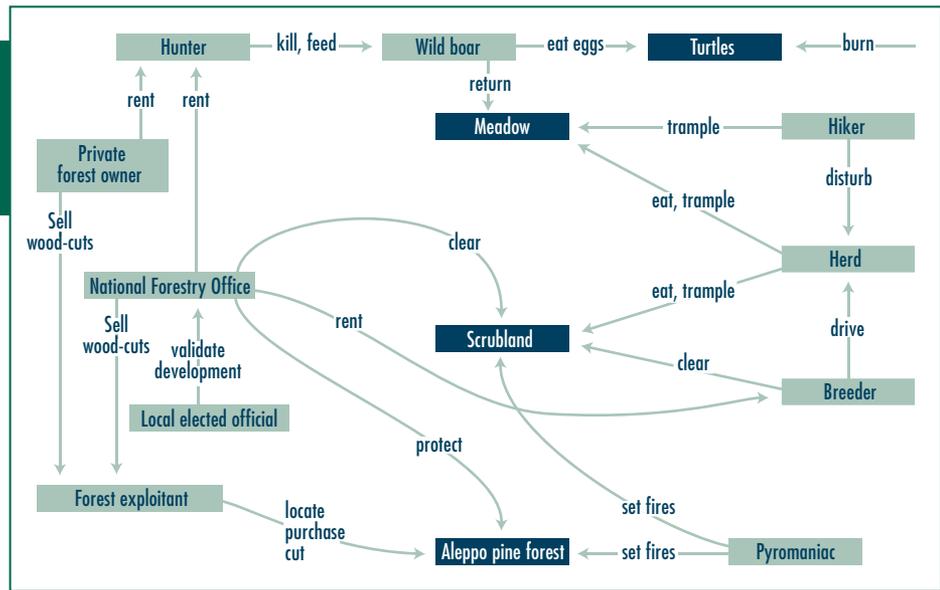


**Fig. 3: Diagram of resources**  
(in this example, Vosges du Nord Biosphere Reserve)



**Fig. 4: Diagram of ecological dynamics**  
(in this example, Vosges du Nord Biosphere Reserve)

**Fig. 5: Diagram of interactions (in this example, Luberon Biosphere Reserve)**



both similar and antagonistic roles (multiple negotiation). Lastly, they are projected into the future using role-playing. The model for this simulates landscape dynamics resulting from actions that are chosen individually or collectively by the stakeholders.

During simulations, participants can visualize landscape dynamics, action dynamics or production dynamics, using animated maps or dynamic graphs. These viewpoints translate what each person is used to seeing or wants to see on the territory he or she manages or administers, or where they have a regular activity. This enables an individual to understand what the other person sees, and measure the impact of each one's own practices on indicators he or she is not used to employing.

## Applications

### Becoming aware of interactions

This aspect is part of the approach currently applied in France within the framework of the periodic review of biosphere reserves, or to support preparatory considerations for the creation of a new biosphere reserve. The main initiators in the creation or periodic review project are invited to take part in the exercise over four or five half-day sessions. The first day is devoted to discussion among the participants about the components that make up the biosphere reserve (stakeholders, resources) and the main natural dynamics at play, giving each person an opportunity to express his or her opinion. The purpose is to create a shared vision of the future biosphere reserve territory, to stimulate the creativity of participants and to reveal potential usage conflicts. Particular effort is focused on clarifying the terms that are used, defining described entities, and establishing the concerned time step.

2. In negotiation, two stakeholders try to come to an agreement directly. In the event they wish to involve a third party, conciliation consists of the third party suggesting solutions, while mediation involves helping the stakeholders reach an agreement, without suggesting solutions.

The second day is devoted to identifying the major biosphere reserve issues and drawing up interaction diagrams concerning these issues. This phase requires participants to describe the actions that have a decisive impact on territorial dynamics or make it possible to strengthen a particular social link. If there are not too many issues and participants, it may be carried out collectively; otherwise it is preferable to divide the participants into groups of five or six people and, at the end of the session, to discuss and compare the diagrams created by each group.

The last half-day addresses the scales of time and space that are relevant for the representation of the management entities used by the selected stakeholders. For each of the stakeholders, it is necessary to specify the scope of his or her activity (number of stakeholders and portion of the concerned territory), its economic, social and ecological impact, and the current state of knowledge. This leads to an attempt to spatialize the issues on those parts of the territory where all stakeholders identified in the interaction diagrams are present, and where it is possible to make biodiversity conservation compatible with the sustainable development of economic activities. This involves quantifying the main activities that have an influence on the territorial dynamics and qualifying the ecological, economic, social and cultural viability of the current development model on this territory.

The exercise then combines these various components to facilitate the identification of research, education and continuous monitoring needs, as well as to identify the local stakeholders who should be involved, and for which interfaces it is necessary to consider them. These elements then enable the collective definition of the biosphere reserve project or the periodic review of

the biosphere reserve file, and consideration of the types of policies that will ensure sustainable development of the territory (Fig. 6).

### Addressing use conflicts

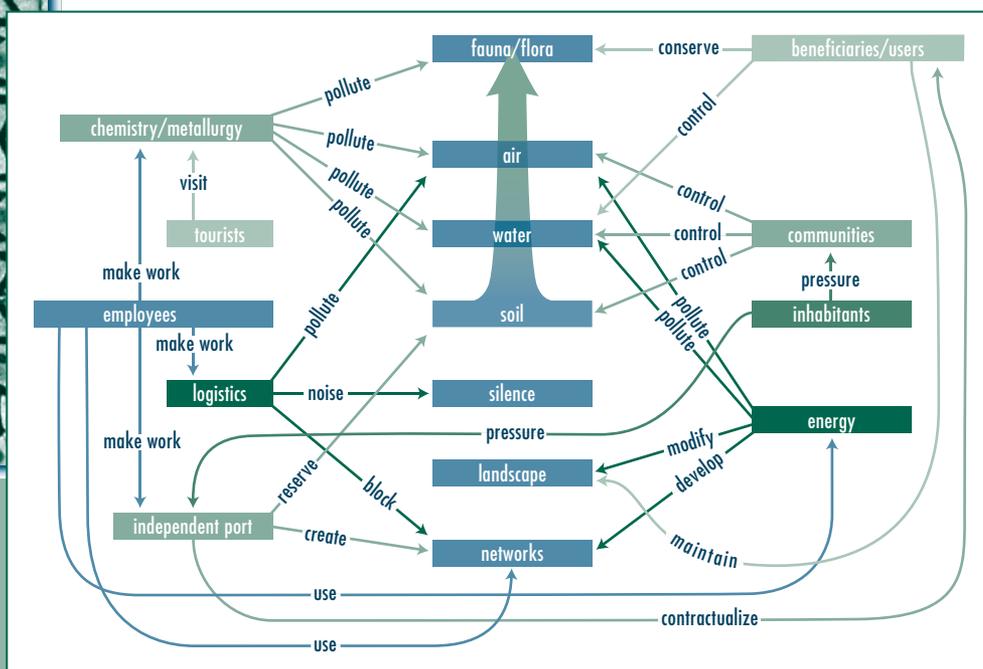
This aspect was addressed during a workshop in May 2003 in Benin focusing on six West African biosphere reserves<sup>3</sup>. The first part of the workshop allowed participants to consider the different elements that make up a biosphere reserve (stakeholders, resources) and the main dynamics at play (ecological and social). The participants were divided into three homogenous groups according to their professional status (MAB National Committees, reserve managers, local representatives) and including a representative from each country (Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal). In order to ensure that all participants would have the same level of understanding about the territory under discussion, the groups tried to outline the functioning of a fictional biosphere reserve deliberately located in a country that was 'exotic' to them (Chile), with the goal of protecting ecosystems that were, however, similar to their own (savannas and dry forests, herbivores and wild cats) in a rural context modelled by agricultural activi-

ties that are common in their home country (breeding, hunting, gathering firewood).

This exercise took two days. The first day was spent collecting and organizing the information that the three groups considered essential, while during the second day participants worked together to sketch out a functional diagram of the biosphere reserve and a proposal for zonation and actions aiming to reduce potential sources of conflict. During the first day, each group answered the four questions outlined at the beginning of the paper, based on the same core information: a general presentation (written) of the context of the virtual biosphere reserve, illustrations (photos and block diagrams), and additional information to be consulted upon request, provided by two resource persons trained beforehand by the workshop trainers.

The comparison and collective discussion of each group's proposals revealed that the choices concerning the representations of methods, viewpoints, and ranking of objectives differed greatly according to each group's origins. Figure 7 summarizes the main points highlighted by each group concerning the principal resources, main stakeholders, decisive ecological processes and human activities that could threaten these processes. A comparative analysis of each group's proposals showed that perceptions are expressed on different scales, in terms of both stakeholders and resources, with highly contrasted hierarchical criteria.

Next, by sharing the representations it was possible to draw up a list including all the stakeholders concerned by the biosphere reserve, the resources, and the ways they were used. This step revealed the importance of reaching an agreement about the definition of terms and the functions attributed to these words during collective debate. The collective construction (imposed by giving the floor to each individual three times maximum) of interaction diagrams among these



**Fig. 6 : Diagram of the interactions around the industrial zone/natural zone interface (example of the periodic review of Camargue Biosphere Reserve)**

3. UNESCO. 2003. UNESCO-MAB/UNEP-GEF regional project. Final Report. Training Workshop on dialogue and concertation in Six Biosphere Reserves in West Africa. 11-17 May 2003. Pendjari Biosphere Reserve, Benin. – 13 pp + appendices.

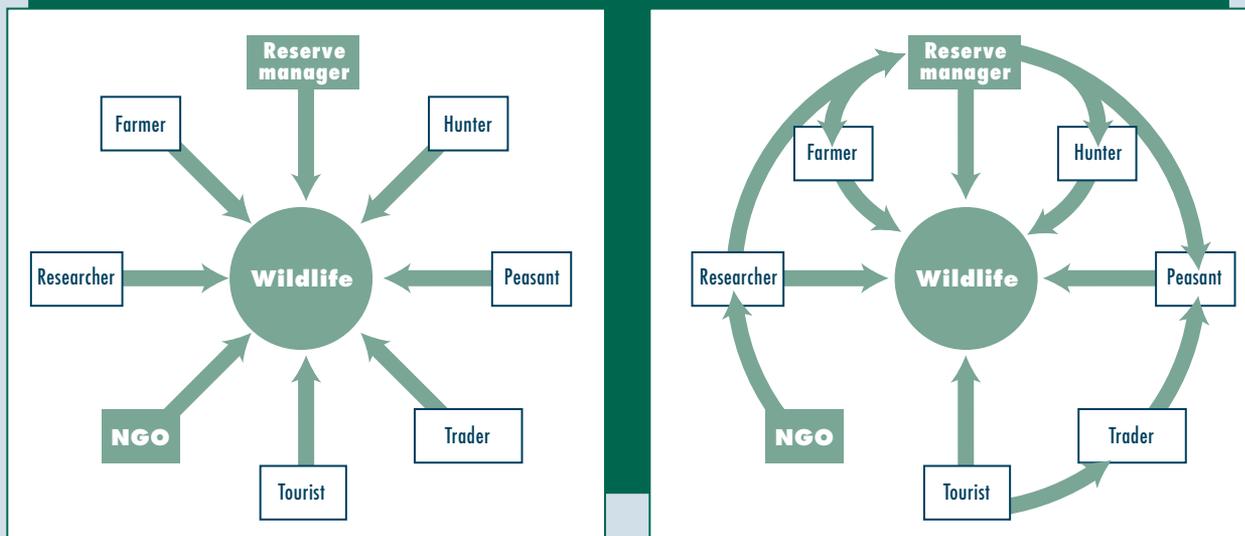
stakeholders and the main resources then made it possible to identify the primary potential sources of stakeholder conflicts. Comparing the diagrams in fact made it possible to determine either those that have the greatest impact on the area or those that have the highest probability of conflict.

The group focused more closely on three of these by attempting to agree about the ways the stakeholders should act with respect to the type of resource, based on three aspects of their behaviour. Participants were asked to name a verb that expressed the action accomplished, a word to explain the goal they were aiming for, and a value to quantify the satisfaction rate for the objective. This exercise illustrated the direct and indirect pressure on resources and the actions associated with survival or pleasure, or the location of interactions where conflicts may appear. It also gave participants an opportunity to measure the difficulty of establishing objective criteria to determine rules of management that guarantee the sustainable conservation of resources. Discussion of the indicators required for the implementation and enforce-

ment of such regulations revealed that a great deal of knowledge and monitoring are necessary to create and manage a biosphere reserve.

The example below (Fig. 7) concerning the resource 'wildlife' clearly shows the direct action of those who hunt or observe and the indirect action of those who sell the gains of the hunt. It also provides a clear illustration of the differing perceptions of those who see wildlife as the heritage of future generations (NGO, reserve manager), a source of pleasure (tourist, farmer, hunter), a source of food (hunter, peasant), and a source of profit (trader, peasant, reserve manager).

**Fig. 7: Wildlife resource.** Figure on the left is the result of the exercise. Figure on the right is the version as corrected after discussion on direct and indirect stakeholders



	Objective	Action	Criterion
<b>Trader</b>	Trade	Sell trophy, skins	Positive supply
<b>Farmer</b>	Trophy	Hunt	Handsome trophy
<b>Peasant</b>	Income + food	Hunt	Meeting needs
<b>Hunter</b>	Meat + trophy	Hunt	Pleasure
<b>Reserve manager</b>	Conservation	Enforce the law	Population density
<b>Tourist</b>	Pleasure	Observe	Maximum n° of species
<b>Researcher</b>	Knowledge	Observe	Sample size
<b>NGO</b>	Conservation	Provide funding	



The following example (Fig. 8) concerning the resource 'grazing areas' made it possible to include the spatial dimension as a potential source of conflict. In addition, it enabled participants to realize that wild herbivores can legitimately be considered 'predators' of fodder resources. It also revealed two ways to resolve potential conflicts between domestic and wild herbivores. Regulations can be used by the reserve manager to reduce access rights to grazing areas for peasants, in order to encourage wild herbivores to feed there. Negotiations can be used by the reserve manager to ask researchers to find ways to render 'double' use compatible, so that both domestic and wild herbivores could graze in the area. The results of this research would be communicated to breeders through the agricultural education services.

### **Encouraging exchange among researchers and reserve managers**

This aspect was developed within the scope of a research-development project funded by the French Institute for Biodiversity (IFB) following a call for tender entitled 'Biodiversity dynamics and means of access to habitats and resources'. The project objective was to test the application of the companion modelling approach to facilitate exchanges between scientists and reserve managers on an issue of common interest. The main question they addressed had to do with the interaction between closing open habitats and the development of new social expectations concerning the environmental value of these habitats. The question was submitted to researchers from different backgrounds in the humanities and social sciences (geography, sociology, ethnology, economics) and natural sciences (ecology, biology, genetics) in four biosphere reserves in France that were selected for their contrasted ecological and socio-economic conditions.

All these biosphere reserves have undergone similar experiences in terms of the utilization of the surface they cover: intense use during the 19th century, widespread abandon between the two world wars, decline of traditional breeding systems, appearance of the 'biodiversity conservation' issue in the 1980s, development over the last 50 years of woody plant species, causing profound modifications to biodiversity (genetic, specific, and landscape), and, lastly, the arrival of new categories of inhabitants. These points in common concerning the history of society–nature interactions and questions about shrub encroachment and its impact on biodiversity are nonetheless part of very diverse social and ecological contexts:

- In the Mer d'Iroise Biosphere Reserve, created in 1988, an oceanic island is subject to widespread proliferation of scrub and overgrowth. It is home to

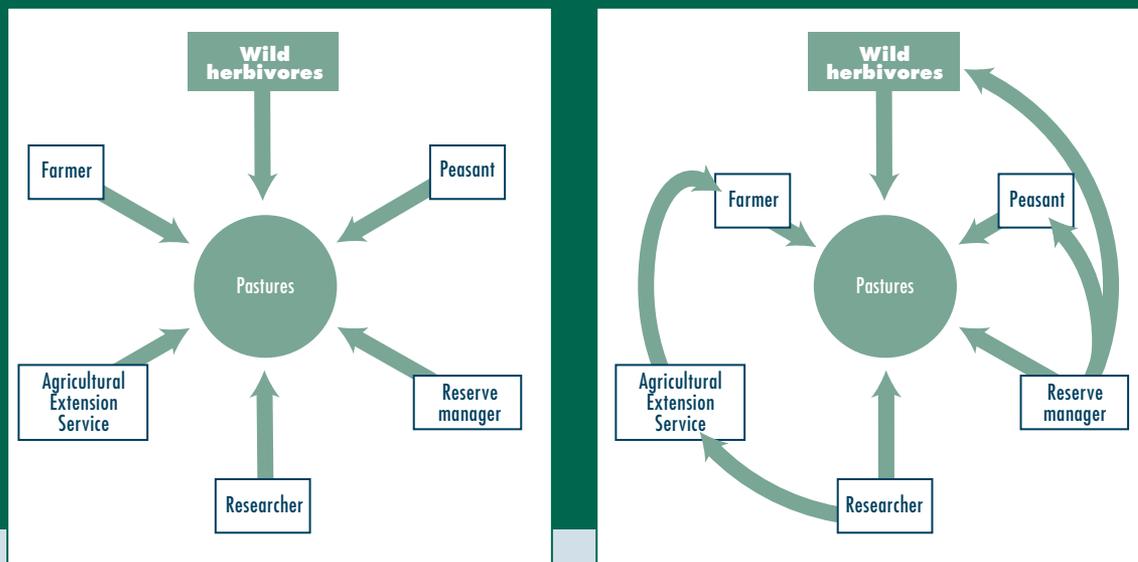
an original population of red-billed choughs that are very sensitive to the development of tourism activities.

- Vosges du Nord, a biosphere reserve created in 1989, is an immense forest interspersed with narrow, grassy valleys with original wetland meadows where the disappearance of traditional management through hay-cutting has created a threat to the diversity of flora and fauna.
- Mont Ventoux, a biosphere reserve created in 1990, is a mountain in the midst of scrubland. Home to exceptional flora and fauna, it is undergoing a spectacular expansion of cedar and pine forests with an impact on the genetic quality of populations settling here.
- In the Luberon, a biosphere reserve created in 1997, scrubland is shrinking, giving way to forests of cedar and Aleppo pine trees, thereby reducing the mosaic of Mediterranean landscapes and increasing the risk of fires.

This was an original approach because it focused on formalizing the interactions between natural dynamics and social dynamics, and collectively comparing the visions of researchers and reserve managers concerning natural resources and their dynamics, based on their own objectives and specific criteria. This co-construction approach, between researchers and reserve managers, successively addressed the four questions mentioned at the beginning of this contribution, which form the basis of the conceptual model.

The conceptual model implementation phase then forced the reserve managers to explicate the rules underlying decisions made by the main stakeholders concerned by the management of renewable natural resources. They had to specify the spatial entities on which such decisions were based, and the time step for updating the indicators at the source of decisions. The formalization of these management rules using a multi-agent model greatly facilitated the comparison of the time step of the natural systems under study and the economic and social rhythms of the users of such systems. It will now make it possible to simulate scenarios for the management of these systems and to evaluate their impact on biodiversity on several scales (genetic, species, and landscape). The utilization of the model as an intermediary object during role-playing sessions scheduled with local stakeholders in 2006 should help measure the social acceptance level of the proposed scenarios and develop new options for the control of access to resources.

Fig. 8: Pastures resource



### Discussion and prospects

With companion modelling, the model plays the role of a friendly and dynamic intermediary model. It is both a tool for sharing representations and a tool for scenario evaluations. The fact that it is the outcome of co-construction between researchers and reserve managers guarantees the ready appropriation of its content, direct validation of the representations it contains, and the clear identification of the limits of utilization. Insofar as it helps individuals understand others' viewpoints, it ensures good visibility of the role of each modelled agent, and stimulates the synergy between practical knowledge and technical expertise, between the layperson's know-how and the scientist's understanding.

Implementation, however, requires a large body of available knowledge in many different disciplines and, very often, the use of a computer platform. The success of this approach also depends to a large extent on the aptitudes of one or more leaders who will participate, one after another, in the conception-validation-utilization process, and on their ability to prove their legitimacy and guarantee their independence. The phase during which decisions are made about choice of partners, venue for sessions, and methods of invitation is, in particular, a very difficult exercise because the representativeness of the participants, and thus the agents who will play a key role in the model, depends on this phase.

According to the experience gained thus far, although the innovative aspect is relatively destabilizing for the participants, it is especially appreciated and is often mentioned as a critical feature of the approach. This exercise involves building something from nothing.

Comparing the knowledge of stakeholders from different backgrounds, in addition to the careful argumentation imposed by this approach, ensures that the final outcome is fully pertinent and legitimate. The primary obstacle remains the often necessary reliance on computers, and what this implies in terms of dependency on specialized computer technicians. Yet it is truly possible to stimulate a collective discussion on the management of natural resources without being able to accurately represent the underlying dynamic processes?

Another aspect often mentioned as a handicap in feedback about ongoing experiments concerns the approach being complicated and time-consuming to implement. If one measures these aspects on a standard application that includes the co-construction of the model, development of the model, design of a role-playing game, utilization of the role-playing game and comparison of scenarios, it indeed takes one to two years, depending on the complexity of the issue being addressed and the scope of the territory in question. And during these one to two years, it must be possible to mobilize a number of stakeholders simultaneously, in working sessions that often last all day. This is the price to pay, but it is likely that such an investment is well worth it when one considers the time saved subsequently, during implementation of development or land management projects that result from this approach.

The companion modelling approach may be mobilized at three points in the life of a biosphere reserve: when it is created, as an educational tool to build awareness of the processes at play (landscape dynamics, biodiversity, awareness about fires); during periods of usage

conflicts, as a tool for mediation between partners (role-playing); and lastly, during periodic review as a decision-making tool for the implementation of concerted land management.

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# Co-construction in six West African biosphere reserves: in search of interaction indicators for biodiversity management



## Sustainable development, interaction indicators, and biosphere reserves

Agenda 21, adopted during the 1992 Earth Summit in Rio de Janeiro, set out the objectives to attain sustainable development, and divided them into 40 chapters. The 40th and final chapter calls for the harmonization of efforts to allow the construction of sustainable development indicators: 'Methods for assessing interactions between different sectoral environmental, demographic, social, and developmental parameters are not sufficiently developed or applied. Indicators of sustainable development need to be developed to provide solid bases for decision-making at all levels and to contribute to a self-regulating sustainability of integrated environment and development systems'. (Commission on Sustainable Development, 1992, 40.4).

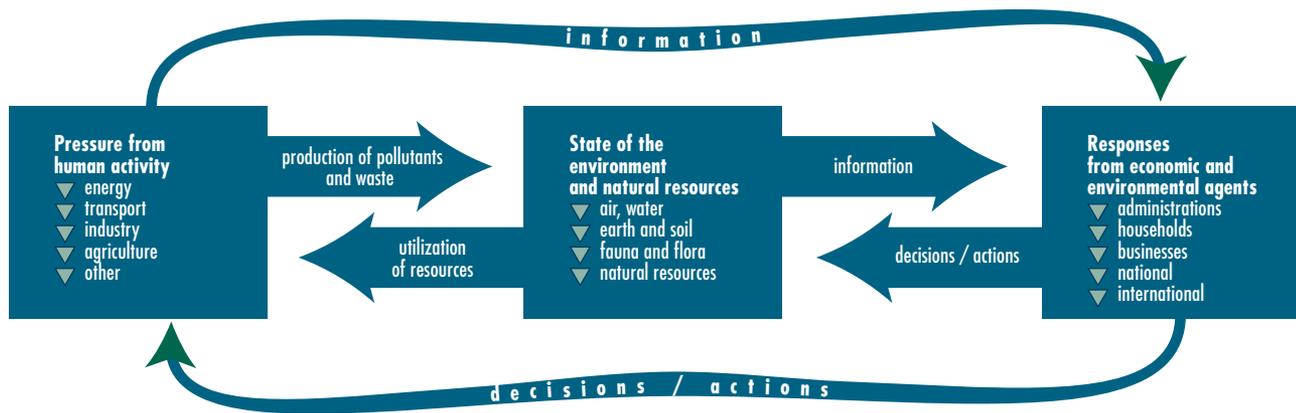
Working on the interactions between people and biodiversity is one of the approaches adopted by UNESCO's intergovernmental MAB Programme, relying in particular on biosphere reserves – sites where it is possible to test the relevance of indicators regarding interactions between social and ecological parameters.

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offset the negative effects of such pressure. They were the model for the driving forces-pressure-state-impact-response indicators of the European Environment Agency (EEA, 2003), the driving forces-state-response indicators of the Commission on Sustainable Development (CSD, 2001), and the pressure-state-use-response-capacity indicators of the Convention on Biological Diversity (CBD, 2003).

Within the framework of a regional programme<sup>1</sup> aiming to better understand the dynamic interactions between stakeholders and resources, new methodological approaches – based on mediation and local know-how – were tested.

Fig. 1 : PSR indicators (OECD, 2001)



There are several types of interaction indicators. The Pressure-State-Response (PSR) indicators set up in the 1990s (OECD, 1994) are the most widely used. They allow an assessment of the pressure that human activities exert on the state of the environment and the identification of the social responses that will make it possible to

1. UNESCO-MAB/UNEP (United Nations Environment Programme) - GEF (Global Environment Fund) Regional Project on 'Building scientific and technical capacity for effective management and sustainable use of biodiversity in dryland biosphere reserves of West Africa'. This research programme involves six biosphere reserves in West Africa: Pendjari in Benin, Mare aux Hippopotames in Burkina Faso, Comoé in Côte d'Ivoire, Boucle du Baoulé in Mali, the 'W' Reserve in Niger, and Niokolo Koba in Senegal.

## Co-construction of interaction indicators

### Interactions

In biology, interaction is a concept that designates the process by which two or more factors are mutually determined by a reciprocal relationship. In the social sciences, interaction refers to the actions of individuals who adapt their behaviours in response to others in a given situation (Letonturier, 2004, p.540). Interaction may be direct or indirect. An example of direct interaction is the prey-predator relationship between two populations, A and B. An example of indirect interaction is the relationship of competition between population A and population B with regard to resource C, on which both are dependent.

### Interaction indicators

An indicator is a plural object that may be defined according to its function, the tool it represents, and/or the method of construction used to develop it:

- **The functional aspect:** the function of an indicator is to provide succinct information about a given phenomenon so that it is possible to communicate, understand, or take decisions about this phenomenon.
- **The instrumental aspect:** an indicator is an instrument composed of a synthesizing mechanism – aggregation, mean value, weighting ... – making it possible to summarize a vast amount of information, and an interface – index, map, colour, ... – allowing the release of signals containing the summarized information. In order to be effective, the indicator's form must be adapted to its function, as is true of any tool. The form must, moreover, be adapted to the capacities and representations of potential users so that the synthesized information contained in the signal may be easily extracted.
- **The constructivist aspect:** an indicator is a tool made by using a method that entails a social division of labor – data collectors, specialists, statisticians ... – and a decision-making process – negotiation, mediation, concertation, validation ... It is the combination of these two components that leads to the adoption of conventions concerning the indicator – unit of measure, spatial scale of reference, synthesizing mechanism. Such conventions are both partial and biased; they may, nevertheless, appear as legitimate if the method is in line with the functions that are expected of the resulting indicator.

The interaction indicators therefore represent socially constructed tools whose purpose is to provide concise information about the way in which various phenomena have a reciprocal influence on one another, with the aim of communicating or taking decisions about such co-evolutions.

### Interaction indicators: for whom and for what reasons?

The goal of the approach recommended here is to facilitate concertation among stakeholders regarding biodiversity. This means giving stakeholders the opportunity to coordinate their representations, interests, and opinions – which may be conflicting – so they can work together toward development and conservation objectives and on the methods and tools used to reach such objectives.

This methodology implies that interaction indicators are intended for all those concerned by the biosphere reserves – reserve managers, local populations, scientists – and should facilitate better communication among stakeholders when it comes to resources, while also strengthening their technical and scientific capabilities through better access to information.

### Methodological assumptions adapted to established objectives: how and by whom?

To define the theoretical and ethical foundations underlying the construction process, a list of preliminary assumptions was drawn up.

The first assumption concerns the existence of a symmetry of ignorance (Arias and Fischer, 2000). None of the stakeholders – as individuals or a group – has enough knowledge to solve a problem or address an issue that is collective in nature. Knowledge is dispersed: in relationships, practices, institutions, expertise, and memory. In this context, the knowledge of scientists is complementary to the know-how of lay-persons. Moreover, the various stakeholders concerned by a common problem have different bases of legitimacy.

According to the second assumption, it is necessary to set up a protocol to facilitate the 'opening up' of information as well as the involvement of all stakeholders, so that as many people as possible may benefit from dispersed knowledge and experience, thereby ensuring a degree of equality in access to information (Dietz et al., 2003). Sharing such information must provide a base from which it will be possible to create a common language to begin discussion and exchange opinions. This implies abandoning 'expert methods' in favour of an approach that could be described as 'technical democracy', which implies broad participation by local players in the

indicator construction process (Callon and Lascoumes, 2002). Such an approach requires adopting two elementary principles: participants must have equal weight during exchanges, and no matter what happens, the approach must remain voluntary (Dietz et al., 2003).

The third assumption is that the process must enjoy a certain ‘external’ aspect – or neutrality – in the eyes of participants, so that it appears fair. This ‘coming from outside’ quality may be ensured by one or more mediators, who have been recognized as legitimate by all parties, and whose objective will be to elicit a structure for concertation (Weber, 1996).

In light of these factors, an interaction indicator co-construction process was suggested. It was based on an extended social division of labour including representatives of local populations, biosphere reserve managers, scientists with backgrounds in the natural and social sciences, and a mediation-based process for taking decisions.

### Protocol: a co-construction process

The concept of co-construction responds to that of co-management, which implies sharing knowledge and power. It refers to the methods of companion modelling (Étienne et al., 2005; see also this work).

The co-construction process is coordinated in each of the project’s West African countries by an ‘interaction indicator’ focal point with experience in the field of indicators. For each biosphere reserve, the work of co-construction is carried out in two phases, over two weeks<sup>2</sup>.

**The first phase** lasts one week and consists of approaching representatives of local communities. Meetings take place with professional groups, interest groups, villages, and individual representatives. The goal is to establish a first contact, present the objectives of the programme, and begin discussions. Discussions focus on issues relating to biodiversity access and use – in particular, the identification of resources for stakeholders, the diminution of certain resources, conflicts over access or use, local communities’ relations with biosphere reserve personnel, and so forth – in order to better comprehend the institutional and ecological situations in which stakeholders develop and evolve. During such encounters, participants are asked to designate a representative who will act as their spokesperson during a work session to take place the following week. It is clearly understood that these representatives will be required to report back to their home villages and to the groups they represent (hunters, fishers, stock breeders, etc.). Such reporting

2. Note that what we refer to as the ‘co-construction process’ represents only the first phase of a project on interaction indicators that takes place over a period of two years.

will be monitored by the indicator focal point in each country. In addition, reserve managers keep the representatives informed of developments in the programme after this first phase of work has been completed.

The choice of stakeholders and groups to be met with is based on several criteria. Those involved should be:

- representative of the activities taking place in the biosphere reserve;
- representative of the villages located in the biosphere reserve (for most of them, in the transition areas);
- representative of low-status groups.

Organized encounters also depend on subjective factors, such as geographical limitations and time constraints, networks of focal point relations or park manager relations, and, at times, pure chance.

This first phase of work makes it possible to identify several potential mediators to carry out the co-construction process. They are selected based on their legitimacy in the eyes of local populations as well as reserve managers, but also taking into account the institution they come from and their local mediation experience. One of the objectives is to have two leaders who do not belong to the same institutions, to ensure a degree of self-control.

**Phase Two**, which lasts three to four days, addresses the co-construction of indicators. It consists of bringing together the representatives of local stakeholders, i.e., from ten to fifteen people, including two scientists who are familiar with the area under study – one from the social sciences and the other from the natural sciences; one or two reserve managers; and the two local mediators.

The co-construction process consists of a certain number of rules that will make it possible to organize the work of producing indicators. The objective is to respect diverse perceptions and viewpoints while seeking to create a common language that aims to coordinate these viewpoints.



The scientists' main role is to help participants when they need specific information, in particular in the event of disagreement or to verify a particular point. Their role is also to organize the information that is provided. They must not, however, intervene directly in the negotiation processes or during collective choices.

The mediators' primary role is to record the discussion results in a chart, to generate a climate of trust, and offset power struggles during the negotiation processes. They must also act as translators, since participants do not all speak the same local language. Discussions are facilitated by the use of mediation tools – diagrams, maps of the reserve, icons, figurines, arrows – that make it possible, little by little, to illustrate the results of discussions (see Figure 2 on Niokolo Koba Biosphere Reserve, Senegal).

The co-construction method must be simple and pragmatic. There is no point in talking about 'indicators' or 'biodiversity', concepts that have no real concrete meaning for participants. Instead, discussion should focus on 'resources', 'relationships', 'signs' and 'practices'. Work is organized in steps, based on simple questions inspired by the work conducted in the Pendjari Biosphere Reserve in May 2003<sup>3</sup>:

- ▼ **Which stakeholders utilize the reserve's natural resources to meet their needs?**
- ▼ **Which are the six main stakeholders on the list?**
- ▼ **What are the reserve's resources for each of these stakeholders?**
- ▼ **What relationships exist among these resources?**
- ▼ **How do the stakeholders procure, collect, and/or make use of these resources?**
- ▼ **What do they do with these resources? And with whom?**
- ▼ **What relationships exist among these stakeholders regarding the reserve's resources?**
- ▼ **On the basis of what information, criteria, and constraints do the stakeholders make decisions concerning their activities?<sup>4</sup>**
- ▼ **What signs reveal that resources are more abundant or more scarce in the reserve?**

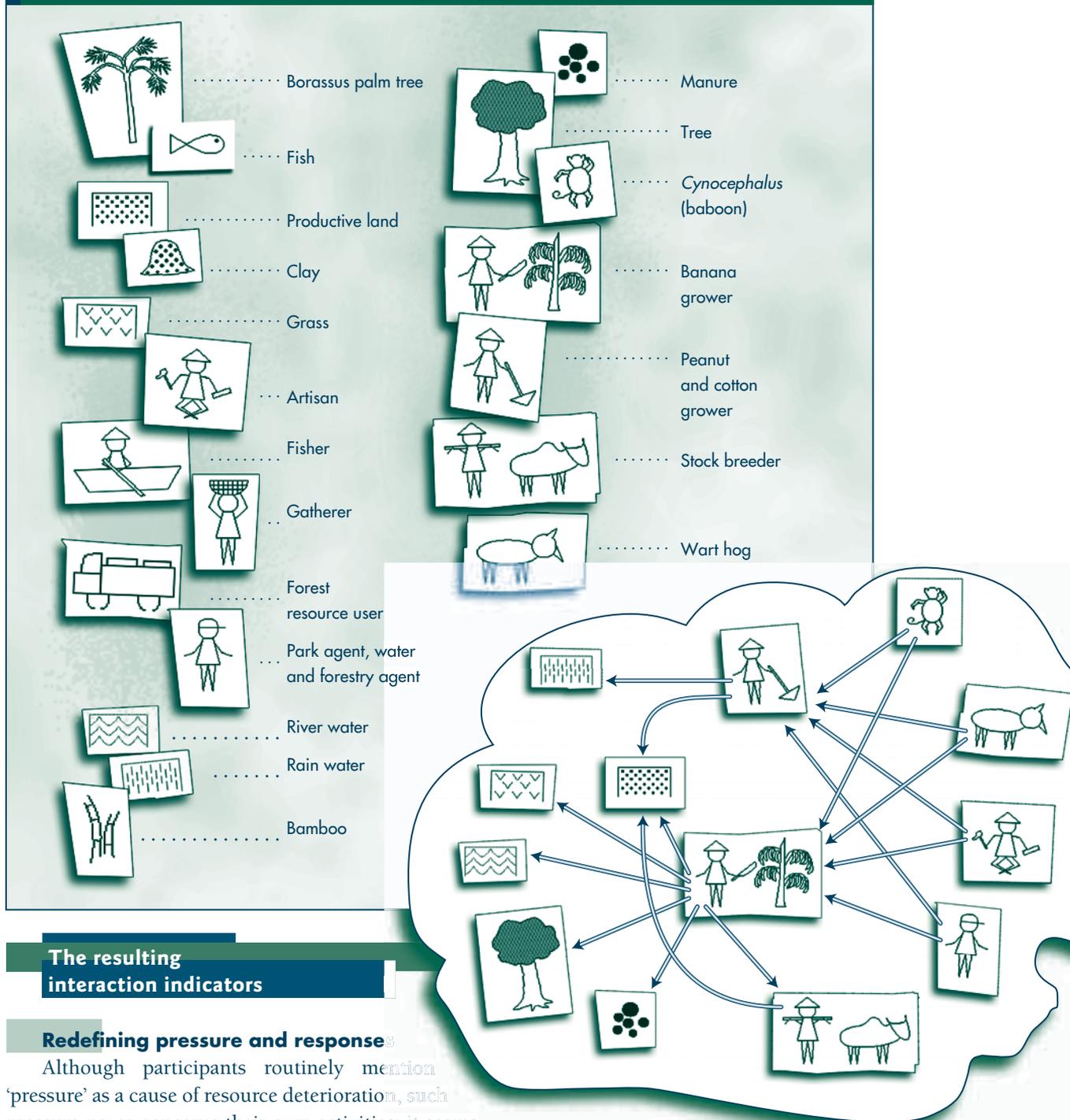
These questions are designed to launch and stimulate discussion about the use of biodiversity and related information. To address these issues, the participants break into two working groups. The leaders monitor the groups to ensure that everyone is participating and that the issues have been fully grasped.

A collective reporting session takes place for participants to exchange their viewpoints and negotiate in the event of disagreement about the choice of stakeholders, resources or interactions. Discussions continue until the participants reach consensus. If consensus is not possible, the mediators take into account the different perceptions for the next step. The mediators take part in the discussions in order to organize the debate and underline possible redistribution of the groups – in order to limit the number of parameters to be taken into account – to avoid the utilization of terms that have no concrete meaning or to identify inconsistencies in the descriptions. They regulate how much time each participant takes the floor to ensure that each one can express his or her opinion about the topics under discussion. The co-construction process requires 'quality' mediators who are able to calm struggles in the balance of power that occur during dialogue and concertation.

Once the group has decided on the stakeholders, resources and interactions, the mediators summarize the results and list them on a chart. This allows a gradual description of the system of stakeholder-biodiversity interactions and offers an overall view of results. It is interesting to note that questions about social and ecological interactions often arise without the mediators needing to bring them up. When the participants describe their use practices or criteria for action, they spontaneously mention the stakeholders with whom they come into contact to reach their objectives or carry out their activities. Similarly, speaking about signs of evolving resources always prompts participants to talk about the interactions existing among the various resources.

Simulations are then begun, based on scenarios proposed by the participants in order to make the indicators more dynamic, or more 'lively'. Three types of tools are used for this: interaction matrices, diagrams composed of icons, and arrows accompanied by geographic maps and role-playing. Such simulations make it possible for the indicators corresponding to the participants' descriptions to co-evolve. Thus it is possible to test the coherence of interactions, to identify elements that may have been overlooked, to define the appropriate time step,<sup>5</sup> and to fine-tune the interaction parameters.

Fig. 2: Example of mediation tools used in Niokolo Koba Biosphere Reserve (Senegal)



### The resulting interaction indicators

#### Redefining pressure and response

Although participants routinely mention 'pressure' as a cause of resource deterioration, such pressure never concerns their own activities; it seems to be caused only by 'other users' of resources. Users of the reserve often have a simplified view of the activities they do not carry out themselves, and which they consider to be a source of pressure, but they refuse the idea that their activities might be considered in the same light. When discussing uses and criteria for decisions, the participants seek to show the diversity of the practices and techniques connected to their activities, or to justify this or that use. This step in co-construction in fact gives them an opportunity to explain to the other participants – and to the reserve managers in particular – what they

3. These questions represent a base that the mediators worked from, according to language, context, how the project evolved, and the participants' interest. The order in which issues were addressed, the form they took, and the level of detail varied from one site to another.
4. This rather broad formulation aims to identify what we call 'criteria for action'. They represent the factors that give structure to individual actions. These parameters may be connected to information, institutions, social interactions, needs...
5. The time step concerns the way in which one looks at the system's evolution. An adequate time step thus corresponds to the most significant time scales to understand how the system under study evolves: season, year, day, or even the period of transhumance represent examples of time steps that may appear adequate for understanding the evolution of stakeholder-biodiversity interactions in the biosphere reserves.



do, why and how, and to show that their activities may not be simply considered as a form of 'pressure'. The purpose of PSR indicators is not to allow participants to understand one another better, but rather to classify activities as 'pressure' and to designate the people who are responsible for exerting this pressure, which can exacerbate tensions and certain conflicts.

Moreover, pressure exerted on the environment is not always anthropogenic –invasive species, for example – *Typha australis* in the Mare aux Hippopotames or *Sida cardifolia* in the 'W' Reserve. Competition for resources, for example, between the growing elephant population and the villages around Pendjari Biosphere Reserve in Benin, causes a great deal of damage to the fields.

The uses of biodiversity may help maintain or renew such biodiversity, thereby offering opportunities to nature. This happens, for example, when people create beehives, which results in an increase in the bee population and enables the pollination of numerous plant species, or when human activities have the effect of limiting an invasive species. In this case, the interaction between humans and their natural habitat is a mutualistic relationship, i.e., one of reciprocal benefits. Such a relationship cannot be incorporated into the PSR framework. And yet it appears just as important to identify the interaction indicators that make it possible to monitor uses representing pressure as those representing opportunities for biodiversity – symbiosis – or those that simply have no substantial impact on biodiversity – commensalism – to imagine genuine possibilities for the reconciliation of development goals and conservation goals. This is why it is more useful to speak in terms of 'forces' than in terms of 'pressure' – since the system can be subject to 'forces' caused by human activity that may be positive or negative.

Traditionally, indicators regarding responses are the percentage of protected surfaces or the existence of parks. In the case of our study, the classic institutional responses therefore already existed.

The representatives of the local populations mentioned responses that are linked to the uncertainty of their situation: professional material that will make it possible to produce more or confer added value to products by transforming them; equipment, such as drills for access to water, or road infrastructures for access to markets. Responses that more specifically concern conflicts were also mentioned: processes of conciliation and clarification of access and use rights; organization of watering point along transhumance routes.

Two opposing trends appeared among the reserve managers. The first group recommended radical solutions, such as killing the entire herd if it is caught inside the central zone of the biosphere reserve, with the hope

of stopping incursions by transhumant stock breeders. The second group, taking a participatory management approach, recommended setting up co-management policies. Both groups emphasized the need for infrastructures, equipment, and training in order to move around, improve communication between control stations, ensure biodiversity monitoring, and better control access to the core areas.

Lastly, the representatives of conservation programmes and participating scientists put forward numerous solutions for the erosion of biodiversity at these sites. Among other ideas: developing ecotourism, the utilization of improved fireplaces to reduce firewood consumption; the use of natural fertilizers to improve production without causing pollution; the use of fodder to relieve pressure on pasture lands.

Responses tended to vary according to the category of stakeholders making the suggestion. While for the local populations, the solutions to biodiversity erosion involve developing production capacities and access to markets, for reserve managers they are rather a matter of monitoring capacity and, depending on the case, the managers' leeway to penalize or to negotiate. Lastly, the conservation programmes seek an intermediate solution that aims to reconcile development objectives and conservation objectives.

The wide range of proposed solutions makes it possible to highlight the political nature of this category of indicators. Response indicators will be useful for reserve managers only if they are linked to indicators giving information about individual and collective response capacities, but also about the effectiveness of these responses. To a large degree, individual response capacities are linked to the population's dependency with regard to biodiversity. Collective response capacities refer to institutional and organizational capacities. This is, in particular, a matter of identifying the indicators that make it possible to assess the local population's capacity to take responsibility for managing the resources on which they depend. Finally, response effectiveness is largely a function of the legitimacy of the process that led to the adoption of responses. These different factors are determined by numerous economic parameters – financial, human, and organizational resources – as well as social parameters – political will upstream, the nature of local social relations, conflicting interests, the status of stakeholders, institutions for access and existing uses – all of which make the identification of response indicators extremely difficult to implement.

Lastly, the ecological and social interactions concerning biodiversity are not taken into account in the PSR model, even though participants consider them to

be very important during the description of interactions. It would thus seem important to develop these categories of interaction indicators.

Based on the above remarks and suggestions, we propose a new conceptual framework as an alternative to the PSR model, which may enable a different organization of interaction indicators for the management of biodiversity (Fig. 3).

### Indicators focusing on the state of biodiversity and use by stakeholders

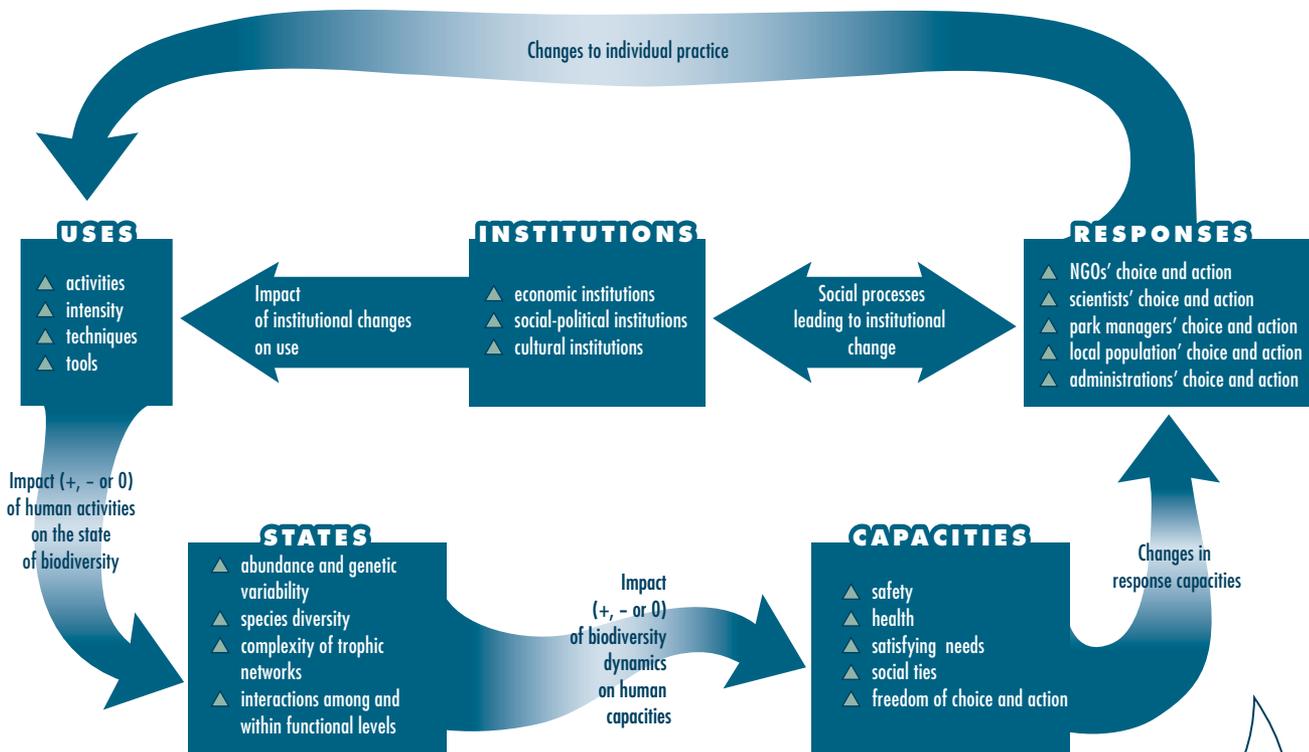
Indicators concerning biodiversity were addressed on the basis of signs of evolving resources perceived by local populations as they carry out their activities. Most of the time, local stakeholders are in fact entirely dependent on the resources surrounding them and keep track of various signs that provide information about any changes to such resources. Therefore, they have specific information about the evolution of a given resource. Some of these signs indicate non-viable use (number of truckloads of wood headed for towns, intensive techniques), while others are indirect signs (such as species

that indicate soil fertility) or direct signs (flight initiation distance, the time it takes for a beehive to fill).

All these signs provide biodiversity monitoring indicators that are both simple and relevant for local populations. For the participants, they translate into negative or positive trends concerning their future and their children's future, and thus relate to sustainability indicators.

Use indicators aim to make the connection between uses and decision-making criteria, including motivations (finding food, warmth), technical limitations (lack of means for more intensive farming, lack of means of transport), ecological limitations (scarcity of certain resources, lack of water), regulatory constraints (boundaries of the natural reserve, size of mesh for netting), incentives (price, demand, risk), conventions (trans-humance routes they have 'always' used), institutions (extensive livestock breeding among the Peuls, sacred forests), rules of behaviour (eating habits), representations (planting banana trees as a source of profit). These are indicators that stakeholders use in a more or less conscious way when making decisions about their activities. These indicators refer to the 'capacities' availa-

Fig. 3 : Alternative schema for interaction indicators



ble to them, and which concern the use of resources, but also possible adaptive responses. These capacities are mainly linked to acting institutions<sup>6</sup> and state of biodiversity (Table 1).

These details provide precious information for those who would like to communicate about biodiversity conservation and prompt a change in uses. In particular, they make it possible to identify the indicators that need to be adjusted or developed in order to observe real changes in system dynamics. These indicators are use-

ful in that they make it possible to better understand how and why stakeholders adopt this or that type of use. They also concern such stakeholders' capacity to adapt. If such capacity is limited (self-consumption, lack of substitution techniques, no alternative resources), it is difficult to change practices without offering new opportunities to the concerned stakeholders. Such indicators make it possible to underline the fact that implementing conservation policies and identifying the corresponding response indicators requires companion policies for local development to be taken into account.

Based on use indicators, synthetic indicators of capacity and sustainability were developed (Table 2).

**Table 1: Indicators of biodiversity and use obtained in the biosphere reserves studied for beekeepers, fishers and hunters<sup>7</sup>**

Stakeholders (resources)	Indication of changing resources	Use indicators	Criteria for decisions
<b>Beekeeper (bees)</b>	<ul style="list-style-type: none"> <li>▼ number of hives</li> <li>▼ size of swarms</li> <li>▼ rainfall</li> <li>▼ speed/ time it takes for the bees to fill the hives with honey</li> <li>▼ change in the number of modern hives / traditional hives</li> </ul>	<ul style="list-style-type: none"> <li>▼ number of beekeepers</li> <li>▼ number of hives observed on trees</li> <li>▼ % of modern hives / traditional hives</li> <li>▼ honey production</li> <li>▼ number of associations of honey producers</li> <li>▼ material available to process and package honey</li> </ul>	<ul style="list-style-type: none"> <li>▼ ease with which a hive can be colonized</li> <li>▼ ease with which a hive can be constructed</li> <li>▼ ease of honey collection</li> <li>▼ cost of the hive</li> <li>▼ desired quality of honey</li> <li>▼ demand for honey</li> <li>▼ price of honey</li> <li>▼ availability of sites that meet requirements for installing a beehive</li> </ul>
<b>Fisher (fish)</b>	<ul style="list-style-type: none"> <li>▼ change in price of fish</li> <li>▼ water abundance</li> <li>▼ rainfall</li> <li>▼ number of fishers on the water</li> <li>▼ changing embankment areas,</li> <li>▼ scarcity of 'flagship' species (sold and consumed)</li> <li>▼ increase or decrease in amount of banned materials</li> </ul>	<ul style="list-style-type: none"> <li>▼ number of fishers</li> <li>▼ number of catches</li> <li>▼ species caught</li> <li>▼ size of fish caught</li> <li>▼ number of dugout canoes on the water</li> <li>▼ number of nets in the water</li> <li>▼ number of inventoried nets, hoop nets, dugout canoes</li> <li>▼ number of fishers' associations</li> </ul>	<ul style="list-style-type: none"> <li>▼ need of fish for food</li> <li>▼ need of fish to pay taxes, pay for ceremonies</li> <li>▼ lack of alternative resources</li> <li>▼ seasons (low /high waters)</li> <li>▼ species sought</li> <li>▼ water currents</li> <li>▼ available material</li> <li>▼ water level</li> <li>▼ park limits</li> <li>▼ fines imposed by foresters</li> <li>▼ prices offered by major traders</li> <li>▼ price of fishing material</li> <li>▼ regulations concerning net / mesh sizes</li> <li>▼ regulations concerning protected species</li> </ul>
<b>Hunter (game)</b>	<ul style="list-style-type: none"> <li>▼ changing meat prices</li> <li>▼ rainfall</li> <li>▼ change in number of domestic animals, appearance of epizootic diseases (especially for buffalo)</li> <li>▼ easy observation of 'flagship' species (hartebeest, cheetah, sassaby, elephant...)</li> <li>▼ animal calls, cries</li> <li>▼ flight initiation distance</li> <li>▼ quantity of traces / prints and recent droppings</li> </ul>	<ul style="list-style-type: none"> <li>▼ number of observed carcasses</li> <li>▼ number of cartridges found</li> <li>▼ number of observed hunting camps</li> <li>▼ number of fines/tickets</li> <li>▼ number of observed hunting systems</li> <li>▼ respect for traditional hunting rules</li> <li>▼ number of poachers observed (by guides in particular) when moving from place to place</li> </ul>	<ul style="list-style-type: none"> <li>▼ need for food</li> <li>▼ abundance of game outside the core area</li> <li>▼ alternative resources</li> <li>▼ limits of the core area</li> <li>▼ eating habits</li> <li>▼ orders from major traders</li> <li>▼ traditional hunting rules</li> <li>▼ price of meat</li> <li>▼ habits</li> <li>▼ available material</li> <li>▼ fines (number and cost)</li> </ul>

6. 'The institution refers to a social state of individuals, to something that represents an authority in relation to their interests or their preferences'. (Corei, 1995, p.7). This may include moral rules, values, conventions, ways of doing things, representations, etc.

7. The other categories of stakeholders the participants wished to focus on during the different co-construction processes included: sedentary stock breeders, transhumant stock breeders, banana growers, peanut farmers, cotton growers, farmers, market gardeners, gatherers of firewood, of fine wood, of timber; artisans, blacksmiths, weavers, potters, women, oil and butter producers, practitioners of traditional medicine, water finders, *Cynocephalus* (baboons), and wart hogs. The number of resources mentioned remained roughly the same.

**Table 2: Synthetic indicators of capacity and sustainability**

Activities	Use indicators	Indicators of sustainability of use	Indicators of capacity for changing use practices
<b>Fishing</b>	<ul style="list-style-type: none"> <li>abundance and diversity of catches / fisher / time of day</li> </ul>	<ul style="list-style-type: none"> <li>number of traditional fishers / number of professional fishers</li> </ul>	<ul style="list-style-type: none"> <li>existence of local access and use rules and their effectiveness</li> <li>resources from fishing / total resources</li> </ul>
<b>Hunting</b>	<ul style="list-style-type: none"> <li>abundance and diversity of catches / hunter / hunt</li> <li>number of signs of poaching (cartridges, hunting camps, flight initiation distance, etc.) per hectare</li> </ul>	<ul style="list-style-type: none"> <li>level of external demand: tourists, major 'foreign' traders, ... (estimated number of exported items)</li> </ul>	<ul style="list-style-type: none"> <li>resources from hunting / total resources</li> <li>existence of traditional hunting rules and their effectiveness</li> </ul>

**Indicators concerning ecological and social interactions**

To go further in describing the impact of changing use practices, it is important to consider the social and ecological interactions that lead to retroactive effects on biodiversity uses. Such interactions are formalized during co-construction processes through diagrams showing icons connected by arrows. The indicators are identified based on such diagrams. It is nevertheless necessary to limit the identification of indicators to a specific area, since otherwise the diagrams rapidly become too complicated. In the following example, taken from co-construction carried out in Burkina Faso, the interaction indicators concern fishing practices.

Use indicators are combined with ecological interaction indicators – links between rainfall, invasive species, state of the water body and abundance of fish – as well as with social interaction indicators – relations between fishers, traders, foresters and development projects (Fig. 4).

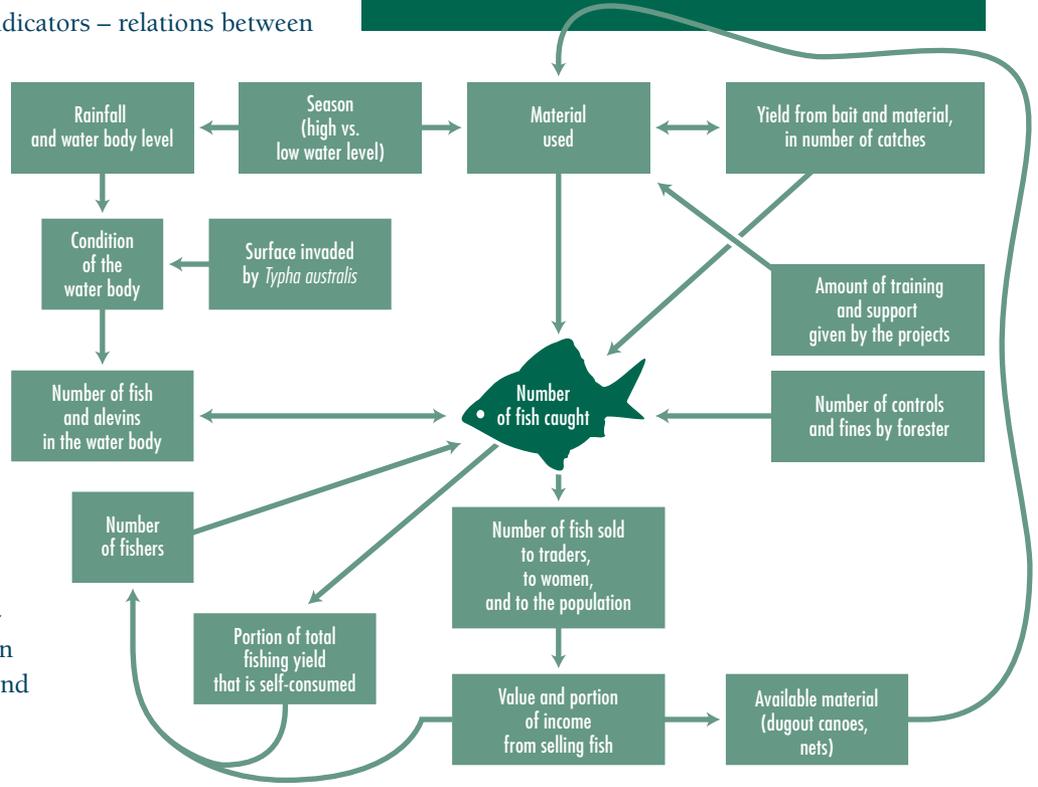
The value of these interaction indicators lies in helping to highlight co-evolutions concerning problems that are economic (change in number of catches), social (change in conflicts with reserve managers), and ecological (change in fish habitats). They make it possible to emphasize interdependencies, test scenarios, and facilitate arbitration between development objectives and conservation objectives.

**Restitutions and simulations**

In order to assess how well the indicators resulting from the co-construction process fulfill their function, it is necessary to evaluate the degree of usefulness assigned to them by the various stakeholders and in what way they can provide tools to support concertation. The participants' reactions to the indicators were as follows.

**Scientists from a natural science background** mainly criticized the biodiversity monitoring indicators, which were addressed through signs of changing resources as

**Fig. 4: Use and interaction indicators: example of fishing in Mare aux Hippopotames Biosphere Reserve (Burkina Faso)**



perceived by local populations. The scientists felt that this type of information was not as reliable as when classical methods of ecological monitoring are used, for example, based on transects. They however appreciated the description of the stakeholders' individual behaviours thanks to use indicators that enabled them to better understand the stakeholders' strategies.

**Scientists from a social science background** criticized the use indicators for being reductionistic, especially those related to the stakeholders' criteria for action; thus the stakeholders' behaviours cannot be summarized in a truly satisfactory way using these indicators. But they liked the way it was possible to identify biodiversity indicators based on individual perceptions and to envisage monitoring protocols based on local know-how.

**The reserve managers** had positive reactions about the signs and uses, the first providing them with valuable information about the state of biodiversity, and the second enabling them to better grasp the stakeholders' use strategies. In both cases, they can provide reserve managers with very effective tools for communicating with local stakeholders.

**Representatives of the local populations** were interested in the use and monitoring indicators because they represent indicators that had been identified based on their personal experience. They manifested a degree of concern, however, about the way in which they could actually make use of them.

The social and ecological interaction indicators were well received by the scientists, but did not really convince the reserve managers and even less so the representatives of local populations (Table 3).

It was also a matter of evaluating in what ways these indicators would make it possible to better comprehend society-nature interactions, and therefore to better appropriate the co-evolution processes between social

systems and ecological systems, in such a way to then be able to utilize them as a tool to facilitate discussions about the uses of biodiversity. For this, simulations were carried out based on interaction indicators and mediation tools.

The success of such simulations is directly linked to the mediation tools that are used. The utilization of interaction matrices did not yield useful results due to the complexity created by the large number of parameters, retroactive effects that were difficult to grasp, and the use of nouns and verbs that were often hard to express in a non-written way. The diagrams provided a way to communicate more easily, but did not make it possible to convey much information. Role-playing turned out to be the most effective means to carry out simulations. It stimulated a great deal of interest among the participants, with very strong participation and long impassioned discussions.

When simulations were based on matrices or graphics, these representations were produced by the mediator. When simulations were based on role-playing, the mediator simply organized them. In the first case, participants take a 'command and control' approach to indicators, making it possible to describe or 'pilot' a system. In the second case, they are in a system and interact with it through the utilization of indicators. The simulation is itself the result of choices made by the players during the game. These choices have an impact on individual indicators – income, yields, time available, investment, etc. – but also on the collective indicators that each player uses – availability of wood or of water. This type of simulation is useful because participants become individual users of the indicators they previously created, which offers them a unique opportunity to appropriate these indicators. In such a way, the players enjoy the direct observation of the impact of their uses, social interactions, certain rules of biodiversity dynamics, or of the retroactive effects that occur.

By making indicator-based decisions, they appropriate them and realize they need new indicators to win their round of the game. The connection between the indicator refinement and decision-making enables players to become aware of the direct and indirect interactions

– social and ecological – on which they and the surrounding resources depend, but also to adapt their behaviour (individually or collectively) in order to deal with these

**Table 3: Interest expressed by the participants to the different types of indicators**

Indicators	Signs of changing resources	Use (activities and decision criteria)	Ecological and social interactions
Stakeholders			
Local populations	+ + +	+ +	-
Reserve managers	+ +	+ + +	+
Social scientists	+ + +	+	+ +
Natural scientists	+	+ + +	+ +

changes. They provide the opportunity to begin repeated processes of individual and collective learning about society-nature interactions. Role-playing in fact makes it possible to link ecological, social, and economic dynamics to individual decisions that have an impact on parameters concerning various players, which sooner or later prompt the participants to begin collective discussions with the goal of proposing and negotiating solutions to deal with these collective problems. These negotiation processes imply comparing the arguments of the various parties who use the co-constructed indicators to justify this or that viewpoint. The process makes it possible to gradually identify the key or structural indicators that determine, to a large extent, the dynamics of the society-nature system. Lastly, role-playing gives managers and scientists an experimental tool to work on the indicators, since it enables the observation of how the indicators are used as a tool for communication and decision making: those that make the most 'sense' for the players when they make choices concerning their activities or when they adapt their practices; those that will be mobilized during collective debates to justify a viewpoint or an action; and, lastly, those that seem to be the most legitimate for all parties: all of this being necessary information to ensure better communication among stakeholders within the biosphere reserves.

Therefore, while indicators represent a traditional tool for centralized planning and expertise, related most of the time to an approach in terms of 'command and control', role-playing offers the opportunity to use the indicators in an interactive, decentralized way at a local scale.

### Some conclusions and prospects

The process of co-constructing interaction indicators represented an opportunity to launch concertation dynamics among stakeholders who, quite often, are not used to communicating with one another. Thanks to a collective process of negotiation, making choices, and ranking priorities, it allowed all the participants to gradually formalize the society-nature interactions present in the biosphere reserves. This process also provided the opportunity to produce indicators that make sense for all the stakeholders and which, moreover, enjoy a certain legitimacy.

With respect to the interaction indicators, it became clear that a desire to classify the indicators based on a pressure-state-response model did not fulfill the objective of improving communication among the stakeholders. In fact, identifying sources of pressure and response involves identifying those responsible for them and taking measures that will be adopted to the detriment of certain

categories of stakeholders. For this reason, establishing pressure and response indicators will have a tendency to exacerbate conflicts rather than facilitate discussion.

Identifying interaction indicators based on a detailed description of uses and putting the accent on local stakeholders' ability to change their use practices or make adaptive responses to various types of change that affect them seems to offer interesting prospects for improving communication among stakeholders about biodiversity use and access, and for its sustainable management. It also seems to be necessary to identify indirect interaction indicators concerning social and ecological dynamics in order to understand how society-nature systems co-evolve.

The operational character of the interaction indicators drawn from this co-construction exercise is linked to the selection of a limited number of indicators, to the availability of information that will make it possible to implement them, and to the existence of models that could make the indicators dynamic.

A first point is that working group participants select, among the identified indicators, those that will be most useful for the local stakeholders, and those that will make it possible to respond to the need for information about specific problems.

The second factor is the necessity to have access to information making it possible to monitor the indicators and to define parameters for existing interactions among the various selected indicators. This implies there will be a cost for collecting, processing, and maintaining the information that will enable these operations to be carried out. To reduce these costs, it is important to organize existing information rather than wanting to create new information. In particular, it is possible to reach an agreement with resource users and set up simple protocols to collect information during the activity itself. Such processes exist already, especially with tour guides who gather information while moving from place to place. However, this means making such practices widespread by applying them to fishing, apiculture, gathering activities, and so on. Once this information has been collected, it should be reviewed by the scientists and/or reserve managers, then reported in different forms to the stakeholders who practice the activities and are concerned by resource monitoring.

By way of example, once a month simple information could be collected about fishing by those who carry out this activity – date, fishing spot, material used, number of species caught, number of fish caught, time spent on the water, number of fishers near the boat – to then produce indicators of value for both the fisher and the reserve manager – number of fish caught depending on what material was used, number of species depending



on the site, productivity per hour and by site, anthropic pressure per site, species diversity, abundance. This should enable local populations to better appropriate the indicators developed from this information and provide the basis for discussing issues of biodiversity use.

This, however, requires the presence of a resource person 'on the ground' to centralize, organize, and report the information. This person should, in particular, be able to provide the means for users to collect this information, maintain ties with the population, scientists and reserve managers in order to create a climate of trust among the different parties. The person would be responsible for distributing information and would manage a network within which the information could be enhanced and used by all. The resource persons would need to receive training about organizing and processing information.

Finally, the last point concerns the need for models to make the indicators dynamic. Role-playing is one possibility to consider, but one can also use computer-based models that include these various interactions. This is the case, for example, of the multi-agent models mentioned in this publication.

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# Prospects Chapter 4 and conclusions

'But if in your thought  
you must measure time into seasons  
let each season encircle all the other seasons

And let today  
embrace the past with remembrance  
and the future with longing.'

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Khalil Gibran (1959). *The Prophet*. © Alfred A. Knopf,  
New York

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## Understanding and foreseeing concertation itineraries: proposals for research and training

MERIEM BOUAMRANE AND JACQUES WEBER

**T**he previous articles illustrate the complexity of the challenges and approaches to biodiversity management, in particular on the territories that make up biosphere reserves. Such complexity stems as much from the biodiversity to be managed as from the diversity of stakeholders and their relationships with respect to biodiversity, as well as their perceptions about the most effective way to manage it. Building dialogue among these stakeholders appears to be one of the preliminary conditions needed to set up such territories and manage them from a sustainable development perspective. This need for dialogue appears repeatedly in the recommendations listed under the major goals of the Seville Strategy. Is dialogue an essential key to guarantee the sustainable management of a biosphere reserve? Is it the basis for reaching the three objectives assigned to a biosphere reserve in an integrated, sustainable way? With its more than 30 years of experience, is the World Network of Biosphere Reserves able to say how, and under what conditions, sustainable management and biodiversity conservation are compatible, when the stakeholders are so diverse and the contexts so different?

We would like to put forward several suggestions for reflection. They build upon the main notions presented in this work, which we have translated into proposals for research and training.

### Dialogue

#### Conservation and Sustainable use of biodiversity: a failure?

The title of issue 75 of *Courrier de la Planète* (2005) asked: 'Biodiversity, conserving it for whom?' This issue analyses the evolution, at the international level, of debate about biodiversity conservation and its repercussions on national and local practices. Certain authors mention the confrontation of two paradigms: the preservationist paradigm, which takes a strict approach to conservation by enforcing bans and excluding all use, and the integrator paradigm, where conservation cannot be dissociated from the political issues of development and fairness (Louafi and Tubiana, 2005). These two paradigms do more than simply reflect a different percep-

tion of the most effective way to conserve biodiversity. They also reveal the emergence of new stakeholders on the conservation scene, in particular civil society and NGOs (Agrawal and Redford, 2006; Sanderson, 2005), which receive substantial financial resources for the implementation of such approaches (Chapin, 2004). The development of new mechanisms for conservation, covering large territories, such as the 'conservation concessions', also gives rise to basic questions about the fairness, legitimacy and effectiveness of these new tools and about the exchange of 'development rights' against financial payments (Karsenty and Nasi, 2004).

This confrontation between different schools of thought and methods for biodiversity conservation brings us back to a question which has apparently not found a satisfactory answer: is it possible to reconcile the conservation and the sustainable use of biodiversity within a given area and for a certain amount of time, a sustainable period of time? This is indeed the founding and explicit goal of the biosphere reserve tool (Batisse, 1986; UNESCO, 1996). The 'rebirth' of a preservationist paradigm seems to represent a challenge to integrated approaches, an acknowledgement of the failure of stakeholder participation policies, of integration of conservation and development projects. Yet underlying this seeming acknowledgement of failure, the issue of access to the biodiversity that is to be conserved and/or used in a sustainable manner seems to be crucial. How can one assess what the effective conservation of biodiversity consists of without defining and examining who has the right to manage or conserve it, and the approaches for such management? The Convention on Biological Diversity reaffirms that States have sovereign rights over their resources. Yet at the same time, this sovereignty does not prevent certain people from perceiving and treating biodiversity as a heritage, either collective or marking one's identity (Cormier and Roussel, 2004).

The issue of access to biodiversity is critical in the social sciences, especially economics. It is estimated that the cause of two-thirds of conflicts has to do with the access and use of resources: this fact is overshadowed

by the usual classification of conflicts according to their ethnic, religious, economic and political means of expression, rather than their root causes.

The growing interest for biodiversity is combined with the issues of appropriation, space and resources, or the access and use rights of these resources and of intellectual property (Weber and Lateltin, 2004). Many different means of appropriation exist throughout the world, which are part of spatial and temporal dynamics that may be opposed. In certain contexts, the attribution of property rights serves only to exclude and not to regulate, and may lead to social disturbances and conflicts.

A great deal of research on common property has shown that, when it comes to the sustainable management of resources, neither the solution of centralized management overseen by the State, nor regulation based entirely on the market and private property, have produced the best results (Ostrom, 1990; Berkes, 1994; Weber, 1995).

In biodiversity management, the decision-making process has become ever more complex due to a growing number of tools to regulate access to resources, which may or may not be exchanged on the market (plant breeders' rights, quotas, patents, development rights), new ways of appropriating space and resources in a context marked by the globalization of exchanges and production, diverse perceptions of biodiversity, and a wide range of interests (Weber and Lateltin, op. cit.).

What is the best way to reconcile individual and collective interests? Answering this question implies designing methods, procedures and forums for dialogue, negotiation and concertation (Mermet, 1992; Billé, 2006). Setting up mechanisms for concertation and conflict management involving the concerned stakeholders has for many years been recommended to improve the management of resources and ecosystems and to ensure the viability of biodiversity conservation actions and the co-management of protected areas (Borrini-Feyerabend, 1997). It also follows from the observation that conserving a given land, species, variety or knowledge is nearly always a collective choice, and that biodiversity conservation is all the more effective when these choices are not imposed but result from a process of concertation.

Participatory approaches, defined as 'approaches in which stakeholders negotiate, define and guarantee among themselves a fair sharing of the management functions, entitlements and responsibilities for a given territory, area or set of natural resources' (Borrini-Feyerabend, op. cit.), fall under this concept of collaborative decision making. The term 'participation' does not clearly reflect the collective construction of the questions asked, unlike concertation and as part of the supportive research approaches of the ComMod (companion mo-

delling) group (Beuret, this work; Étienne, this work). We feel that this collective construction, or co-construction, is the preliminary condition required for the establishment of a biosphere reserve and its sustainable management. The development of collective rules governing the access to and management of the resources in a biosphere reserve, the division of the territory into core area(s), buffer zone(s), and transition area(s) (zonation) should be the result of stakeholders' negotiations about means of access and uses of resources and habitats.

The challenges of concertation within a biosphere reserve would thus be to ensure greater respect for collective rules and lower enforcement costs, the joint implementation, by the management authority and stakeholders, of management rules, and the sharing of the costs and benefits of programmes or projects (Beuret, 2006). Concertation approaches in a biosphere reserve should make it possible to reach a compromise between those who wish to conserve the resources and those who live off them; they should make it possible to ensure the future and find a shared focus based on a sustainable development objective.

In order to grasp the challenges of managing biodiversity, one must take into account the diversity of access rules, legal systems and conservation and use practices, in particular with respect to the relations among different levels of biodiversity management. In pursuit of this objective, the World Network of Biosphere Reserves constitutes a rich historical basis offering a wealth of lessons and considerations for a research and training programme that aims to understand how to draw up rules for access and the use of resources, in what framework for dialogue they are developed and revised, at whose initiative they may be renegotiated, and how these dialogue practices are translated into biodiversity management practices (Boissau, 2003; Boissau and Castella, 2003; Bousquet et al., 2005).

Since the creation of the first biosphere reserves in 1976, the tool has evolved considerably on the ground. Objectives have been re-assessed, refined and reaffirmed (UNESCO, 1996) to better take into account society-nature interactions, to better respond to the difficult operability of a rich, ambitious concept whose implementation remains complex, ever-changing and dynamic, and which must be adapted to the specific characteristics of each context (UNESCO, 2002).

The wealth of what we refer to as the biosphere reserves' concertation itineraries and the lessons they offer should be shared. Although each itinerary is unique, the challenges and objectives remain the same from one biosphere reserve to another. Certain biosphere reserves gave priority to one function over another (conserva-



tion, research or even sustainable development) at different points in time, according to different methods, or, to the contrary, from the outset addressed the challenge of reconciling<sup>1</sup> (Rosenzweig, 2003) areas and uses with a land management project. The choice of priority issues, the observation of time steps, the historical analysis of changing orientations, the role of endogenous and exogenous factors in such dynamics, the methods for linking the different management levels, from local to national, are all factors that one needs to be familiar with in order to understand the history and dynamics of a biosphere reserve.

By taking into account the human, scientific, technical and political wealth of the World Network of Biosphere Reserves, it should be possible to contribute to meeting the international challenges of sustainable management of biodiversity. At the same time, this should contribute to ongoing and recurring debates about the effectiveness of management methods and of participation, which has become a strategic focus, especially in protected areas.

What must we take away from the sites' experiences to understand the present and build the future? What can we learn from the World Network of Biosphere Reserves? A great deal, to be sure. First, however, it is important to be able to grasp this diversity without simplifying it and to ask questions that highlight the local, unique and specific context, while enabling comparisons and assessments that will be useful to all the sites, in the spirit of exchange and sharing that are precisely why the World Network of Biosphere Reserves exists.

### **Proposal for the World Network: sharing sustainable development practices**

A biosphere reserve is a multi-objective (conservation, economic development, scientific research and training, learning and exchange), multi-use and multi-actor space, which relies on a zonation system to fulfill its functions. The actors and institutions that intervene in this space very often have divergent interests and relationships to time, property and nature, which may at times conflict. One of the challenges in creating and managing a biosphere reserve is to reconcile, in the same space, conservation and economic development objectives and foster the convergence of the long-term interests of the stakeholders involved. Underlying this challenge is the hypothesis that, among all the conservation strategies, there are some that favour development, and that among all the development strategies, there are some that favour conservation. The trajectory to follow lies at the point where the two intersect.

The objective here is to share the experience of stakeholders on the ground and the research teams by taking advantage of the diversity of World Network sites in order to establish sustainable development reference practices. In early 2006, the World Network included 482 biosphere reserves in 102 countries, which means 482 concertation itineraries and proposals for reflection about sustainable development, 482 sites for study and experimentation, 482 ways to design, update and implement rules, dialogue practices, indicators and criteria to reconcile conservation and development. Priority is given to the study of the dynamic and historical aspects of the transformation of practices and uses within the biosphere reserves.

### **Interdisciplinary and mediatory research**

Robert Barbault (this work) mentions that 'those in charge of natural areas' show 'a lack of interest in research' and underlines 'the research community's lack of interest in the problems posed by the conservation, management and optimized use of these areas.' The biosphere reserves interest numerous scientists working on subjects involving all disciplines and in many countries serve as laboratories for interdisciplinary questions concerning biodiversity. These sites also serve as observatories of long-term dynamics, in particular for climate change<sup>2</sup> (UNESCO, 2002). It is nonetheless necessary to make an effort to increase sharing and awareness of such research. The co-construction of projects mobilizing different disciplines is still, unfortunately, rare. The questions raised by conservation and the sustainable management of biodiversity require building interdisciplinarity and partnerships: interdisciplinarity among biologists, interdisciplinarity among all the natural sciences, and between the natural and the social sciences (Barbault, op. cit.), as well as the establishment of connections between scientists and reserve managers. Research must support management of the biosphere reserve spaces and resources which meet the needs and demands of reserve managers. Such research, necessarily interdisciplinary, must facilitate access to knowledge and ways of thinking, and suggest methods and ways to assess these methods, as well as the optimization and communication of research.

Pursuing this sustainable development objective, research would then play a mediator's role, making it possible to better integrate stakeholders' representations to better explain their interests and concerns, and their hopes. It should help establish the link between scientific knowledge and local know-how, the latter being based not only on knowledge but on ways of thinking that one must be able to grasp. Research would support

individual and collective decision-making (Étienne, this work). It would be useful for monitoring, by responding to questions and objectives co-constructed from the outset with the users of the information that is produced. This concerted effort among those involved in research and those involved in managing the territories is one of the strengths to tap into for the creation and management of the biosphere reserves, as recommended in the Seville Strategy<sup>3</sup> (UNESCO, 1996).

It is thus necessary to mobilize scientists as well as university researchers and students, and encourage them to become involved in the research needs of biosphere reserves (Barbault, op. cit.), especially for the study of society-nature interactions, in the most sustainable way possible.<sup>4</sup>

## The biosphere reserves as observatories of concertation approaches

The objective is to take advantage of and share the biosphere reserves' knowledge and experiences to better understand the interactions between social and ecological dynamics. It also consists of contributing to the decision for sustainable management and local development. Observing and understanding concertation approaches, whether long-term or temporary, with respect to a resource, an area or the entire biosphere reserve, based on long time steps, would be the main theme for discussion that is focused on research issues and training programmes.

## Unique contexts and itineraries: common questions and approach

A research and training programme entitled 'Dialogue and concertation in biosphere reserves' was begun in 2005.

The programme's objectives are as follows:

- determine the biosphere reserves' needs in terms of conflict prevention and management;
- identify and involve scientists from the concerned countries who work on these subjects;
- analyse the practices of the different parties in terms of dialogue and concertation with the local stakeholders concerning efforts to seek a compromise between biodiversity conservation and development;
- analyse and highlight certain biosphere reserve experiences that might be shared within the World Network;
- encourage exchange among the biosphere reserves on this theme.

1. Reconciliation ecology 'is the science of inventing, establishing and maintaining new habitats to conserve species diversity in places where people live, work or play.' <http://winwinecology.com/definition.html> and see the selective bibliography.
2. Such as, for example, the *Global Change in Mountain Regions* (GLOCHAMORE) project, funded by the European Commission.
3. In particular Objective III.1: Improve knowledge of the interactions between humans and the biosphere.
4. This is one of the goals of the regional UNESCO-MAB/UNEP-GEF project in West Africa. The core question, broken down into several research and training actions, is 'how to manage society-nature interactions' in these six biosphere reserves.

**Table 1: Common analysis grid for the 'Dialogue and concertation in biosphere reserves' programme**

**PART ONE:**

**The system and its dynamics**

- What is the biosphere reserve today? What is its purpose? Can you describe it briefly?
- Tell us how the reserve was created, why, by whom, in what context and how it has evolved to date.
- What particular rules were set up within the reserve to manage it? Who manages the reserve? What actions have been taken?
- How do local stakeholders participate in the life of the biosphere reserve? Describe coordination with other local or outside institutions.

**PART TWO:**

**Stakeholders, conflicts and compromises**

- On this sheet of paper, can you represent the various categories of stakeholders concerned by the biosphere reserve and relations between them?
- For the management authority: how do you work with the population?  
For stakeholders: how do you work together with the management authority?
- Describe the main conflicts among stakeholders within the reserve.
- For one or more of these conflicts, describe what happened, from the beginning. As you tell the story, explain what made managing the conflict easier.
- Are there any examples where you were able to both use resources and conserve biodiversity, even though this initially appeared difficult? Give examples. How were these compromises reached, and thanks to what?
- What does sustainable development mean to you? Have you taken any measures to facilitate it? Such as?

**PART THREE:**

**Dialogue**

- Concerning dialogue among the stakeholders in and around the reserve, what experiences would you like to share with other biosphere reserves? What achievements would you like to describe?
- With respect to dialogue, concertation, mediation, in what areas would you like to receive support? What are your needs? Which national experts support you or would be able to do so?
- What have you lost or gained by entering into dialogue (or not) with local stakeholders?
- In light of your perspective today, do you think that, in terms of the effectiveness of your actions, it would be better to exclude human activities, define and impose strict rules, or develop rules with the concerned stakeholders, sell use rights? Why?

**PART FOUR:**

**Assess the effectiveness of designing a biosphere reserve**

- What are the criteria that allow you to assess the existence and action of the biosphere reserve? What other criteria and topics for evaluation seem relevant to you?

The programme, which is being implemented in 15 or so biosphere reserves<sup>5</sup> (Box 1), makes use of a common analysis grid, divided into four parts (Table 1):

**Box 1: 'Dialogue and concertation in biosphere reserves' programme. Preliminary list of the biosphere reserves taking part in the international comparative research programme**

Country	Biosphere Reserve
Benin .....	Pendjari
Brazil .....	São Paulo Green Belt
Cambodia .....	Tonle Sap
Canada .....	Clayoquot Sound and Lac Saint-Pierre
Estonia .....	West Estonian Archipelago
France .....	Iroise and Luberon
Guatemala .....	Maya
India .....	Nanda Devi
Mexico .....	Calakmul and Montes Azules
Korea (Republic of) .....	Jeju Island
Uruguay .....	Bañados del Este
Vietnam .....	Can Gio Mangrove

The purpose of this analysis grid is to recontextualize the observations in each biosphere reserve and link them to the social, political, economic and technical systems in the countries concerned.

The questions raised must make it possible to understand the context in which the biosphere reserve surveyed was created, with which stakeholders and methods. Some biosphere reserves were created as an extension of parks or protected areas, while others were the result of an integrated territorial management objective. The different ways in which stakeholders participate and the ways used to facilitate dialogue among stakeholders make it possible to highlight the compromises reached and look at how they are updated. The role of research to support and accompany the process of creation and updating is also studied.

The study of dialogue practices makes it possible to analyse the resulting management methods, thus the dynamics of these territories. The questions that are asked must shed light on the capacity of the biosphere reserves' systems of governance to adapt to crises and changes. Is it possible to determine that which is irreversible? How does a biosphere reserve develop over time and what

ecological and social factors determine these changes? This section looks at the dynamics of use practices, stakeholders' strategies, the mobilization of knowledge and know-how, and the putting into perspective of the practices with representations and strategies to shed light on management problems. Uses, appropriation and management methods, the access and management of resources, the establishment of rules and the attribution of rights to individual or collective players, are studied on different time steps. These studies should help clarify to what extent these rights influence stakeholders' practices and strategies. Will it be possible to observe the emergence of new means of concertation or the implementation of new institutional systems?

The study of practices to manage and revise a biosphere reserve's rules and institutions according to different time steps contributes to current discussions of the way to reconcile the conservation of biodiversity with development. This objective is also being pursued by the International Association for the Study of Common Property (IASCP), by the Collaborative Management Working Group of the World Conservation Union (IUCN) Commission on Environmental, Economic and Social Policies (CEESP), and by the work of the Com-Mod<sup>6</sup> group and researchers from Resilience Alliance. The adopted approaches are deliberately situated at the interface between research and management, in an effort to define itineraries that can help reconcile the relationships of this or that group with respect to the management of resources. We believe that these researchers who share common concerns should make greater use of biosphere reserves as fields for experimentation.

**Taking complexity into account: innovative methodology and tools**

These society-nature interactions, these observations and analysis of the concertation processes according to different space and time scales, at the crossroads between social realities and ecological processes, require the development of innovative tools and underline the crucial role of supportive research. The proposals set out in Chapter 3 of this work concerning a methodology for the co-construction of interaction indicators (Levrel et al.) and companion modelling using role

5. The first phase of this MAB programme study is coordinated by Jean-Eudes Beuret, in cooperation with the MAB National Committees, the staff of the biosphere reserves and scientists from the concerned countries.  
6. <http://cormas.cirad.fr/fr/reseaux/ComMod/index.htm>. The ComMed charter may be downloaded from this web page: <http://cormas.cirad.fr/en/reseaux/ComMod/charte.htm>. See the selective bibliography for the references and addresses of the Internet sites of the institutions mentioned in this contribution.





playing (Étienne) are promising and should be pursued in other biosphere reserves. Such tools may be mobilized and used at various points during a biosphere reserve's itinerary: when it is created, during periods of conflict and once every ten years when the biosphere reserves are subject to periodic review in accordance with the Statutory Framework (UNESCO, 1996; Étienne, this work). Such tools and approaches are rooted in the co-construction of the questions arising from the management of a territory and its resources. This co-construction mobilizes the stakeholders in research and management, and represents an approach to building interdisciplinarity. These approaches and tools make it easier to understand changes and to anticipate them thanks to dynamic modelling, a simplified representation of reality. This dynamic view of biodiversity and society-biodiversity interactions may also be found in the work of the Millennium Ecosystem Assessment (2005) and the proceedings of the international conference held at Unesco, 'Biodiversity: Science and Governance' (Paris, 24-28 January 2005) (Barbault, 2006).

### **A necessary assessment of participation practices**

The concerted management of a biosphere reserve requires that one must review the process for identifying conflicts, issues, stakeholders and their representatives on a regular basis, rather than considering this step as accomplished once and for all (Beuret, this work).

Participation today requires an analytical examination, both critical and constructive, rather than a general vision (Billé, this work). The central question in the assessment of participatory processes within the biosphere reserves must address the following: what standards should be applied to assessing the concerted management of a biosphere reserve? Can agreement be reached on one or more objective benchmarks for assessment? How can one assess the collective interest of conserving biodiversity and the stakeholders' various interests and objectives? (Billé, op. cit.).

Concertation is an active, dynamic and time-consuming process; it cannot be reduced to a one-off operation, a procedure or a fixed process (Beuret, 2006). It never quite follows the pre-determined path set out for it. The question of the effectiveness of the participatory approaches within protected areas (and territories that have also been designated for the conservation of biodiversity, like biosphere reserves) is once again coming to the fore. The implementation of new biodiversity conservation instruments, presented as being more effective than the 'traditional' tools of protected areas, is evidence of these mixed results. Yet the assessment of these participatory approaches to conservation is based on what

criteria? Various studies mention, in particular, the range of stakeholders, the arrival of new stakeholders who now have legitimacy for biodiversity conservation, and the cost of concertation transactions; attention is drawn to the principles of efficiency, fairness and legitimacy, yet we lack methodological tools, data and comparative studies over long time periods to better analyse this connection between conservation and development (Agrawal and Redford, op. cit.).

The research programme on dialogue and concertation practices in the biosphere reserves aims to contribute to these reflections by exploring the criteria the countries choose for the assessment of effectiveness. The effectiveness of the rules in a biosphere reserve may be measured by the yardstick of three common objectives and the integration of these three objectives within the same area. It may also be measured by the limitations imposed on local stakeholders in their economic, social and cultural activities, in order to reach this level of effectiveness. The question of indicators to evaluate the effectiveness of a biosphere reserve will thus be asked. On the basis of the initial studies carried out within the framework of the dialogue and concertation programme, a methodology to evaluate concertation effectiveness has been proposed and is being tested at pilot sites, in partnership with the institutions and scientific teams in 2006<sup>7</sup>.

### **A need for training: responses to be adapted**

Concertation requires new competencies of the stakeholders involved in biodiversity management. Benchmarks, methods and practices must be provided for stakeholders when it comes to dialogue, concertation and conflict prevention and management. The MAB Secretariat has organized several training workshops for certain stakeholders who are active within a biosphere reserve (managers, local communities, institutions), using different methodologies and approaches but giving priority to the co-construction approach to the challenges of managing each biosphere reserve. These workshops make use of national and regional training centres and workshop leaders (Box 2).

The World Network makes an effort to capitalize on and take advantage of local, individual and institutional talents and competencies for concertation. Their experts could, at the request of the countries, intervene in one of the Network's biosphere reserves to assist in the understanding of a conflict and exchange about dialogue

7. A partnership to define a methodology to assess the effectiveness of participatory approaches in the protected areas and the biosphere reserves is being developed by the Graduate Institute for Development Studies (IUED), the World Conservation Union (IUCN), the IRD and other partner institutions.

### Several training workshops have been organized by the MAB Secretariat

in cooperation with institutional and scientific partners in response to Objective III.4 of the Seville Strategy, which recommends, at the national level: 'Define the training needed by biosphere reserve managers in the 21st century and develop model training programmes on such topics as how to design and implement inventory and monitoring programmes in biosphere reserves, how to analyse and study socio-cultural conditions, how to solve conflicts, and how to manage resources cooperatively in an ecosystem or landscape context.' The training approach allows participants to highlight the existence of several viewpoints among biosphere reserve stakeholders concerning resources and asks how to analyse these different representations and what type of information the stakeholders need to understand one another. Such training is designed to enable the different parties to understand one another's viewpoints with regard to renewable resources, to identify potential sources of conflict and to begin a collective discussion of the land management scenarios that aim to make development and biodiversity conservation compatible. They emphasize the considerable need for information required to manage a biosphere reserve and the importance of research to support it.

**September 2002** Vosges du Nord Biosphere Reserve (France) in the framework of the EuroMAB Network. Training for the biosphere reserve coordinators. The French MAB National Committee was the co-organizer for this workshop.

**May 2003** Pendjari Biosphere Reserve (Benin). This training programme was designed for the managers of six biosphere reserves in West Africa, for representatives of the local communities, and for the focal points of the MAB National Committees. A role-playing methodology with the multi-agent system (MAS) was tested during the training, which was co-organized with the Benin MAB National Committee, INRA, CIRAD and ENSAR within the framework of the regional UNESCO-MAB/UNEP-GEF project.

**September 2003** Cévennes Biosphere Reserve (France). Training targeted the managers of the biosphere reserves and representatives of the ministries, within the framework of the EuroMAB Network. Co-organized with the French MAB National Committee.

**November 2005** Bañados del Este Biosphere Reserve (Uruguay). Regional training for managers and officials from the ministries of the environment, organized by the UNESCO Regional Office in Montevideo within the framework of the IberoMAB Network, with the Uruguay MAB National Committee.

**February 2006** Training in using role-playing for companion modelling. 'Putting stakeholders in situ to share representations and simulate dynamics.' Six mediators from biosphere reserves in West Africa took part in the training within the framework of the regional UNESCO-MAB/UNEP-GEF project. Training was co-organized with CIRAD, INRA and CEMAGREF.

Training reports are available through the MAB Secretariat.

#### The Division of Water Sciences (IHP)

of UNESCO has introduced the PCCP project, 'From Potential Conflict to Cooperation Potential'. This project aims to foster and facilitate the change from a conflictual to a cooperative approach in the management of transboundary water resources across the globe. It promotes the development of methods to prevent water related conflicts, in order to avoid situations of open conflict.

In light of this objective, the project develops various university and professional training programmes for the prevention of conflicts relating to water and the shared management of this resource. Several training programmes have been set up since 2000 in southern Africa and Latin America, in partnership with the university networks in these regions. Currently the PCCP project's major focus is the implementation of similar training programmes in Southeast Europe, Central Asia and Arab countries.



and concertation practices and processes set up in other biosphere reserves. The content of training programmes is adapted to the specific context of the biosphere reserve or to common general issues, such as within the framework of the regional programme in West Africa. Research plays an important role in the content of these training programmes. It emphasizes the significant need for information for the management of a biosphere reserve and the management of this information itself. The need for training in interdisciplinarity and the use of new tools (especially to manage important information gathered at certain sites) are increasingly expressed. The World Network has a critical role to play in the exchange of competencies and know-how for the management of society-nature interactions and the prevention of conflicts.

### Moving forward...

In certain countries, the creation and management of biosphere reserves lie at the heart of national strategies for the sustainable management of biodiversity and land use planning. Such sustainable development sites make it possible to strengthen relations between the worlds of research and conservation and those of land management. They represent precious tools for the implementation of observation and monitoring systems in the long term.

The role of biosphere reserves is to provide areas for sustainable development based on dialogue; they are intended to provide a setting for experimentation and learning. The role of the biosphere reserves is to increase our understanding of ecosystems and their processes, of society-nature interactions in various contexts. They make it possible to carry out comparative and dynamic studies and establish reference frameworks. They may be the basis for a sustainable development theory confronted with reality on the ground.

How could the biosphere reserves better share their experience of the way they reconcile individual and collective interests? How could they better share their questions and difficulties in their effort to establish itineraries, at the crossroads of conservation and development, with reserve managers, scientists, institutions and players from civil society? How could they better participate in the current and recurring debate, with certain voices speaking of the failure of conservation dialogue and development?

It is our hope that the research proposals and suggestions for reflection presented in this work will encourage people to react and want to share even more. 



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Janvier-mars 2005. No. 75.

<http://www.courrierdelaplanete.org/75/index.html>

*Espaces naturels*. January 2006. No. 13. Dossier (in French) on concertation processes. <http://www.espaces-naturels.fr>

*International Social Science Journal*. Journal founded by UNESCO in 1949, published quarterly in six languages.

<http://www.unesco.org/issj/>

*Journal of Artificial Societies and Social Simulation*.

<http://jasss.soc.surrey.ac.uk>

*Natures, Sciences, Sociétés*. Recherches et débats interdisciplinaires. EDP Sciences. <http://www.edpsciences.org/nss>

*Revue Tiers-Monde*. No. 177. January-March 2004 t. XLV. Quarterly review. Permit markets and the environment.

Edited by Alain Karsenty and Jacques Weber.

# Internet Sites

Aarhus Convention. Focus on access to information, public participation in decision-making and access to justice in environmental matters.

<http://www.unece.org/env/pp/>

CBD (Convention on Biological Diversity).

<http://www.biodiv.org>.

CDE, Research programme: 'Concertation, decision-making and the environment' set up by the French Ministry of the Environment.

<http://www.inra.fr/sed/environnement/pr-cde.html>

CEESP, IUCN Commission on Environmental, Economic and Social Policy. CEESP is an interdisciplinary network of professionals whose mission is to act as a source of advice on the environmental, economic, social and cultural factors that affect natural resources and biological diversity and to provide guidance and support towards effective policies and practices in environmental conservation and sustainable development.

<http://www.iucn.org/themes/ceesp/> et <http://www.cenesta.org>

CIRAD (French Agricultural Research Center Working for international development).

<http://www.cirad.fr>.

CORMAS/CIRAD, a site devoted to modelling relationships between societies and their environment.

Presentation of approaches for using multi-agent systems (MAS), which are simulation tools specially adapted to studying the dynamics of interactions between resources and society and the use of role-playing; development of modelling tools that make it possible to simulate interactions on several scales and methodological reflection about the use of these tools.

<http://cormas.cirad.fr>.

FAO (Food and Agriculture Organization of the United Nations).

Numerous publications about conflict management.

<http://www.fao.org>.

Concerning forest resources:

<http://www.fao.org/forestry/index.jsp>.

IASCP (International Association for the Study of Common

Property). Founded in 1989, association devoted to understanding and improving institutions for the management of environmental resources that are (or could be) held or used collectively by communities in developing or developed countries.

<http://www.iascp.org>

IDRC (International Development Research Center), a public corporation created by the Parliament of Canada in 1970 to help developing countries use science and technology to find practical, long-term solutions to the social, economic and environmental problems they face. Support for applied research in the field of the environment and the management of natural resources. Many publications available.

<http://www.idrc.ca>.

IFB (French Institute of Biodiversity). Numerous publications available on line.

<http://www.gis-ibf.org>.

IIED (International Institute for Environment and Development), with research on aspects of fair and sustainable development at the international level. A number of publications on conflicts, land issues and on access to / use of resources.

<http://www.iied.org/>

IRD (French Institute for Research and Development).

<http://www.ird.fr>.

Millennium Ecosystem Assessment: Central role of biodiversity in ecosystems. Reports available in several languages.

<http://www.millenniumassessment.org>

MNHN (French National Museum of Natural History).

<http://www.mnhn.fr>.

Resilience Alliance. Multidisciplinary research group that explores the dynamics of complex adaptive systems.

<http://www.resalliance.org>

UNESCO, Division of Water Sciences and PCCP Project ('From Potential Conflict to Co-operation Potential').

This project aims to foster and facilitate the move from a conflictual approach to one of cooperation in the management of transboundary water resources across the globe.

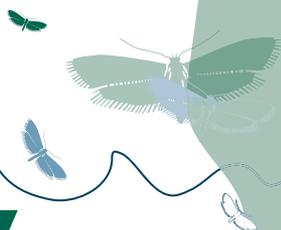
<http://www.unesco.org/water/wwap/pccp>.

UNESCO, Man and the Biosphere Programme. Documents about the Seville Strategy and the Statutory Framework, presentation of the sites of the World Network of Biosphere Reserves, programme on dialogue and concertation in biosphere reserves, and on conflict prevention and training.

<http://www.unesco.org/mab>.

# Acronyms

ADEME:	Agency for the Environment and Energy Management (France)
CBD:	Convention on Biological Diversity
CEESP:	IUCN Commission on Environmental, Economic and Social Policy
CIRAD:	Agricultural Research Centre for International Development (France)
CRDI:	Research Center for International Development
DATAR:	Regional Land Planning Administration (France)
ECOPAS:	Protected Areas of Sahelian Africa Project. Funded by the European Commission in the transboundary 'W' Region Biosphere Reserve (Benin, Burkina Faso, Niger)
ENGREF:	French Institute of Forestry, Agricultural and Environmental Engineering
ENSAR:	National School of Agronomic Sciences, Rennes (France)
FAO:	Food and Agriculture Organization of the United Nations
GEF:	Global Environment Facility
GELOSE:	Law for securing local resource management (Madagascar)
IFB:	French Institute for Biodiversity
IFREMER:	French Research Institute for the Management of Maritime Resources
IHP:	UNESCO's International Hydrological Programme
INRA:	French National Institute for Agricultural Research
IRD:	French Institute for Research and Development
IUCN:	World Conservation Union
MAB:	Man and the Biosphere Programme
MNHN:	French National Museum of Natural History
NGO:	Non-governmental Organization
OECD:	Organisation for Economic Cooperation and Development
PNR:	Regional Natural Parks (France)
UNDP:	United Nations Development Programme
UNEP:	United Nations Environment Programme
EU:	European Union
UNESCO:	United Nations Educational, Scientific and Cultural Organization



## Dialogue in the Seville Strategy (UNESCO, 1996)

### Goal II :

#### Utilize biosphere reserves as models of land management and of approaches to sustainable development

##### II.1: Secure the support and involvement of local people

- II.1.1. Prepare guidelines for key aspects of biosphere reserve management, including the resolution of conflicts, provision of local benefits, and involvement of stakeholders in decision-making and in responsibility for management.
- II.1.4 Identify and promote the establishment of activities compatible with the goals of conservation, through the transfer of appropriate technologies which include traditional knowledge, and which promote sustainable development in the buffer and transition zones.
- II.1.5. Survey the interests of the various stakeholders and fully involve them in planning and decision-making regarding the management and use of the reserve.

##### II.2: Ensure better harmonization and interaction among the different biosphere reserve zones

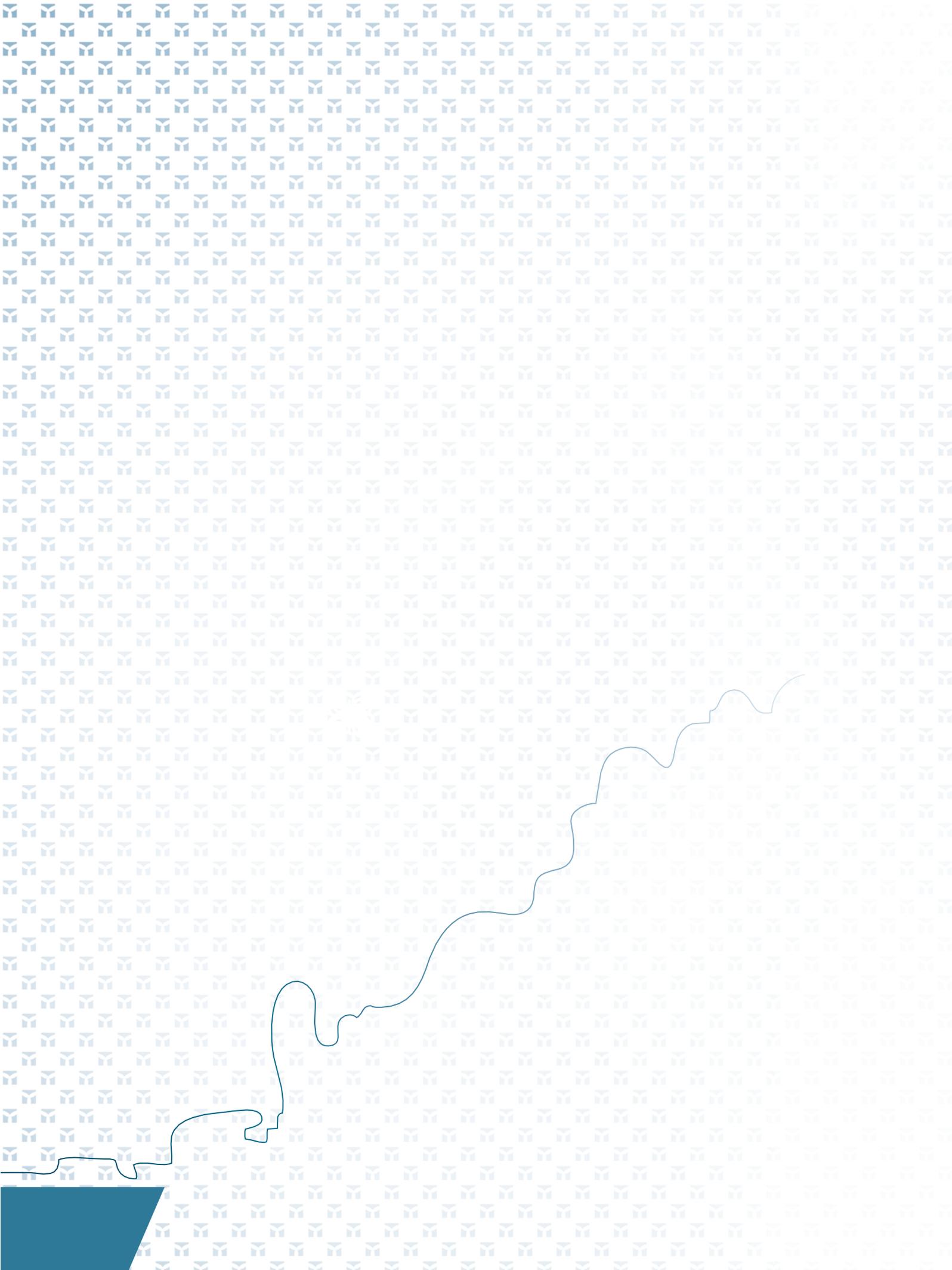
- II.2.4. Establish a local consultative framework in which the reserve's economic and social stakeholders are represented, including the full range of interests (e.g. agriculture, forestry, hunting and extracting, water and energy supply, fisheries, tourism, recreation, research).

### Goal IV :

#### Implement the biosphere reserve concept

##### IV.1: Integrate the functions of biosphere reserves

- IV.1.5 Prepare guidance on management issues at biosphere reserve sites, including, inter alia, methods to ensure local participation, case studies of various management options and techniques of conflict resolution.





[www.unesco.org/mab](http://www.unesco.org/mab)

**For thirty years, the Man and the Biosphere (MAB)**

**Programme**, particularly through its World Network of Biosphere Reserves, has initiated and supported studies on the interactions between human societies and natural resources in various cultural and socio-economic contexts.

**In light of the many objectives assigned to**

a biosphere reserve and the diversity of stakeholders, institutions and their interests, biosphere reserves are research and training laboratories for the prevention and management of conflicts arising from the challenges linked to conservation and sustainable use of biodiversity.

**The reflections in this work** must be enriched by the contributions of our partners in the coming years and with initiating comparative case studies throughout all regions of the world, making use of the richness and diversity of experiences and practices within the biosphere reserves that make up the World Network. The Division of Ecological and Earth Sciences, through its MAB intergovernmental Programme, wishes to make a substantial contribution to meeting the challenges of biodiversity management in multi-use areas with the objective of sustainable development.