Environmental Conservation 27 (4): 326–333 © 2000 Foundation for Environmental Conservation

Adaptive management in transboundary protected areas: The Bialowieza National Park and Biosphere Reserve as a case study

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Date submitted: 16 June 1999 Date accepted: 23 June 2000

Summary

Transboundary protected areas (PAs) currently represent nearly 10% of the world's network of PAs. The protection of their biological wealth poses special challenges because of the need for cooperation among sovereign states. Adaptive management strategies offer hope for a more accurate assessment of ecological conditions within PAs, and have the potential for furthering one of the major objectives of these PAs, namely enhancing environmental cooperation between countries across whose boundaries the protected area complex is situated. This paper examines the implications of adaptive management for transboundary PAs by using the Polish/Belarusian Bialowieza PAs as a case study. Managers of PAs have conventionally aimed at accurate predictions and short-term system equilibrium through 'top-down' policies of control and exclusion. In the case of PAs, these objectives have meant limiting use and employing models of linear growth. Adaptive management strategies rely instead on long-term experience, assessment of experimental interventions, and collection of greater amounts of information to assess future outcomes. They aim at the satisfaction of objectives that may include equilibrium changes. These features of adaptive management imply attention over time to the interactions between different key species, greater involvement of local populations in the collection of information about the resources, and experimenting with different levels of use to infer the most suitable protection strategies.

Keywords: transboundary protected areas, adaptive management, community-based conservation

Introduction

Protected areas (PAs) can be classified into six management categories (IUCN 1994, pp. 2–10) and are a critical element in the conservation strategies of nation states and international conservation agencies (Van Osten 1972; McNeely & Miller 1984; West & Brechin 1991; Lucas 1992; Alpert 1993; Butynski & Kalina 1993; McNeely 1995; IUCN 1998). This system of protection constitutes perhaps the most visible symbol of concern for nature (WRI 1994). The world's network of more than 30 350 PAs covers about 8.83% of the total land surface, and has grown steadily in the latter half of the twentieth century (M. J. B. Green & J. Paine, personal communication November 1997). From this network, Zbicz and Green (1997) identified 136 cases of transboundary complexes that had 406 individual PAs in 98 countries with 112 international boundaries. These transboundary complexes represent nearly 10% of the world's 13.2 million km^2 that are under some form of protection. This paper examines the relevance of adaptive management strategies, as outlined by Holling (1978) and Walters (1986), for transboundary PA management. It does so by focusing on the Polish/Belarusian Bialowieza PAs as a case study.

The number of PAs and their area has increased enormously over the past century. Although there is some dispute over whether the rate of growth has diminished in the last fifteen years, even for the 1990–94 period there is little or no evidence of a decline in the rate of growth of the area under the PA network (M. J. B. Green & J. Paine, personal communication November 1997). Conservation biologists (Soule 1983; Wilcox 1984; Lomolino 1994) suggest that larger contiguous areas of protection minimize the disruption of ecological communities, the erosion of constituent species, and the risk of extinction. Because of the ecological imperatives of conservation and because the distribution of biological resources does not respect international boundaries, transboundary PAs have become an increasingly important component of the total extent of PAs (D. C. Zbicz & M. Green, personal communication September 1997).

Since the 1980s, conservation strategies related to PA management have registered a movement from exclusion toward participation (Durbin & Ralambo 1994; McNeely 1995; Ribot 1995; Agrawal & Gibson 1999). These developments in the practical management of PAs correspond to some of the theoretical arguments about adaptive management of renewable resources, and constitute an important avenue to explore. Adaptive management of ecosystem resources can be seen as an innovation that implements policies as experiments, 'probes the responses of ecosystems as people's behavior in them changes' (Lee 1999), and mobilizes available information for objectives that are less susceptible to unexpected outcomes. Although recent works have examined the problems and promises of adaptive management for ecosystem management (Walters & Holling 1990; Holling

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1995; Iles 1996; McLain & Lee 1996; Walters 1997), this paper is one of the first attempts to relate adaptive management to conservation strategies that involve local residents (see Rogers 1998; Johnson 1999), and to trace the implications of adaptive management for conservation in transboundary PAs.

Conventional management of PAs often relies on hopes of accurate predictions and assumes short-term system equilibria. Top-down policies of control and exclusion are based on assumed models of predictable ecosystem functioning (Gunderson 1999). In the case of PAs, these aspects of conventional management translate into models of linear growth of flora and fauna that inform strategies oriented to limit use and harvesting levels.

In contrast, adaptive management relies on learning from long-term experience, treating policy interventions as quasi-experiments, and collecting and analysing significant amounts of information about ecosystem responses (Holling 1973, 1978). In the case of PAs, these features of adaptive management imply greater attention to interactions among key species, involvement of local populations in the collection of information about PA resources, and experimenting with different levels of use to infer how best to enhance benefits from protection (Walters 1986).

In significant ways, adaptive management potentially complements the recent trend in PA management where it has become common to involve local residents and community members in buffer zone development and protection of PA resources. Such involvement of local populations can be crucial in generating the long-term information and time horizons necessary for adaptive management techniques. Lee (1999) points out that an adaptive approach is likely to work only when reliable answers to scientific questions can be generated at low costs. Involvement of local populations in management can help address problems researchers often face in gathering data at low cost. Finally, because residents in buffer zones rely on nearby natural resources for their long-term livelihood, their involvement can also prompt a longer-term management perspective.

Community-based conservation

Emerging solutions to PA management, in contrast to earlier exclusionary options, often treat local resident populations as potential partners in protection. New conservationist strategies try to combine the goals of conservation and development (Kempf 1993) and have become possible in part because of a populist turn in the rhetoric of resource use. Local residents are often viewed not just as resource users, but also as effective managers. Indeed, in many regions of the world, local populations following forest-based livelihoods have long resided in areas that are home to environmentally key ecosystems, processes, and species (Mittermeier *et al.* 2000).

Three key assumptions undergird the new turn in PA management. These assumptions are about the relationship of PA management to participation, property rights, and poverty. Greater participation by local communities, it is believed, will promote better conservation. Similarly, devolution of property rights to lower level decision-makers and stakeholders is believed to lead to better conservation. Finally, many policy-makers and scholars act on the assumption that improving the incomes of local residents improves the prospects for conservation because the poor are forced, despite themselves, to overuse resources (cf. Broad 1994).

A wealth of new research has begun to show that the three assumptions listed above may either be suspect, or at least difficult to use as the basis for PA management. Thus, for example, the form and nature of the community, and how it is to be involved in conservation is disputed. Popular conceptions of community, especially those that see communities as small, bounded, fixed, harmonious collections of agents with similar goals and norms are inappropriate as the basis for management (Agrawal & Gibson 1999). Equally vexed is the nature of participation. Even if participation is interpreted narrowly in terms of the property rights over resources that local residents come to exercise, it has occurred only to a limited extent (Agrawal & Yadama 1997). The incommensurable spatial scales of communities and PAs, and the political costs of transferring authority to lower level actors are only two of the reasons preventing change in resource ownership and management status (Naughton-Treves & Sanderson 1995). Finally, the assumption that higher incomes for poorer households will lead them away from dependence on PA resources can prove inappropriate because the rich can exercise greater control and therefore use local resources in PAs even more intensively than the poor (Agrawal 1999).

However, the role of communities in PA management remains critical because of the potential gains from such involvement. Of the different actors interested in protection, many members of communities are likely to have among the longest time horizons in relation to the resources on which they depend. Devolution of authority to accountable federations of community organizations can create actors large enough to negotiate with state or other external actors. Finally, careful design of institutions can address stratification within communities so that allocation of benefits from managed resources is not skewed (Agrawal & Gibson 1999).

Problems of transboundary protected areas management

If the number of issues that provoke obstacles to careful management of PAs within the nation state is large, it multiplies for transboundary PAs (Fall 1999, p. 252). We possess only an inadequate understanding of the issues and management questions at the level of the community or the region. Political negotiations and international relations are even less well understood for transboundary PAs. In the environmental arena, international politics surrounding the allocation of externalities becomes critical because of the absence, vagueness, or unenforceability of transboundary

laws (Young 1989; Haas *et al.* 1993). The primary reason is the tension between the principle of sovereignty of nation states enshrined and consolidated since the Peace of Westphalia in 1648, and the interests that several nation states can have in the same territory, its resources, their use, or the externalities that result from use. The emergence of competing concepts such as the common heritage of humankind, human rights, and the growing interdependence of the global economy create additional difficulties for unambiguous practical application of the idea of sovereignty.

Sovereignty of the 200 or so nation states (Westing 1998) into which the planet is divided has three complementary interpretations. Internal or territorial sovereignty implies that a nation state has exclusive domestic jurisdiction over all resources and people within its boundaries. External sovereignty means that in the international arena no state can subject another to its will. External sovereignty is limited by international laws that are well explicated in some spheres, and only emerging in others. Sovereign equality says that all states are juridically equal (Schrijver 1993, p. 21). Environmental implications of national sovereignty are inscribed in the concept of 'permanent sovereignty over natural resources' (Schrijver 1997, pp. 57–81). The concept of 'permanent sovereignty' is itself an outcome of the interest that most developing countries had in controlling their territories and resources in the wake of decolonization and independence from European imperial nations (Schwarzenberger 1970, 1976; Schrijver 1997)

The concept of permanent sovereignty over natural resources implies rights that each state exercises over its resources. But over the last three decades the concept has also come to mean reciprocal obligations since all states are supposed to enjoy this right (UNGA 1962; ILA 1986). Since many resources such as wildlife, fisheries, oil and gas, water, and atmospheric air are hard to partition on the basis of national territorial boundaries, a number of bilateral and regional treaties and agreements on natural resources have been negotiated using criteria of prior use, historic rights, proportionality, and relative needs. Under the auspices of the United Nations Environment Program (UNEP), these principles have also been applied to the use and management of transboundary PAs (UNEP 1978*a*, *b*).

As it has become clear that many natural resources cannot be protected without interstate cooperation, three principles for the use of transboundary resources seem to have emerged as a basis for international treaties. The first involves sharing of information: states should consult relevant parties. The second implies equitable sharing. The third relies on not doing harm to another state through the activities within the boundaries of one (Westing 1998). The concept of common heritage, especially for space and deep sea mineral resources, encompasses the above three principles. It also implies reservation of these resources for future generations.

In the context of transboundary PAs where wildlife movements and ecosystem protection are the objective, joint management, mutual assistance, and mutual access to administrative and judicial proceedings require closer collaboration and negotiations. Although there are important benefits to be gained from closer international collaboration, the issues are far more political, and hence, cooperation more difficult. Changes in status quo often threaten the interests of important stakeholders, making effective management of transboundary PAs even more difficult.

At a minimum, transboundary PA management means an increase in the number of implicit and explicit objectives of management because of the presence of a larger number of actors (in comparison to intra-state PAs) and greater difficulty in generating the information needed for making decisions. In combination, these two factors can increase the number of dimensions along which tensions can exist among the actors involved. These concerns become especially critical in relation to adaptive management because of the need to collect and take into account greater levels of information to understand the dynamics of ecosystemic change, and the relationship of management to ecosystem behaviour. Some of the mechanisms through which these difficulties can be addressed are informal or grassroots liaison to build greater familiarity and closer contact among communities living across the border, the creation of administrative authorities for consultation or other forms of cooperation, and formal agreements that lay down detailed rights and obligations (C. Shine, personal communication September 1997).

Need for transboundary adaptive management

There are important justifications for transboundary PA management despite the difficulties of coordination across borders (Kelson & Lilieholm 1999). Perhaps the most important justification is based on ecological theory and arguments about distribution and representation of ecosystems in any PA network (Soule 1983; Wright 1996). Environmental security depends among other things on checking the continuing erosion of biodiversity and protection of ecosystems, landscapes, and keystone species and processes through PAs (McNeely & Miller 1984; Wilson 1984; Myers 1985; Thorsell 1990). The distribution of PAs around the world ill represents some of the most important biomes and countries (Olsén & Dinerstein 1998; Mittermeier *et al.* 2000). The chief rationale for transboundary PAs, then, is that many areas that should ideally be a part of the conservation network are situated along the political boundaries of the nation states. Typically, political boundaries of nation states are distant from major centres of development, and in consequence these areas often bear the smallest imprint of human activities. Westing (1993*a*) estimates that nearly a third of the world's high-priority natural habitats with significant levels of biodiversity cover some part of the 220 000 km of international boundaries between nation states. The overlap among bioregions and their overlap with international boundaries create the need for transboundary PAs (see also Fall 1999).

According to Westing (1998, p. 93), PAs can also play an important political role in inter-state relations. In some cases, they can safeguard and improve existing friendly relations between neighbouring states. Even where relations between states are not friendly, it is possible to use PAs across borders as a mechanism to make existing territorial disputes less intense (Westing 1993*b*; McManus 1994), or to ease the reunification of divided states.

Even apart from the management of resources, transboundary collaboration occurs among sovereign nation states where the interests of these states can be resolved without recourse to arms. Such collaboration has led to shared maritime zones among nation states along 33% of the possible 420 maritime boundaries (Blake 1993). Most of these are bilateral agreements and several have been in existence for more than 20 years. Other forms of close interstate collaboration are necessary for neutral zones, buffer zones, rights of transit, regional economic cooperation, watershed cooperation, and sharing of land resources such as minerals. Of these, the last two perhaps require the greatest coordination and cooperation administratively, and rights of transit and economic cooperation entail substantial interactions on economic matters.

Given the importance of collaboration on PAs, it is not surprising that despite all the difficulties in their creation, there were nearly 70 instances even in the late 1980s where some degree of collaboration over the management of PAs existed (Thorsell 1990). The first international transboundary PA was established when the Waterton Lakes National Park in Canada and the Glacier National Park in the USA were joined together symbolically in 1932. Since then, several such PAs with some collaboration between neighbouring countries have been established in Europe, Africa, South America, and Asia. Much of the growth in the numbers of transboundary PAs since the late 1980s (Table 1) has taken place in developing countries and Europe.

The existence of adjacent PAs across international boundaries is accompanied by different levels of cooperation among the governments of the contiguous states. Adjacent PAs can protect ecosystems and species on different sides of borders without any coordination among the states or the PA bureaucracies. When there are border tensions, boundaries may be militarized preventing even local contacts. A second situation is where there is little coordination at the level of the nation state, but local PA bureaucracies and resident populations maintain some interactions across the border. A third level of cooperation is achieved when countries establish their PAs in conformity to international plans and share information, but continue to manage independently. These three levels of cooperation can be seen as various degrees of independent management, with a potential for joint management (L. S. Hamilton *et al.*, unpublished data 1998). It is primarily beyond this level of cooperation that adaptive management techniques become feasible. Such techniques differ significantly from conventional management (Table 2).

Given the objectives of adaptive management, trying to follow related strategies almost certainly necessitates greater sharing of information in the context of PAs, so as to create a knowledge base from which management options can be devised. But adaptive management requires cooperation beyond information exchange. Because the rationale for adjacent transboundary PAs is the joint protection of ecosystems that are arbitrarily divided by political lines, it follows that independent management of neighbouring PAs is unlikely to allow much gain from adaptive management. At least two additional levels of cooperation that facilitate adaptive management can be envisaged. In the first, countries continue to own their territories, but carry out joint implementation of protection measures including approval of travel across the border for surveys, research, anti-poaching measures, fire management, creation of buffer zones, and administration of buffer zone programmes. In such a situation, local populations can be involved closely in the management of the PAs. Allocation of funds for creating alternative, non-agricultural sources of incomes for local populations can also occur jointly. The greatest level of cooperation would take place when the land for the PAs is contributed to an international PA, managed by a single agreed-upon authority that includes staff from each partner country (see also MacKinnon 1993, p. 83). These latter levels of collaboration can be called 'cooperation for adaptive management'.

Table 1 Regional growth of transfrontier protected area (TPA) complexes since 1988 (adapted from Zbicz & Green 1997, p. 3).

Region	*Number of TPA complexes in 1988*	*Number of TPA complexes in 1997*
North America	5	8
Central and South America	7	24
Europe	20	45
Africa	20	34
Asia	7	25
Total	59	136

Table 2 Conventional versus adaptive management objectives of policy analysis (adapted from Walters 1986).

Conventional	*Adaptive*
(1) Seek precision in predictions	Uncover range of possiblities
(2) Build models based on detailed understanding	Model from experience, and aggregate responses
(3) Promote scientific consensus	Highlight alternatives and tradeoffs
(4) Emphasize short-term objectives	Promote longer-run goals
(5) Seek certainty and control	Emphasize learning and feedback
(6) Seek productive equilibrium	Learn from interactions; expect change and emergent properties.

Greatest benefits from adaptive management in transboundary PAs occur when there are high levels of cooperation. But it is precisely this form of cooperation that is the most difficult. Even in terms of economics, there are significant limits on finances available to undertake transboundary management. But in considering the feasibility of adaptive management for transboundary PAs, three sets of questions need attention: these are, namely environmental, political, and economic. The first question is whether a transboundary PA is appropriate on environmental grounds? That is to say, is it necessary to have a PA on more than one side of a border? Two, what are the political factors that facilitate or hinder the formation of a tranboundary PA? Finally, we must consider whether adaptive management techniques provide greater insights or benefits in comparison to traditional strategies of protection (Table 2).

In principle, adaptive management techniques can improve the management of even those PAs that aim only to provide suitable habitats for ecosystem and species protection. But such techniques are more likely to be considered and adopted when PAs are used for some additional benefits or where there is some significant level of human use of the PA. Such uses can be tourism, limited harvesting of fodder and firewood, or extraction of other renewable products from the PA for local residents. Some of these points about the feasibility and desirability of adaptive management in transboundary PAs can be clarified with the help of a concrete example.

The Bialowieza National Park and Biosphere Reserve in Poland and Belarusia

The Bialowieza PAs comprise nearly 150 000 ha on the two sides of the Polish (62 500 ha) and Belarusian (87 500 ha) border. Both these PAs, like many others, began as royal hunting reserves. The Polish PA was declared a Biosphere Reserve in 1977 and a World Heritage Site in 1979 (Okarma *et al.* 1996, p. 167). The Belarusian side became part of a Man and Biosphere Programme in 1993. With a level of biodiversity that is still not fully investigated and is among the highest in Europe, this is one of the earliest examples of transboundary PAs in Europe (Okolow 1986). Several conservation regimes characterize the area under the two PAs: from strict protection to managed forestry.

Tree stands in the strictly protected part of the PA on the Polish side are mainly deciduous species, while on the Belarusian side, the natural dominant tree stands are mixed conifers. The Polish part has witnessed a much higher intensity of exploitation and plantation in comparison with the Belarusian forests. The average level of timber harvests in the Polish PA (3.05 m^3/ha) is nearly four times that in the Belarusian area (0.82 m^3/ha) (Okarma *et al.* 1996, p. 169). In terms of animal species, there are 54 species of mammals and more than 230 species of birds in the Bialowieza region (WCMC 2000). The Polish part has a high density of ungulates such as red deer (*Cervus elaphus*), moose (*Alces alces*), roe deer (*Capreolus capreolus*), and wild boar (*Sus scrofa*), and their hunting is permitted. The numbers of European bison (*Bison bonasus*) are kept in check through culling (Krasinski 1978, 1990; Sokolowski 1983), and a breeding programme was the first area of cooperation between the Polish and the Soviet authorities (on the Belarusian side) as early as 1961. Recently there have been some claims about the abundance of the bisons being too high and leading to damage to tree stands (Okarma *et al.* 1996).

Although a great deal of research has been carried out on the PA, it is only in the past few years that researchers, with support from the Global Environment Facility (GEF), have really begun to focus on transboundary interactions among wildlife species (both ungulates and carnivores), and plants. PAs on each side of the border have their own research establishment and bureaucracies, and until 1993, there was little cooperation across the border. Earlier research across the border is also hard to compare owing to the different methods that have been used. A two-metre high fence still continues to divide the PAs along the national border, and acts as an artificial barrier to animal movements. Since 1993, however, cooperative projects have been launched with the help of GEF funds to investigate migration patterns of the European Bison, collaborate for GIS mapping and gene bank establishment, study the impact of human activities in the PAs (GEF 1992*a*, pp. 70–71), and examine the migration and range of wolves (*Canis lupus*) and lynxes (*Felis lynx*) (GEF 1992*b*, p. 16, 18). A protocol also permits PA employees to visit either part of the PA without border passes. However, some problems are also visible; together with GEF funds to promote scientific collaboration across the borders, the Polish government is also seeking loans from the World Bank to develop its forest industry with the prospect that logging pressures in the Bialowieza forest are likely to intensify (Adhemar 1995).

General arguments about transboundary PAs are represented in this case study in a number of ways. The sovereignty of the two nation states prevented much cooperation before 1993. Even the movement of animals across a habitat that constituted a single ecosystem remains restricted owing to the physical barriers that demarcate national boundaries. In terms of cooperation, whether the issue was data collection or management, the PA services of the two countries operated more or less independently. Their different management strategies are reflected in varying densities of different plant species and wild animals, and in the type of interactions among the different animal and plant species.

However, the existence of a transboundary PA is certainly justifiable on environmental grounds. The amount of land set aside as the core of the PAs is limited on both sides of the border. By allowing animals to range over the entire extent of the PAs, it would be possible to provide a larger undisturbed habitat for carnivorous animals such as the wolf and the lynx. Over the past few years, GEF aid has made it possible to cooperate in the arena of data collection and the movement of PA officials across the national boundary that divides the transboundary PAs. However, for adaptive management

techniques to be adopted in the PAs, more careful data collection and analysis, and even more importantly, collaboration between resident populations and officials across the international boundaries are necessary. Whereas standard arguments for better management of the PA require further exclusion of local residents, and planting of new stands of trees (Breymeyer & Noble 1996), these strategies are unlikely to be prescribed were an adaptive management approach to be adopted. For adaptive management, it may be more useful to gather information from local residents around the PA to gain a better understanding of carnivore–ungulate–plant interactions, rather than advocate new plantations or limit the number of wild animals. The costs of such data collection can be greatly reduced by the involvement of local people. Further, because local people can be expected to have a long-term interest in the sustainable management of resources in the PAs, their meaningful involvement would also help local officials gain a longer-term view of PA management. The attempt to promote ecological farming in the buffer zone of the transboundary PAs can be seen as a step in this direction (GEF 1992*a*, pp. 59-65).

One of the primary factors that affects the feasibility of using adaptive management techniques is the extent of linkages across the different levels of administration that are involved in the management of the PA: from the top management to the local residents. In this sense, community-based conservation, of which efforts to involve local populations in PA management are an example, can be seen as a unique opportunity to deploy adaptive management techniques for PAs. The potential and need for involving local residents and loosening central control in the management of transboundary PAs is even greater. If local officials and populations have some leeway in defining the terms of their cooperation, broad-based collaboration in information collection and management can proceed even when central government officials across a border become uncooperative.

Conclusion

One of the main thrusts of this paper is for greater attention to how various levels of management in a given system connect with the aims of adaptive management. While nation states and regional actors can make decisions at the spatial scale necessary for transboundary PA management, their temporal horizons are far more limited than the typical time span over which returns from management can be expected, especially in democratic systems. Their ability to collect data at low cost is also limited. On the other hand, local residents are far more likely to have the kind of longer-time horizons that are necessary for adaptive management. Their involvement in research can also assist low-cost data collection. If local residents are drawn into the management of transboundary PAs on grounds of adaptive management, on-ground cooperation across the border can proceed even in the presence of some level of tension between the relevant states. It is necessary, therefore, to design institutional arrangements that have space for local residents and their representatives to contribute to management objectives, implementation, and enforcement. Such institutional arrangements have the potential to generate far better information for adaptive management. Involvement of local residents can also help extend the time horizon over which managers make decisions. Finally, representative and accountable institutional arrangements that encourage the participation and aggregation of multiple interests can help overcome the problems associated with the diffuse nature of local residents and communities.

A second inference of the paper is that promotion of adaptive management depends upon and furthers the likelihood of greater collaboration among the nation states in whose territories PAs lie. Much of the existing work on transboundary nature conservation indicates how such initiatives can further international cooperation. Adopting the principles of adaptive management is likely to impress upon the collaborating parties that independent management of adjacent PAs is insufficient to gain the greatest possible benefits from protection. It is only by building management models of social and ecosystemic interactions and processes that characterize transboundary PAs, by taking into account the information gathered by the different sides across the borders, by jointly implementing the implications derived from these models, and by involving local communities in these activities that we can begin to realize the full potential of adaptive management for transboundary protection of resources.

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