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## Transboundary Natural Resource Management: An Overview

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*Millions of people depend on the African continent's renewable natural resources for food, shelter, medicines, and fuel — and as a means of income generation. Natural systems also provide ecological services such as water supplies, soil protection and fertility. In addition, they have broader values—such as cultural heritage and intrinsic values. However, international boundaries cut across many natural resource systems, which can have serious management implications.*

International border areas contain some of the most intact ecosystems in the world, many of which are located in remote and inhospitable areas (Westing 1998; Griffiths 1995). However, international borders are political, not ecological boundaries. Consequently many key ecological systems and components are dissected by borders (see Maps 1-9), and may be subject to different management and land-use practices across borders. Sometimes these practices are incompatible, damaging the resource base and causing hardship to stakeholders. In these cases, to ensure that present and future generations can have sufficient access to natural resources and thereby secure their livelihoods, the management of water catchments, ecosystems, and migratory wildlife must become more compatible and participatory across local, national and international levels. Planning and management should take into account the ecological, sociocultural, economic, political and institutional concerns of stakeholders across national boundaries.

Over the last few decades, management of natural resources and biological diversity has moved from a site-level focus toward broader landscape approaches. This has been

accompanied by growing interest in transboundary natural resource management (TBNRM), particularly over the past decade. The TBNRM concept means different things to different people, and there are many different incentives for involvement in transboundary initiatives and activities. This publication shares experiences and current understanding of TBNRM in Africa and presents an overall continuum for TBNRM as well as practical guidance. Since it is not always easy to determine when a TBNRM approach is appropriate (e.g., having a natural resource in two adjacent areas across a border does not automatically mean that TBNRM will provide the most effective management), the publication also aims to provide more clarity on that front. Recognizing that TBNRM is a relatively new discipline, the reader should see the publication as one step in the longer-term development of thinking and understanding to further the TBNRM process and its application.

Given the broad origins of TBNRM, this chapter gives a brief history before moving on to provide a definition of TBNRM and outline a continuum of types of TBNRM initiatives. Different groups of stakeholders are interested in TBNRM activities for different reasons, such as economic development, strengthening of sociocultural ties, political stability, or sustainable management of natural resources and ecological processes. In an appropriately holistic and effective process, all these interests need to be taken into account. Since the main audiences for this publication are natural resource managers and conservation practitioners, the publication uses this as the entry point and rationale for instigating TBNRM.

## 1.1 A Brief History of Transboundary Interests

**M**any local communities have been implementing TBNRM at a local level for a long time, which is not surprising since cultures often straddle international borders. Borders often dissect ethnic groups and the traditional natural resource management systems which were in place before colonial boundaries were imposed (see Box 1.1). International politics have in some cases eroded these traditional systems. Metcalfe (1999) provides an overview of components of community-based natural resource management (CBNRM) that are relevant in the context of TBNRM, as well as opportunities and constraints for TBNRM from a community perspective. Provided principles such as efficiency, equity and sustainability are met, single-country CBNRM approaches near borders could develop into TBNRM initiatives. A shared identity with neighboring communities is one of the key elements for restoring or building collaboration across a border.

The Albert National Park was the first park crossing international borders in Africa, established by the Belgian colonial regime in 1925 to conserve natural resources occurring in two nations. It spanned the colonial states of Ruanda-Urundi and the Congo.

### Box 1.1 Transhumance in West Africa

Traditional land-use systems in West Africa are to a large extent determined by climatic conditions. Average annual rainfall and variation in rainfall within and between years determine the type and organization of land-use systems. As a strategy to deal with this high rainfall variation, pastoralists move around extensively with their herds. Centuries-old mobile livestock systems make use of resources in (semi)arid and more humid zones, varying routes depending on resource availability in different areas. However, opportunities for herders to move around with their livestock have decreased over time, as a result of the conversion of pastures and transhumance passages into agricultural lands. It also has become more difficult for pastoralists to cross international borders, notwithstanding existing bilateral or regional agreements securing transboundary movements of livestock through stipulating issues related to vaccination, places of entry and departure, grazing zones, etc. In extreme cases, conflicts between local residents (farmers) and foreign herders reach the government level and put pressure on international relationships. Overall, the viability of these transhumance systems is becoming more limited because key resources no longer exist or are becoming less accessible.

*Source:* Lycklama à Nijeholt *et al.* (2001).

After independence in the early 1960s, the Rwandan part became Parc des Volcans (Volcanoes National Park), while the Congolese part became Virunga National Park (Wilkie *et al.* 2001).

The world's first International Peace Park was established in 1932, linking Glacier National Park in the United States with Waterton Lakes National Park in Canada. A Memorandum of Understanding (MOU) exists between the park departments of both countries, and management is implemented through a combination of internal and transboundary management activities. The two parks are largely managed separately; they cooperate on joint nature tours, search-and-rescue operations, and fire management. Prior to that Poland and Czechoslovakia had signed the Krakow Protocol in 1925 to set a framework for establishing international cooperation to manage border parks (Thorsell 1990). The first of these parks, however, was not established until after 1945.

The number of Transboundary Conservation Areas (TBCAs) grew gradually in the second half of the twentieth century until around 1990, at which point it started to increase rapidly. By 2001 the number of identified adjoining protected area complexes had more than doubled since 1990, to 169 in 113 countries including 667 individual protected areas (see Table 1.1). As of 2001, in Africa alone there are 35 complexes involving 34 countries and including 148 individual protected areas (Zbicz 2001). With this increasing interest—and building on a meeting held in 1995 by the IUCN's World Commission on Protected Areas (WCPA) and Australian Alps National Parks—

**TABLE 1.1 — INTERNATIONALLY ADJOINING PROTECTED AREA COMPLEXES  
IN AFRICA AND WORLDWIDE**

	<b>Number of protected area complexes</b>	<b>Number of countries involved</b>	<b>Number of protected areas involved</b>
Worldwide	169	113	667
Africa	35	34	148

IUCN/WCPA generated materials outlining guidelines for Transboundary Protected Areas at three meetings convened in Somerset West, South Africa (1997), Bormio, Italy (1998) and in Gland, Switzerland (2000) (Sandwith *et al.* 2001). On April 7, 1999, the first post-colonial African Transfrontier Park was created when Botswana and South Africa signed a bilateral agreement for the Kgalagadi Transfrontier Park. The whole area is to be monitored by a new Kgalagadi Transfrontier Park Foundation; a joint management agency will implement some activities jointly, and others will be done by each nation independently.

At the same time, integration of economic development on a regional level has become more and more important across the world, particularly over the past two decades. In Africa this is seen in the development of regional institutions such as the Economic Community of West African States (ECOWAS), Central African Economic and Monetary Community (CAEMC), the revived East African Community (EAC) and the Southern Africa Development Community (SADC). As expressed by SADC (1994, p. 3), *regional cooperation is not an optional extra; it is a matter of survival*. While the primary reasoning for the establishment of these institutions is economic development, given people's dependency on natural resources, increasing attention is being given to integrating broader environmental concerns and natural resource management under these agreements. As concluded, for example, in the Biodiversity Support Program's study on TBNRM in Southern Africa, the potential for nature-based tourism there is very high in a transboundary context, and as yet under-exploited (Griffin *et al.* 1999).

This increased interest and need for TBNRM is in line with broader landscape priority-setting exercises developed and undertaken during the past few years by international conservation organizations and others, which recognize the ecological need to work on larger scales (WWF-US in press). This work highlights the strong correlation between areas of high biodiversity value and proximity to international boundaries. All this increased interest is also reflected in the incorporation of transboundary aspects in certain international conventions, and a number of regional and African conventions and agreements

## Box 1.2 Development of TBNRM Approaches in Regional and Global Conventions and Agreements

There are a number of formal regional and global agreements and conventions that contain sections calling for transboundary collaboration. There are also others that are primarily set up to facilitate transboundary collaboration between two or more nations. A number of these are mentioned here, regardless of current level of implementation or enforcement.

Early formal evidence in Africa of the need for transboundary collaboration lies in the African Convention on the Conservation of Nature and Natural Resources (Algiers) signed in 1968. The Algiers Convention calls for consultation between upstream and downstream states on water issues. Following Algiers, the Ramsar Convention (Convention on Wetlands of International Importance, especially as waterfowl habitat, 1971) requires interstate consultation on matters affecting shared wetland resources. Ramsar was followed by the recognition of international identification and stewardship of natural resources in the World Heritage Convention (Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972), which called for international recognition and support of cultural and natural heritage sites. And finally, the Convention on International Trade in Endangered Species (CITES), signed in 1973, requires participatory states to conform to specified interstate practices for trade in listed threatened species. These four conventions foreshadowed the broader use of TBNRM principles in treaties to come.

The late 1970s saw the Convention on the Conservation of Migratory Species (Bonn Convention, 1979) calling, for example, for the prevention of obstacles to migration, coordination of antipoaching efforts, and exchange of information. Interstate cooperation moved beyond migratory species in the 1985 Nairobi Convention for the Protection, Management and Development of Marine and Coastal Environment of the Eastern Africa Region. The Nairobi Convention calls for international cooperation on the development of marine and coastal resources and for the protection of migratory, so-called fly-over species, as well as the protection (under international and NGO supervision) of an entire swath of coastline shared by the signatory states.

Around the mid-1990s the full application of TBNRM principles started on an interstate scale. The Convention on Biological Diversity (CBD, 1992) established an ecosystem approach to managing resources, formalized consideration of resources in adjacent countries, and called for the involvement of all relevant sectors of society and science. The United Nations Framework Convention on Climate Change (1992) and Convention to Combat Desertification (1994) express similar principles. In 1994 and 1996 the Agreement on the Conservation of African-Eurasian Migratory Waterbirds and the Conference on Central African Moist Forest Ecosystems were opened for signing and ratification, representing more stringent procedures for international supervision of wetlands and moist forest ecosystems respectively.

A more complete list of conventions, along with their articles relevant for TBNRM, can be found in Annex 1. The annex is not a comprehensive list, but a representative sampling of treaties.

(see Box 1.2). Investment by both bilateral and multilateral donors in TBNRM initiatives has also increased.

Building on national activities, originating from regional institutions, or stimulated by international conventions or interest by donors and international NGOs, many trans-boundary initiatives are now being planned or underway. The Biodiversity Support Program (BSP) initiated a study on TBNRM in Southern Africa in 1998 at the request of USAID's Regional Center for Southern Africa. This was later on expanded to include West, Central and Eastern Africa, and an overall pan-African analysis. Results of this work are reflected in this publication. Box 1.3 shows some similarities and differences in TBNRM-enabling conditions and developments among the four regions.

### **Box 1.3 TBNRM Development in African Regions**

The Biodiversity Support Program's TBNRM project undertook reviews of TBNRM development in each of the four regions in Sub-Saharan Africa (see Map 2). There are many important similarities but also differences in the circumstances and degree of TBNRM development in these regions.

General similarities in circumstances across the regions include the fact that many border areas are relatively remote, sparsely populated and less developed compared to the interior of the countries. People living near the borders are thus particularly dependent on natural resources for their livelihoods. Often their ethnic groups have been divided by political borders, and they may be marginalized because of their remote location. Ecosystems in border areas are often cut by artificial boundaries as well. Many protected areas are located in border areas (see Map 7). Hence in many countries there are important natural resources and biodiversity concentrated near borders.

None of the regions is homogeneous. There is tremendous variation among countries within regions in terms of country size; population density; degree of economic development; amount of remaining intact vegetation cover, natural resources and biodiversity, and pressure on them; warmth (or as the case may be, chilliness) of diplomatic relations with neighboring countries; and degree of economic collaboration. All of these factors affect the opportunities, constraints and enabling conditions for TBNRM.

TBNRM has been occurring at the community level ever since political borders were imposed by colonial powers, in places where traditional management systems dissected by borders have not been eroded by international politics. TBNRM still occurs at an extensive scale in the range management practiced by transhumant pastoralists in Eastern and West Africa, and on a more intensive and local scale in many other resource systems in all the regions. However, traditional management systems have become increasingly constrained by political and national economic forces in many areas.

*Continued on page 8*

Transboundary collaboration among government organizations has been more limited. Informal collaboration has occurred for decades in a few transboundary protected areas, for example in certain adjacent protected areas in Southern and West Africa. In some cases this is being formalized in agreements among governments. Agreements exist in many regions on the management of water resources. Collaboration on animal health, transhumant pastoralism and control of desertification occurs in West Africa, and on many economic development and natural resource aspects in Southern Africa through the Southern Africa Development Community.

In the field of official government transboundary collaboration over wildlife management, Southern Africa is furthest ahead with several large TBNRM projects in place. Threats to wildlife are serious in the region, but in turn opportunities are significant because of the great potential for regional tourism development. TBNRM is occurring as part of a wider regional economic development rather than in isolation. This combination of factors has enabled the region to move ahead rapidly with TBNRM. In West Africa opportunities for developing tourism based only on wildlife are more limited; for this reason there is consideration of combining wildlife with cultural tourism. There is a great deal of interdependence between the Sahel and the coastal areas in terms of livestock production in transhumant systems in the north, and meat markets in the more populous south.

In Central Africa there is much less regional collaboration. In much of the region there are still very large blocks of relatively intact forest, and the need for TBNRM is not as great, except in areas of very high pressure and with high resource value, such as in the Virungas where successful TBNRM is carried out to conserve mountain gorillas. In Eastern Africa there has been relatively little transboundary wildlife management, despite the connectivity across borders and the high potential for cross-border tourism in East Africa. The newly revived East African Community may change this situation in that part of the region.

Some initiatives include two or more regions—the Nile Basin Initiative, for example, involves 10 countries from Central, Eastern and North Africa.

*Sources:* Griffin *et al.* (1999), Lycklama à Nijeholt *et al.* (2001), Rodgers *et al.* (2001a), Wilkie *et al.* (2001).

## 1.2 TBNRM Definition and Continuum

**T**he increase in TBNRM activities is motivated by multiple interests, involves multiple actors, and has various origins. It is not always clear what is meant by TBNRM. The following sections provide a definition for the term as used in this publication and outline a continuum for TBNRM.

## 1.2.1 TBNRM Definition

The definition of TBNRM, as it has evolved and been used in this study, is presented in Box 1.4. TBNRM is defined in such a way that it covers a broad continuum of initiatives and approaches, while being focused enough to share practical experiences and guidance from the specific angle of natural resource management and biodiversity conservation. Note that TBNRM refers to the management process rather than the transboundary natural resources themselves. Resources may be shared across a boundary, but if there is no collaboration, there is no TBNRM. As defined, TBNRM only makes sense if it increases the effectiveness of attaining the goals. In all other cases it would be hard to justify the efforts and expenses needed.

While the actual implementation of TBNRM often takes place at a specific site (a TBNRM Area—or TBNRMA) through transboundary activities, TBNRM is broadly defined as a *process* of NRM across boundaries. The focus of this document is mainly on the process. It emphasizes the need for flexibility when applying this approach. **There is no blueprint model, and the experiences documented and guidance provided should be put in that context—each situation is unique, and requires its own flexible process and approach.**

Two additional notes apply to this definition. First, given the nature of certain goals such as conservation of migratory species (e.g., lesser flamingos) or ecosystem functions, sites concerned may not necessarily be *contiguous* across the boundaries (see Box 1.5), but the process of TBNRM may still be relevant. In most cases, however, examples are drawn from contiguous areas. Second, given the multiple use of certain transboundary sites and the multiple interests of different stakeholders, numerous parties may be *involved for different reasons* (ecological, social, economic, political and institutional). Potential opportunities provided by TBNRM and related to these different reasons are listed in Section 1.3.

In order to take full advantage of these opportunities, and for natural resource managers to be effective in the long term, it is essential to have an open mind and a broad vision on TBNRM—hence the presentation of an overall continuum within which TBNRM can be applied.

## 1.2.2 The TBNRM Continuum

Using the definition above, the TBNRM process is applicable in a broad continuum of natural resource management and conservation strategies as reflected in Figure 1.1. The continuum ranges from Transboundary Protected Areas (TBPAs) at one end, to large regional economic development plans and activities that integrate NRM and biological diversity conservation objectives at the other end. While certain approaches are listed at points along this continuum, they should not be seen as separate, discrete entities—in

## Box 1.4 Transboundary Natural Resource Management (TBNRM) Definition

**TBNRM is any process of collaboration across boundaries that increases the effectiveness of attaining a Natural Resource Management or Biodiversity Conservation goal(s).**

- “Across boundaries” — in the broadest context, this term covers transitions across geographical, legal and land-use borders. While this is relevant in the overall context of TBNRM discussions, this study has limited itself mainly to situations across international borders.
- “Collaboration” — an actively, consciously decided way of working with partners on the other side of the boundary; the process through which TBNRM manifests itself.
- “Increases the effectiveness of attaining” — obtaining the maximum NRM or conservation payoff for every unit of investment; investment can be in staff time and other resources (including but not limited to financial resources).
- “Natural Resource Management or Biodiversity Conservation goal(s)” — Goals can be defined in terms of:
  - species productivity and species and genetic diversity;
  - habitat and its productivity; or
  - ecosystem functions and services.

Goals are to be achieved at a particular site as agreed by, and to the benefit of stakeholders. Areas where TBNRM is applicable span conservation areas with solely biodiversity conservation goals, water-based systems (rivers, lakes, wetlands), and pastoral and agricultural land-use systems that include natural resource management goals.

practice they are often applied in combination with the other strategies at different points on the continuum. Each situation has its own specific mix of complementary strategies, depending on types of land use, juridical and tenure arrangements, and the different actors involved.

While this publication aims to provide general guidance on the application of the TBNRM process across this continuum, other organizations have recently developed guidance for specific approaches. The World Conservation Union (IUCN) coordinated the development of concepts and guiding principles for TBPA for Peace and Cooperation (Sandwith *et al.* 2001). It provides a working definition for Parks for Peace, consolidates guidelines for transboundary cooperation in protected areas, and presents a Draft Code for Transboundary Protected Areas in Times of Peace and Armed Conflict. UNESCO developed the Man and Biosphere (MAB) Seville 5+ Recommendations for the Establishment and Functioning of Transboundary Biosphere Reserves (TBRs) (UNESCO 2000), which describe procedures for the establishment of a TBR, its functioning and relevant institutional mechanisms, all in the context of the goals of the Seville Strategy.

### **Box 1.5 Transboundary Management of Migratory and Ranging Species**

Animals do not respect borders unless they are forced to—by fences, for instance. Some terrestrial species such as elephants range over large areas and frequently cross international borders. Access to critical areas at certain times of the year for adequate food, water, shelter and breeding sites within the range of a species is essential for its survival. Some areas may only be used in extreme years: for example, Kalahari wildebeest traditionally move farther in very dry years to seek perennial water sources. Transboundary planning should take these needs into account, and aim to maintain access for migratory and ranging species to critical sites and resources across borders, including those needed in extreme years. Requirements during El Niño and La Niña years may be a useful guide for the latter. Land-use plans on both sides of a border should include viable corridors linking resources if traditional ranges are encroached by other land uses.

Sustainable harvesting of migratory and ranging species poses extra challenges. There is less sense of ownership of a resource that is only present at certain times of the year, and that may be used by others elsewhere. However, when the resource is under pressure, collaboration over quota setting and enforcement is essential to prevent the loss of the resource. There is probably more experience in transboundary management of shared fisheries than terrestrial species.

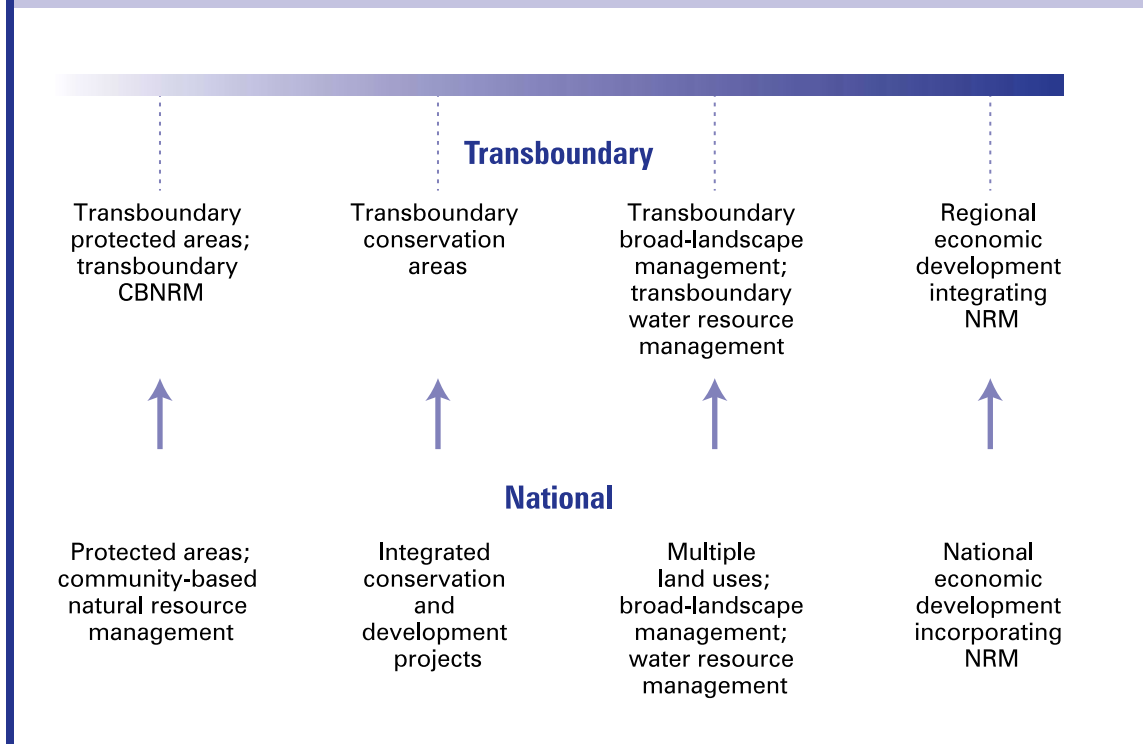
A different form of transboundary management may be needed for species that swim or fly between noncontiguous sites in mainland Africa (e.g., turtles, migrating African and Palearctic wetland birds). In this case it is important to maintain habitat in the mainland sites to meet their needs, and control threats such as excessive harvesting. This is much easier for species that use a few very specific sites at high density, such as flamingos, than for species that migrate over a broad front and occur at low densities. There are very clear in-country roles for each country involved, to conserve sites they have jurisdiction over and limit threats there. However, international collaboration is important for activities such as inventories (e.g., pan-African census), pooling of expertise and helping to build capacity. Where one country poses a threat to the resource, the other countries may be able to take action to encourage changes in the problem country. International conventions can play an important role here.

Wetlands International is planning a GEF-funded capacity-building project to support conservation of critical wetlands along the African/Eurasian migratory waterbird flyway, to assist the countries concerned to implement the Ramsar Convention and the Convention on the Conservation of Migratory Species of Wild Animals. The project will review training, communication, management and gaps in protected areas along the flyway, and identify best practices. A capacity-building program will follow, including demonstration site-management projects. Participating countries in Africa are likely to include Mauritania, Niger, Nigeria, The Gambia, Senegal, South Africa and Tanzania.

(with contributions from David Olson, WWF-US; Anada Tiéga, Ramsar Convention Secretariat; Holly Dublin, WWF International; and Peter Jones, University of Edinburgh)

For some of the other approaches across the continuum no specific guidance has been developed (for example, there is none for integrating TBNRM into regional economic initiatives/projects). While the latter approach is mainly driven by national governments' and donors' priorities to alleviate poverty, and by private sector investment,

**FIGURE 1.1 — TRANSBOUNDARY NATURAL RESOURCE MANAGEMENT CONTINUUM**



it is very important that it is linked to people’s dependence on natural resources. An integrated and holistic approach is required. Given the scale and anticipated impacts of these regional economic developments on the landscape in the coming decades, natural resource managers and conservationists should not only be aware of these developments but become more strategic about getting engaged in these processes and mainstreaming conservation. They should become involved in discussions and development of plans, and collectively increase and improve the understanding and approaches toward these developments over the coming years.

### 1.3 Potential Transboundary Opportunities

Given the multiple use of certain transboundary sites and the multiple interests of different stakeholders, numerous parties may be *involved for different reasons* (ecological, social, economic, political and institutional). Potential opportunities provided by TBNRM are outlined below. Note that not all opportunities will be relevant in each case. Constraints to TBNRM are covered separately in Section 2.7. [Sources for listed opportunities: Biodiversity Support Program (1999), Cumming (1999), Griffin *et al.* (1999),

Lanjouw *et al.* (2001), Lycklama à Nijeholt *et al.* (2001), Magha *et al.* (2001), Metcalfe (1999), Muruthi and Frohardt (2001), Rodgers *et al.* (2001a), Rodgers *et al.* (2001b), Sandwith *et al.* (2001), Shambaugh *et al.* (2001), Steel and Curran (2001), Wilkie *et al.* (2001), David Olson, WWF-US (pers. comm.)].

### **Ecological Opportunities**

- Maintain linkages in ecological landscapes that cross borders to maintain ecological processes and functions (e.g., hydrological systems, biological corridors, animal migrations (see Box 1.5), wild animal access to critical resources, flow of genetic material) and as a strategy to approach anticipated impacts of climate change (see Box 1.6)
- Re-establish key linkages previously disrupted by political borders (e.g., restoring migrations disrupted by border fences, repopulation of species devastated on one side of a border during war)
- Enable an increase in the size of land under ecologically sustainable management
- Ensure appropriate use of marginal land in border areas to promote economic development and prevent environmental degradation (e.g., safari hunting, transhumant pastoralism)
- Reduce transboundary threats to promote sustainable use of natural resources (e.g., through collaborative control of resource exploitation and trade, control of invasive species, integrated river basin management, fire management, livestock and range management for transhumant pastoralists)

### **Social and Cultural Opportunities**

- Facilitate formal contact and cooperation between divided communities, renewing cultural ties that have been severed by the boundary
- Help to legalize cross-border movement
- Strengthen marginalized groups located in border areas
- Increase opportunities for communities through improved social security and welfare, for example by strengthening of community property rights and increasing natural resource value and income-generating options for communities

### **Economic and Financial Opportunities**

- Exploit underused tourism potential for economic development (e.g., development of multi-country destinations to increase the variety of attractions, or use of infrastructure such as an international airport in a neighboring country to improve access)
- Make use of existing and developing regional economic opportunities that can provide incentives to invest in TBNRM activities (e.g., spatial development initiatives in Southern Africa)

## Box 1.6 TBNRM and Global Climate Change

Although Africa contributes relatively little to global climate change in terms of gas emissions, it is extremely vulnerable to it (Biodiversity Support Program 1992). Climate change predictions suggest profound changes in Africa, affecting water resources, food production, human health, desertification and coastal zones. The frequency of extreme weather events—particularly droughts and floods—is likely to increase. A synergy of land-use and climate change will exacerbate desertification (Intergovernmental Panel on Climate Change Working Group II 2001).

While wild species and natural systems have evolved in fluctuating conditions and have a certain amount of resilience and adaptability, they require space and time to adjust. Some of the space they need is across international boundaries. For example, in extreme weather events such as floods and droughts, ranging and migrating animals need temporary access to areas with suitable conditions for them. Temperature rise will cause more permanent altitudinal shifts of species and vegetation types up slopes, mountains, escarpments and river valleys (if plant and animal species can disperse and re-establish fast enough and maintain complex ecological interrelationships). It is therefore very important to maintain landscape linkages—along temperature and rainfall gradients, among different vegetation types in a landscape, and along critical corridors to refugia from extreme events—so that species have space to adapt to these changes. Ecotones and vegetation boundaries are particularly important areas.

As natural systems and species come under increasing stress from climate change, they will be more vulnerable to other stresses. For example, coral is more susceptible to bleaching from temperature rise if it is also stressed from other problems such as sedimentation, pollution and physical damage from tourists or dynamite fishing. Wildlife suffers more from extreme weather conditions if it is already confined in marginal areas and competing with livestock. Climate change is likely to cause profound changes in agriculture practices and settlement patterns. Natural systems will have to contend not only with existing human pressures and climate changes, but also with new pressures caused by climate change-induced alterations in land uses. Loss of genetic diversity in wild species further reduces chances for adaptation and acclimation. Natural resource managers should work to relieve stresses on natural systems wherever possible.

Some countries in Africa have already prepared climate change adaptation plans (e.g., Uganda; see Bwango *et al.* 2000). Since changes to natural systems and species distribution will occur across boundaries, it will be important to expand these plans to include trans-boundary elements. Natural resource managers should stay abreast of climate change prediction developments and early signs of climate change, and collaborate across boundaries as appropriate following the recommendations above to maintain ecological linkages and alleviate stresses. It is important to keep options open now for possible drastic changes later this century.

(with contributions from Kate Newman, Lara Hansen, Stephen Kelleher and David Olson, WWF-US; Barend Erasmus, University of Pretoria; and Peter Jones, University of Edinburgh)

- Increase opportunities for community-private sector collaboration and income-generating options for communities
- Use tourism development to fund conservation
- Benefit from politically correct “green image” for private sector investing in nature-related activities with high transboundary profile
- Enhance opportunities for free movement of people, goods, services and money
- Attract additional donor funding based on the opportunities TBNRM offers; tap into regional funding sources
- Channel funds flexibly, to the country/activity that needs them most at a particular time and where the opportunity for management impact will be greatest (e.g., as the International Gorilla Conservation Programme did in the Virungas)
- Make use of potential efficiencies and economies of scale by working across borders: e.g., sharing human, material and financial resources for control of illegal activities, research, monitoring and evaluation

### **Political Opportunities**

- Lay a foundation for deeper cooperation between neighboring communities and possibly nations, which can help to reduce tensions and conflicts, improve security for communities in border areas, and rebuild divided communities
- Promote global recognition of countries’ conservation efforts through the higher profile possible with transboundary management
- In case of armed conflict in a neighboring country, provide as much support as possible to promote sound natural resource management in border areas during and after the conflict
- Enhance transparency, representation and accountability in land and resource use decisions at national level, if international commitments are involved

### **Institutional Opportunities**

- Enhance the capacity of partners across the border to manage resources more effectively, e.g., through sharing of information and experiences, and through training
- Enhance the ability of organizations to respond more rapidly to changing situations (e.g., through joint monitoring)
- Develop structures that can effectively plan and guide sustainable development based on holistic natural resource management

