RURAL DEVELOPMENT FORESTRY NETWORK

BUFFERS AT THE BOUNDARY

John B Hall & W A Rodgers

Network Paper 13a Summer 1992

John B Hall is a Lecturer in Agroforestry at the School of Agricultural and Forest Sciences, University of Wales, Bangor, Gwynedd LL57 2UW, Wales, UK. ***W Alan Rodgers*** is a Chief Technical Advisor with FAO's Global Environmental Facility Project in Tanzania. He can be contacted c/o FAO, P.O. Box 3, Dar-es-Salaam, Tanzania.

ISSN 0968-2627 (formerly Social Forestry Network ISSN 0951-1857)

John B Hall & W A Rogers

RESUMEN

Este artículo revisa el concepto de `zona de amortiguamiento' en el contexto más amplio posible dentro del campo del manejo y de la conservación de los recursos naturales tropicales. Se refiere a ejemplos tanto de los trópicos húmedos como de los secos, y considera los modelos de zonificación para la regulación tradicional de los recursos (e.g. reservas forestales), así como para los nuevos parques nacionales y los santuarios de conservación de la naturaleza y la biodiversidad. El concepto de zonificación es abordado desde diferentes puntos de vista, incluyendo tanto a aquellos de la comunidad local y de las agencias de desarrollo, como al de las agencias de conservación y de protección de los recursos. También examina las implicaciones de la creación de recursos de árboles, usando la producción de rodales para ilustrar la escala de acción requerida.

Los autores están conscientes del creciente interés en las zonas de amortiguamiento. Consideran que deben de contribuir al éxito de la conservación en el futuro, incorporando mecanismos de apoyo de los pobladores dentro de los objetivos de conservación. Las zonas de amortiguamiento constituyen la interfase entre las actividades de la población local y las de las agencias de conservación. Debido a que estas actividades son generalmente incompatibles, se están dando conflictos cada vez mayores en las zonas limítrofes de las áreas protegidas. A pesar del interés suscitado en el mundo entero por las zonas de amortiguamiento, han habido pocos análisis críticos del concepto total, o evaluaciones de los éxitos y fracasos pasados. Revisiones preliminares sugieren que los experimentos en las zonas de amortiguamiento están todavía en una etapa de planificación o inicio de implementación. Este artículo amplía el análisis para cubrir un gran conjunto de situaciones.

RÉSUMÉ

Ce document fait le bilan du concept des `zones-tampons' dans un contexte aussi large que possible dans les domaines de la gestion et de la conservation des ressources naturelles tropicales. Il se réfère à des exemples pris dans les tropiques humides et secs, et examine les modes de zonage pour la réglementation des ressources traditionnelles (par exemple, les réserves forestières) et les parcs nationaux et les réserves zoologiques —plus nouveaux—créés en raison de leur rôle dans la protection de la faune et de leur bio-diversité. Le zonage est étudié à partir de plusieurs points de vue, y compris ceux des communautés locales et des bailleurs de fonds aussi bien que du point de vue des organisations plus courantes pour la protection et la conservation des ressources. Enfin, les conséquences de la création d'une ressource en arbres, utilisant la production de bois non équarri pour illustrer l'échelle de l'action nécessaire, sont examinées de façon succincte.

Les auteurs sont conscients de l'intérêt croissant lié aux zones-tampons et à la croyance selon laquelle elles aideront à fournir une réponse à une conservation réussie à l'avenir en permettant l'intégration de mécanismes populations-soutien ayant la conservation pour objectif. Les zones-tampons constituent donc l'interface réelle entre les activités humaines et celles de la conservation qui, compte-tenu de leur incompatibilité habituelle, ont parfois été reflétées dans une zone de conflit croissant à travers la zone limite protégée. D'une manière surprenante, en notant l'intérêt croissant au niveau mondial, il y a eu peu d'analyses critiques du concept d'ensemble ou peu d'évaluations des succès ou des échecs passés. Les bilans préliminaires suggèrent que la plupart des expériences dans le domaine des zones-tampons en sont encore au stade de la planification ou d'un début de réalisation. Le document étend l'analyse pour couvrir une gamme de situations plus vaste.

INTRODUCTION

This paper reviews the concept of `buffer zones' in as wide a context as possible within the fields of the management and conservation of tropical natural resources. We refer to selected examples from both the wet and the dry tropics, and consider patterns of zonation for traditional resource regulation (e.g. forest reserves) and the newer national parks and sanctuaries created for wildlife and biodiversity value. We consider zonation from several standpoints, including those of the local community and development agencies as well as the more usual conservation and resource protection agencies. Finally, we examine briefly the implications of tree resource creation in buffer zones, using roundwood production to illustrate the scale of action necessary.

We are conscious of the growing interest in buffer zones and the belief that they will help provide the answer to successful conservation in the future by allowing the integration of people-support mechanisms with conservation objectives. Buffer zones are thus the real interface between human and conservation activities which, given the usual incompatibility of these, has at times been reflected in a zone of increasing conflict across the protected area boundary. Surprisingly, noting the growing worldwide interest, there has been little critical analysis of the total concept or evaluation of past successes and failures. Preliminary reviews suggest that most buffer initiatives are still in the planning or early implementation stage (Oldfield, 1988; Sayer 1991). This paper extends the analysis to cover a broader set of situations.

A HISTORY OF THE BUFFER ZONE CONCEPT

Boundary issues in tropical natural resource management initially arose when areas of land were set aside as forest reserves - almost 150 years ago in India and more recently elsewhere. The boundary was supposed to
divert opportunistic exploitation to other areas, leaving within it an intact and viable forest stand. By the mid-1900s there was less resource available to growing human populations outside protected areas (PAs) and growing pressure on the PAs themselves. Boundaries, and the necessity of policing them, thus became of greater importance in the maintenance of the integrity of the PA (Troup, 1940).

For the first national parks and wildlife sanctuaries, which were set up rather later than the forest reserves, the role of the boundary was similar.

However, it was the wildlife conservation movement, not the forest managers, which developed more innovative thinking about the management of boundaries. Several factors contributed, the most important being the contrasting scales of resource. Forests were of thousands of hectares of trees and the collection of other produce was usually tolerated. Many wildlife areas were created as species populations reached dangerously low levels - a few tens of rhinos or larger carnivore, for example - and when further exploitation would be disastrous. Conservationists became increasingly concerned with total communities and the maintenance of total naturalness in their PAs. Resource exploitation by collection of fuelwood, fodder and smaller animals, for example, was seen as detrimental to the conservation goal. Foresters were concerned with maintaining sustainable supplies of one or a few species of timber tree — other species were of little importance and local gathering was not viewed with anxiety. In the wildlife context, it was

the search for greater protection of the faunal resource that led to the far greater investment in policing. When this measure proved insufficiently successful, the idea of boundary zoning schemes, often incorporating the concept of a `buffer' zone, developed.

The rapid growth of conservation interest since the 1960s has led to a proliferation of new PAs (Eidsvik, 1990; Green, 1991). Population growth and the shrinking extent of natural habitat meant that many new protected areas were fragmented by settlement and had an established history of resource use. The local populations could no longer be separated from the PAs by simple boundaries and increasingly vigorous policing. Solutions were seen to lie in a multiple land use concept. This concept was widely publicised for the first time through the Man and the Biosphere Programme of UNESCO (MAB, 1974). Foresters had long had a roughly equivalent multiple use system, as evidenced in India by the 3-tier Reserved Forest, Protected Forest and Unclassified State Forest hierarchy of forest estate, with each category respectively facilitating greater access and control for local communities, but the scheme was not widely advertised.

The underlying concern of the MAB programme which elaborated the zoning/buffers concept, was the preservation of genetic diversity, or biodiversity in today's terminology. Zonation would give graded control over what were termed `biosphere reserves', recognized as key protected areas in a global network of viable representative examples of the earth's ecosystems. These reserves would be complexes of natural, semi-natural and man-modified communities.

With biosphere reserves MAB provides for core zones for the areas of greatest biological value, and buffer zones for peripheral areas where protection need not be absolute but land use is constrained by regulations. From the conservation point of view a `core' zone may be defined as an area of high resource value set aside to be left in as natural a state as possible, with minimal exploitation or manipulative disturbance. The conservation view of the `buffer' zone is that of a peripheral zone where restrictions are placed on resource use or special development measures are taken to enhance the conservation value of the area (Sayer, 1991). Alternative definitions have emerged from others involved with buffer zones. Saharia (1983) opts for "a type of multiple use area from where the people could be provided forest products and uses". Brown (1992) offers another definition embracing the human element as beneficiary: "An area inside or adjacent to a protected area where a harmonious relationship between the natural environment and people is promoted".

BUFFER ZONES IN THE 1990s

The Rationale

Buffer zones are thus an integral part of the protected area concept, contributing to ability to conserve the biological and resource values within the PA: if there was not a PA there would not be a buffer zone. The overall goal of furthering the conservation of a resource is accomplished in two ways. Firstly, suitable habitat is provided around a relatively small PA core to allow species to extend their ranges over an area large enough for a viable population to be supported: Berkmüller & Mukherjee (1989) term this the `extension' function. Secondly, a sustainable supply of natural resources is made available to resident or adjacent people, reducing their dependence

on PA core resources — this is the `socio-economic' function. The challenge for the manager is to combine these functions in an effective way, matching the most sensitive aspects of the extension function with the lowest-intensity socio-economic impact and vice-versa.

Three broad categories of exploitation arise from this management situation. Concessions allow traditional gathering of renewable products from a buffer zone where it is accepted that this will not appreciably change the ecosystem. A typical example is provision for the local Iban people to farm, hunt and gather products in the buffer zone of the Lanjak-Entimau Wildlife Sanctuary, Sarawak (Sayer, 1991).

In less sensitive circumstances it is anticipated that there will be change within the buffer as local community development takes place: incentives rather than concessions apply here with better prospects of support inputs being available for appropriate initiatives. This is a philosophy only recently assuming prominence and very much part of enlightened modern thinking about land ownership issues and dialogue with the local community. In the Arfak Mountains Nature Reserve of Irian Jaya, Indonesia, the Hatan people collect forest produce from Nature Reserve Management Areas they have delimited on their land but, through outside assistance, benefit from development projects in an adjacent Community Development Zone. Conditions for assistance are that house building and gardening take place in the development zone and that the reserve management area boundaries are respected.

More drastic measures are undertaken in buffer zones where there is necessity to deflect pressure that is degrading the PA, or threatens to do so: in this instance alternative resources, such as fuelwood plantations, are created in the buffer zone. The potential of plantations in buffer zones is indicated (Berkmüller & Mukherjee, 1989) for Dudhwa National Park, Uttar Pradesh, India. At Dudhwa, local use is made of Eucalyptus stands although these pre-date the institution of the buffer zone and were not specially created and are no longer maintained.

The idea of organized interventions outside PAs specifically to achieve land rehabilitation to relieve pressure within is relatively new in application. It appears more usual to specify what is unacceptable activity and to encourage acceptable alternatives adapted from traditional practices where buffer zones lie inside PAs. External buffer zones offer wider scope but comment on these seldom appears in the literature unless linked to conditional support from agencies which publicise their activities. Comparable initiatives entirely due to local people mostly escape attention. Sayer (1991) nevertheless notes that land degradation around forest patches in the Maribios Range, Nicaragua, was halted when locally formed co-operatives integrated trees into the land use system in various ways and rehabilitated neglected coffee plantations.

In a few years some impact from co-ordinated tree planting and other sustainable agroforestry-based systems will be demonstrated. Meticulously planned, community-relevant land use with long term external support is being promoted in the Cross River National Park, Nigeria, under what is termed the Support Zone Development Programme — so named to stress its purpose of supporting the community rather than its defence of the park core (WWF, 1989, 1990). Sayer (1991) cites another example where wide-ranging activities are being encouraged with inputs from outside the local community — the Cyclops Mountains Nature Reserve, Irian

Jaya, Indonesia.

The Physical Reality: The Core-Periphery Gradient

Different categories of protected area recognized for modern day conservation provide for differing levels of resource protection in a core: in turn, these lead to different levels in the peripheral buffer zones. A totally protected core zone of importance for scientific monitoring of extreme richness of biodiversity permits no disturbance — not even non-exploitative tourism — but justifies at its periphery a rigidly protected area where regulated tourism or equally benign usage is permitted. Beyond this lies a zone where harvests of traditional products may be gathered by indigenous communities at sustainable intensity and zones of progressively more manipulative management ultimately phasing via, for example, plantations of exotics into settled and intensively cultivated areas.

Hence, it is constructive to envisage the gradient as one of increasing management intensity away from the core. Oldfield (1988) describes a complex zonation on Hainan Island, China: a gradient from a core of intact tropical moist forest through progressively more modified vegetation, including tree planting areas, to agroforestry plantations and agricultural land associated with a village. Such complexity, however, is not yet commonplace. In practice, existing zonations tend not to extend to both extremes or are simple two-zone situations. Tanzania's Serengeti National Park, for example, constitutes a core area free of exploitative land use buffered by game reserves and game controlled areas. In the game reserves trophy hunting takes place and in the game controlled areas there are concessions which permit pastoralism and limited cultivation.

Influence and Authority: Interested Parties

The designation of buffer zones anticipates a future situation which would not exist in their absence, achieved by suspending or manipulating change. It is then understandable that perceptions of the role of buffer zones and management inputs into them vary greatly. On the professional management side, interpretation ranges from a strictly passive function, through a role as an area of self-sustaining resources for local use, to a zone of higher productivity achieved through more intensive management, such as tree and fodder-grass planting, which supports local population needs. Broadly four groups — `stakeholder' categories (Brown, 1992) — perceiving these effects differently, can be associated with interest in the buffer zone issue:

- the local community
- the biodiversity lobby
- the natural resources sector of government
- the development agencies.

The Local Community

Local people inevitably take a parochial, and often possessive, view of the natural resources around them because of close dependence on these and, often, limited prospects of support in any form from elsewhere. It is now recognized that indigenous knowledge traditions often reflect sophisticated practical capability in the utilisation of local resources and that there is growing awareness in these communities of concerns relating to land use trends on a national scale. At the same time there are strong views about initiatives originating externally which have changed the status of land in the past and about the potential benefits of new technological inputs. The implications of proposed buffer zones are considered in terms of feelings towards the original protected area and whether a new status would preclude other initiatives in prospect, albeit at a preliminary and informal level.

The Biodiversity Lobby

The biodiversity lobby is part of the broader environmental and conservation lobby. The view of buffer zones, like that of the local community, is a polarised one. In this case, the successful maintenance of biodiversity is the all-important goal. Biodiversity lobbies are, however, changing in that there is a much greater understanding of the importance of integrating local community interests into conservation and recognition that full participation is an essential component of community involvement. This differs from activities planned and implemented only a few years ago when there was massive investment in the fortress mentality of conservation, giving barriers and firearms high profiles and forcibly evicting people from biodiversity hotspots. Initially, buffer zones were planned purely from the manager's viewpoint: slowly, they are being designed with inputs from local people. These new approaches are documented in Gadgil (1989), Gilmour et al. (1989), Kiss (1990) and McNeely & Mackinnon (1989), for example. A major problem is how to convince villagers that this more people-friendly conservation activity is a necessary input - esoteric explanations of genetic resources do not work.

The Government Natural Resources Sector

The government view is one unaffected by possessive interest in the land concerned and without obligation to pursue biological conservation interests in their own right regardless of other issues. On the other hand, the government has the authority and power to require buffer zone action where it sees fit and has mechanisms to bring legislation to the support of these. Government is also able to solicit and apply policies concerning buffer zones on the national scale since jurisdiction over protected areas is mostly nationally co-ordinated. On an internal basis, government interest in buffer zones is in their potential to retard, halt or reverse resource deterioration where local communities lack the means to do this or, because of parochial views, are not aware of any problem. On an international basis, governments are able to contribute to such efforts needed on a regional scale and also to make formal commitments which enhance the effectiveness of the global conservation networks.

The Development Agencies

Unless there are local institutions with both mandate and expertise to plan and set up buffer zones around PAs, development agency involvement is necessary. Unlike the other interest groups, the position of the development agencies is to be responsive to appeals for support but without subscribing to a vested interest reflecting dependence on the area concerned. Further, there is appreciation of the desirability of integration of resource conservation and socio-economic advances for the community through compatible development initiatives. Once involved in buffer zone issues, the development agencies can allocate resources to expertise and infrastructure as required and sanctioned by the host government, unconstrained by other priorities or commitments elsewhere.

RESOURCE TENURE

Because different groups concentrate their interest on different sectors of the gradient, buffer zone tenure is a contentious issue, lying at the heart of the success and failure of the zones themselves. Conservation agencies argue strongly that buffer zones should be peripheral to the PA - i.e. outside its boundary (Sayer, 1991). PA managers complain about their lack of control or influence over buffer zones beyond their areal jurisdiction.

Such views, however, are contrary to newer theory advocating the integration of PAs into the external or district socio-political environment. If buffer zones are to have a major effect in extending the area accessible to mobile conservation target species (Saharia, 1983), then ensuring continuity of the natural or semi-natural habitat is of importance and the buffer zone should be under the PA management control. If the buffer zone has a mainly socio-economic function then it becomes important that local communities have a stake in ensuring long term sustainability. For this there must be empowerment through joint management and resource ownership (Poffenberger, 1989, 1990). This philosophy has been successfully demonstrated for semi-arid land wildlife in Zimbabwe, through Operation Campfire where local participation is the dominant feature (Frost, 1991).

The great pressures on lands around many PAs and the consequent lack of space for peripheral external buffer zones means that the only hope of a successful buffer zone is via location within the PA boundary. To create a buffer zone in such a case implies the excision of land from the PA and its transfer to the management responsibility of another agency or to local community groups. There would be strong opposition from many conservationists at this stage of uncertainty in buffer zone management. In fact, with few exceptions, however, national park legislation does not permit the type of exploitation appropriate for many buffers and national park land is a significant proportion of the PA land where buffer zone issues arise. Yet current conservation legislation was often developed by colonial powers long before the need for buffer zone activities and people's participation in management was recognized. We should not be attempting to squeeze activities within the confines of out-dated laws and there is a pressing need to develop newer, more responsive legislation which will permit a variety of activities within flexible PA categories.

Only if local people see real and potential benefits in PA conservation are PAs genuinely accepted by them. The benefit of access to PA buffer zone resources must be seen as coming from the PA - not the local forest or development agency, even though these institutions should be involved in the management activities. There may be value in making provision for a composite buffer with

two distinct components even if legislative change is necessary. One component would be the outer area of the PA itself, controlled by the PA management with a major commitment to extension buffering and well-regulated use by people. The second component would be contiguous but outside the PA and controlled by the district, with considerable local participation in management. In this latter case, emphasis would be on the socio-economic issues and provision of benefits to local communities.

RATIONALIZING AND HARMONIZING VIEWS

If a concerted approach to buffer zone management is to be achieved, there must be wider recognition of the role of the interested parties and how they interact. Harmonisation integrates the strengths and roles of the different interest groups, particularly the synergistic potential of reciprocal linkages between the local community, government and the development agencies. Identifying linkages and bringing them into sharper focus emphasizes complementarity of role and stresses that the factor common to all buffer zone situations is pressure on land from a local community. Pair-wise relationships among these interest groups can be summarized:

Local Community and Government

The local community provides government with information on progress with buffer zone creation and operation in the same way as information flows concerning other development initiatives, reserving similar options on reviews of the whole exercise. Government provides the local community with indications of support in principle for buffer zone initiatives. Further, government facilitates the development of a working relationship between the local community and external development/biodiversity expertise by organizing introductions and liaison under the auspices of an appropriate government unit.

Local Community and Development Agencies

The local community provides development agencies with access to socio-economic information revealing context and initial situation and with counterparts. Development agencies provide the local community with inputs of support technology and expertise.

Government and Development Agencies

Government provides development agencies with clearance for work and introductions to the local community. Development agencies provide government with reports based on the socio-economic monitoring of progress in the initiative and of the implications of the progress in community development terms.

Linkages with the Biodiversity Lobby

Many PAs, primarily those referable to IUCN Protected Area Management Categories I-IV, will require in addition involvement of the biodiversity lobby. From the point of view of the local community and government sector, the biodiversity lobby, as an external and technical stakeholder, can be regarded as an extension of the development agency group. Such juxtaposition of socio-economic and conservation expertise is now widely thought vital (Brown

& Wyckoff-Baird, 1991; Brown, 1992).

The biodiversity lobby must adopt in conjunction with the development agencies a unified position with regard to the plan of action for a buffer zone, and for maintaining a balance between the introduction of constraints and the receipt of benefits. Information on progress (including progress towards the development and implementation of a local conservation strategy), achievements and difficulties arising, is updated on a regular and frequent basis for subsequent reporting to government. The basis of dialogue with the local community must also be expanded to incorporate briefings in locally intelligible and meaningful terms on conservation actions, achievements and implications.

COMMON INTERESTS: BUFFER ZONE TREE RESOURCES

Oldfield (1988) and Sayer (1991), in extracting case study accounts from the writings of others have exposed the inconsistency in the scope and detail of the available information on buffer zones and their current and desired roles. We are emerging from the era of dominance by the biodiversity lobby and preoccupation with the restrictive and regulatory aspects of buffer zone management and becoming aware of the interest groups who should address the issues together. It is also apparent that increased access to woody plant resources has appeal for many local communities and efforts to increase the availability of these by a range of agroforestry initiatives (Wood, 1990) are viewed favourably by the other interest groups.

In the current climate of opinion attention should centre on actions considered acceptable in buffer zones and what beneficial effects might be expected from these. Berkmüller & Mukherjee (1989) call for land use surveys (within and adjacent to a buffer) to allow qualitative assessment of community dependence on buffer zone resources. Increasingly such information is sought. Much more meaningful dialogue among interest groups, however, could revolve around quantitative estimates of inputs and benefits. Here attention is restricted to roundwood production, this being a universal need and sufficiently known readily to permit quantification.

Kasolo (1990) considered, in a four-step process, possible roles for buffer zones as sites for useful agroforestry measures in the context of Uganda's forest reserves. The first step, prioritisation, took account of area, maximum distance to the boundary from any internal point and the ratio of perimeter (km) to area (km^2). High vulnerability arose from small area, short maximal distance to boundary and a high perimeter:area ratio.

In terms of identifying options, the second step, Kasolo related land use approaches to the tree-associated benefits a local community might expect from a buffer zone. Throughout Uganda there is interest in additional cultivable land, fodder/pasture, fuel and poles and additionally erosion control in mountain areas and timber in the lowlands. Nationally applicable approaches are intercropping with trees, home gardens, shade trees, shelter belts and private woodlots. For the mountain areas terraces and contour bunds are added. A full range of benefits can be derived from a restricted range of approaches and Kasolo suggests this restriction will simplify management planning.

Step Three was species selection - based on suitability for growing in configurations dictated by integration with crops or pure, likely growth rates, acceptability of product and silvicultural

familiarity and availability in Uganda. The fourth step was to set a tree planting target which took into account choice of species and quantified the likely productivity (or beneficial effects) and the extent of activity needed for significant impact. Impact can be conveniently expressed as the number of beneficiaries to gain from the resource created, being a significant proportion (>=10% - Hardcastle, 1987) of the local community.

In the pressured situation of buffer zones this equates to sizeable numbers of people - tens of thousands - standing to gain. There are obvious implications for project infrastructure. The annual per caput demand for roundwood is one key element in this estimation of need: Openshaw & Moris (1980) have suggested 1.4 m^3 (1.3 m^3 fuel; 0.1 m^3 poles and other uses). Tree volume on harvest is a second key element: in the domestic context this can be taken as ranging from about 0.025 m^3 to about 0.035 m^3 roundwood (bole plus branches) depending on species and assuming rotations 3-7 years long. Annual roundwood increment per tree can be expected to range from 0.003 m^3 to 0.012 m^3, enabling planting requirements for supplying a given number of people to be estimated. To fully supply 1000 persons each with 1.4 m^3 roundwood, 40,000 - 56,000 trees would need to be cut each year. Providing for 10% mortality, and depending on rotation length, the resource to be established for sustainability for 1000 persons would range from about 130,000-500,000 trees. These require considerable space - even at conventional (2 m x 2 m) spacing, around 0.5-2 km^2. Traditionally acceptable densities of trees on farmland may be low - as few as 50 per ha. In extreme situations, the required tree resource for 1000 people could thus be dispersed over 100 km2! This, however, implies a human population density of only 10 per km which is mostly much exceeded (Barnes, 1990) and exceeded everywhere where buffer zones are needed. It seems logical to assume some dispersed and some more concentrated planting (not necessarily woodlots alone).

Absolute needs require introducing into the equation the estimated size of the dependent population. It is not always clear from the literature how many people are involved but Kasolo (1990) gives 56,000 as depending on land adjacent to Mount Elgon Forest Reserve (10% of the population of Mbale District) and 64,000 as depending on land adjacent to Mabira Forest Reserve (10% of the Mukono District population). Berkmüller & Mukherjee (1989) refer to 80,000 people within 5 km of some 40 km of the boundary of Dudhwa National Park.

The incompatibility of assumed consumption rates, required planting levels and population density is informative. It is inconceivable that populations such as that next to Dudhwa (400 persons per km) are consuming 1.4 m^3 roundwood per person per year and equally inconceivable that a disproportionate amount of the buffer zone can be devoted to pure stands of trees. Here, even a target of 0.5 m^3 fuelwood per person per year (the low extreme of the NAS, 1980, range for the humid tropics) will be well in excess of the current reality and an aim of 10% of demand based on a still lower value (say, 0.4 m^3 per person per year) would still promise a positive impact which could be achieved with tree-growing, admittedly mostly as pure stands, on no more than 5% of the area. In Kasolo's examples the situation appears less critical. Dependent populations are smaller and access to a greater area of buffer zone is assumed (420 km^2, Mount Elgon Forest Reserve; 407 km^2, Mabira Forest Reserve).

Even with assumptions of modest consumption (0.4 m^3 per person per year) it will be apparent that establishing the productive tree resource is a major undertaking - as many as one million (or more) trees are needed. Kasolo's estimates, based on supplying 10% of the needs (using the more generous 1.4 m^3 per person per year consumption rate) for a 50,000 human population would

anticipate planting a million trees in each case. Even spread over a period of around 10 years to ensure a desirable age balance and manageability through five or six small (20,000 plants capacity) nurseries, this is a heavy commitment.

CONCLUSIONS

Since buffer zones were formally acknowledged in the 1970s there have been somewhat divergent perceptions of the roles they should fulfil. In the last two or three years, however, consensus views have begun to emerge although not all interpretations of potential have yet been reconciled. Nevertheless, publicity has brought into the debate fundamental issues with profound influence on buffer zone management which call for actions previously ruled out (e.g. revision of national park statutes) or ineffective (e.g. project planning with inadequate dialogue with local communities) to be approached more realistically. Frustration with progress may be discouraging further buffer zone initiatives but this is a time to promote interest, not to allow it to decline. The various stakeholders are known and their positions and interests recognized, and all are responsive to involvement in collective dialogue. The long time-scales necessary to organize buffer activities appropriately are acknowledged (WWF, 1989, 1990) and we are beginning to understand implications of this.

There will be much learned from persevering with buffer zone programmes. As sites for enlightened integrated development they offer much useful experience for application elsewhere. If buffer zones cannot be made into successes, it is not only protected areas that are at risk: it is the stability of rural land use generally.

* * *

REFERENCES

Barnes R F W, (1990) `Deforestation Trends in Tropical Africa,' *African Journal of Ecology*, 28: 161-173.

Berkmüller K & **Mukherjee**, S, (1989), `Buffer Zones in the Service of Ecodevelopment', *Tiger Paper*, 16: 12-19.

Brown, M, (1992), `Buffer Zone Management in Africa: Searching for Innovative Ways to Satisfy Human Needs and Conservation Objectives', PVO-NGO/NRMS Project, Washington, 16 pp.

Brown, M & **Wyckoff-Baird**, B, (1991), `Integrated Conservation and Development Projects: Lessons Learned and Implications for Design', PVO-NGO/NRMS Project, Washington, 55 pp.

Eidsvik, H, (1990) `A Framework for the Classification of Terrestrial and Marine Protected Areas: Objectives, Criteria and Categories for Protected Areas', a report based on the work of CNPPA's Task Force on Classification. IUCN, Gland, 29 pp.

Frost, P G H, (1991), *Strengthening Land-Use Planning in Zimbabwe. Perspectives on Wildlife Utilisation in Communal Lands in the Zambezi Valley: Implications for Land-Use Planning*, FAO, Rome.

Gadgil, M, (1989) `Deforestation: Problems and Prospects. 1st Foundation Day Lecture of the Society for the Promotion of Wasteland Developments', *Wasteland News*, 4 (Supplement): 1-44.

Gilmour, D A , **King**, G C & **Hobley**, M, (1989) `Management of Forests for local use in the hills of Nepal: changing forest Management Paradigms', *Journal of World Forest Resource Management*, 4: 93-110.

Green, M J B, (1991) `Status of Protected Areas With Respect to Buffer Zone Management in South-Central Asia', WII/UNESCO Regional Training Workshop on Protected Area Buffer Zone Management, 18-23 February 1991, Dehra Dun, 17 pp.

Hardcastle, P D, (1987) *Microplanning for Social Forestry: a Description of the System Designed for Karnataka Social Forestry Project, India*, ODI Social Forestry Network Paper, 4c: 1-24.

Kasolo, W K, (1990), `Buffer Zone Agroforestry for Uganda: a Management Approach', MSc Environmental Forestry dissertation, University of Wales, Bangor, 117 pp.

Kiss, A, (1990) *Living With Wildlife: Wildlife Resource Management With Local Participation in Africa*, World Bank, Washington.

MAB, (1974) *Final Report. Task Force on: Criteria and Guidelines for the Choice and Establishment of Biosphere Reserves*, MAB Report Series, 22: 1-61.

McNeely, J A & **Mackinnon**, J R, (1989), `Protected Areas, Development and Land Use in the Tropics', *Resource Management and Optimisation*, 189-206.

NAS, (1980), *Firewood Crops: Shrub and Tree Species for Energy Production*, National Academy of Sciences, Washington, 237 pp.

Oldfield, S, (1988), *Buffer Zone Management in Tropical Moist Forests: Case Studies and Guidelines*, IUCN, Gland, 49 pp.

Openshaw, K & **Moris**, J, (1980), `The Socio-Economics of Agroforestry', *International cooperation in agroforestry* (ed T Chandler and D Spurgeon), pp 327-351, ICRAF, Nairobi, 469 pp.

Poffenberger, M, (1989) *Keepers of the Forest: Land Management Alternatives in South-East Asia*, Kumarian Press, Connecticut.

Poffenberger, M, (1990), *Joint Management of Forest Lands*, Ford Foundation, New Delhi.

Saharia, V, (1983), `Guidelines for the Preparation of Management Plans for Sanctuaries and National Parks', New Delhi.

Sayer, J, (1991), *Rainforest Buffer Zones: Guidelines for Protected Area Managers*, IUCN, Gland, 94 pp.

Troup, R S, (1940), *Colonial Forest Administration*, Oxford University Press, London, 476 pp.

Wood, P J, (1990) `Deflecting Pressure on Forests: Use of Agroforestry in Establishing Buffer Zones to Protect Nature Reserves', *Mitteilungen aus dem Institut für Allgemeine Botanik Hamburg*, 23: 99-107.

WWF, (1989), *Cross River National Park, Oban Division: Plan for Developing the Park and its Support Zone*, WWF, Godalming, 98 pp.

WWF, (1990), *Cross River National Park, Okwango Division: Plan for Developing the Park and its Support Zone*, WWF, Godalming, 108 pp.

*** * ***

Credits

Network Coordinator:	Dr Gill Shepherd
Editors of this Paper:	Dr Mary Hobley
	Edwin Shanks
Abstracts:	Dr Elvira Belaunde (Spanish)
	Mrs E I F Bourlon (French)
Layout:	Ivana Wilson