Assessment of the value of woodland landscape function to local communities in Gorongosa and Muanza Districts, Sofala Province, Mozambique

Tim Lynam, Rob Cunliffe, Isaac Mapaure and Isau Bwerinofa
Assessment of the value of woodland landscape function to local communities in Gorongosa and Muanza Districts, Sofala Province, Mozambique

Tim Lynam
Rob Cunliffe
Isaac Mapaure
Isau Bwerinofa
# Table of Contents

Executive summary 1  
Introduction 5  

I. Site selection and description 9  
A. Background to Muaredzi 10  
B. Background to Nhanchururu 12  

II. Community Landscape Valuations 15  
A. Methods 15  
1. Initial conceptual model 15  
2. Spatial data management 16  
3. Community information collection 16  
4. Refinement of the model 17  
5. Field sampling for model confrontation 17  
6. Updating the models 20  
B. Results and discussion 20  
1. Initial conceptual model 20  
2. Muaredzi community assessments 21  
3. Nhanchururu community assessments 36  
4. Field Sampling for Model Confrontation 51  
5. Confronting the models with reality 60  

III. Vegetation inventory and assessments 65  
A. Approach and methods 65  
1. Vegetation survey 65  
2. Assessment of explanatory variables 66  
3. Data analyses 66  
B. Results 66  
1. Muaredzi 66  
2. Nhanchururu 71  
C. Discussion 76  
1. Muaredzi 76  
2. Nhanchururu 77  
D. Conservation values of vegetation in Muaredzi and Nhanchururu 78
Executive summary

Assessment of the Value of Local Woodland Landscape Functions to Local Communities

During the process of developing a management plan for Gorongosa National Park (GNP) in northern Sofala Province, Mozambique the presence of people within the park and in the areas immediately surrounding the park was identified as a major management concern. The major objective of the park was the conservation of ecosystems and biodiversity. Local people were recognised as users of natural resources but park management had set itself the objective of ensuring that the use of resources did not undermine the achievement of conservation, recreation and knowledge generation objectives. Little was know of the spatial patterns of use of resources by local communities nor what areas were likely to be heavily impacted by community use of resources.

The aim of the research was to develop and test an approach to estimating local values for landscape units and relate these to formal biodiversity conservation values. The Tropical Resource Ecology Program (TREP) team conducted participatory analyses in two village scale sites; Muaredzi that was entirely within the boundaries of GNP and the other, Nhanchururu that straddled the boundary of GNP. The team used a combination of participatory research methods, Bayesian probability modelling and spatial data analyses of baseline digital data sets and remotely sensed images, to iteratively improve understanding of the factors determining the value that local people assign to specific landscape elements or locations.

In parallel to this participatory process, an assessment was made of the vegetation diversity of the same areas using standard scientific methods of firstly interpreting satellite imagery and then field sampling to validate the resultant maps and to fill in the details of species composition in each vegetation type. Vegetation types were scored and ranked in order of conservation importance. Conservation importance values were derived as a function of relative area of each vegetation type, species diversity of each vegetation type and the presence of key species of conservation interest. The local landscape values were then overlain with the conservation importance indices to identify areas where conflicts between village use and conservation were likely to be high, i.e. where both conservation and village valuations were both high.

Community resource use assessment teams (CRUATs) were elected by the people of each village to work with the scientific team. The analysis followed the same pattern in each site. Firstly, the scientific team developed a prior model or hypothesis of the value, to local villagers, of each landscape unit. In this model landscape unit value was defined as being a function of the ratio of benefits derived from the unit to the costs of
procuring benefits from the unit. The larger this ratio the more valuable the site. The CRUAT listed and scored, to reflect relative importance, the basic needs that households required for an adequate quality of life. The CRUAT then mapped the local landscape into locally identified and recognisable units and listed the goods and services that emanated from each unit. Using the scores allocated to basic needs an index of the gross value of a landscape unit was estimated as the weighted sum of goods and services derived from the landscape unit or location. The weightings were the local, relative importance scores for each good or service. The cost component of the model was estimated to be a function of the distance from the village to the location or landscape unit and any institutional or physical barriers which increased the labour costs of procuring or using resources. Local estimates of the relative contributions of each of these cost components were identified and then converted into spatial cost maps using the GIS. The final estimate of landscape value was then created as a spatial map of the Benefit-Cost model.

To explore the usefulness of the model it was confronted with real world data. Randomly selected locations were visited by members of the CRUAT who scored each location for all model components; benefits, costs and final value. The resulting data were used to confront the model and then update it.

**Basic needs and the natural environment**

The livelihood systems of both villages that participated in the local valuation of landscape functions project were dominated by natural resources based production with very few external inputs. Food was derived from local agricultural production based on a tree fallow system of nutrient replenishment, from forest products, from wild foods and from purchased commodities. The latter contribute only about 20% of the total food input although this increases in drought or flood years. Most household basics are also directly derived from natural resources; houses are constructed from cut trees bound with tree fibre and grass thatch rooves; water is drawn from shallow ground wells or rivers and cash is generated through the sale of grain, livestock and natural products. Non-agricultural food products become very much more important in drought and flood years, eventually supporting the household. Poorer households have a greater dependence on natural products than do wealthier households.

The landscape is also important from a cultural perspective. With local spiritual beliefs closely linked to the intercession of ancestors in matters of importance the burial of the dead is of great cultural significance. Hence cemeteries are very important local landscape features. People site the burial of their ancestors as a major reason why they would not be interested in moving from their current village areas.

**The value of woodland landscape units to local communities**

A very large number of products were used from the landscape of both village sites. The project team aggregated many of these into classes of product that satisfied specifically identified needs. There were for example, four different types of honey but these were all classed as honey, in the wild product category. The benefit side of the local valuation was therefore based on the supply of between 13 and 25 categories of goods.

The goods that contributed most to the values of landscape units were water, land for agriculture and houses, construction materials (these included poles, fibre, thatching grass and reeds), firewood, general household and craft materials (such as wood for tool handles, reeds for mat construction or materials for constructing pestle and mortars) and various wild foods. This pattern of importance values associated with the goods derived from natural resources are similar to those observed elsewhere in southern Africa. Villagers collected or used resources from areas of about 300 km² for a village of 40 to 100 households. Again this is a similar area to results observed elsewhere in the region.

Important lessons that emerged from the analysis as to the factors governing local valuation of landscape functions or locations the project included the following:

- Village landscapes are valued for the bundles of ecosystem goods and services that people derive from each location in the landscape.
- In terms of predicting the value of a given location the preference-weighted sum of stocks of resources on a given site was a good predictor of the values local people assigned to that location. Costs did not contribute much to the values assigned by local users. Neither distance nor local (traditional) regulations or institutions played much of a role in determining the value of a location.
- Strictly enforced regulations, such as were prevalent in some areas of GNP and for some resources, did act to exclude users and hence greatly reduce the value assigned to the given location.
- The value assigned to a given site was completely determined by tangible benefit stocks. Non-visible ecosystem services, for
example, were not identified as benefits and therefore did not contribute to the values assigned in this analysis.

**Biodiversity conservation values and potential conflicts between conservation and livelihood systems uses**

Both sites included a range of vegetation types from open grassland areas through various savanna woodlands to thickets and forests. Thirteen types were identified for Muaredzi as compared to seven for Nhanchururu, although the total number of plant species recorded was similar for both sites (231 for Muaredzi and 246 for Nhanchururu). For both sites it was the thicket and forest communities that were identified as being of greatest biodiversity conservation importance, both on the basis of their species composition and particularly their limited occurrence in the overall landscape.

For both village areas the thicket and forest ecosystem types had both the highest conservation value and the highest local livelihood values. These landscape units are likely to be under the greatest threat from village level consumptive use and thus where the greatest conflict is likely to occur in terms of meeting both conservation and livelihoods needs.

**Implications for land use planning**

Community use of resource areas can be divided into two broad classes; land transformation and multiple use. Land transformation comprised the conversion of woodland areas into cultivated fields or riverine gardens. This was clearly the most destructive process and would directly and negatively impact biodiversity and hence conservation objectives. Multiple use of given landscape units by the community could however, under certain management conditions, remain compatible with conservation objectives.

The expansion of human populations in and adjacent to the park will inevitably result in greater demands from people for agricultural land and for the resources that the park seeks to conserve. It would thus seem inevitable that conflict between the park and people whose livelihoods depend on park resources will intensify. Further conflict is likely to arise through the build up of wildlife populations, such as elephants and large predators.

One possible solution for the park management is to identify key ecosystem units, such as forest communities, and put in place fully enforced regulations governing the clearance of these areas for cultivation. Development of land use zones in collaboration with the affected local communities would be one way of achieving this. Once these areas of both high conservation and high local resource value have been identified, and their use regulated through zoning, co-management structures and institutions could be developed to provide sustainable multiple use opportunities to those communities with a high dependency and capacity to manage these resource units.

Secondly, the park management will need to develop and maintain functional relationships with these communities (i.e. relationships with low levels of conflict and high levels of co-operation), which will require significant management inputs. The maintenance of communities within the park will incur additional costs, including both direct costs such as the costs of maintaining ranger’s posts in the areas in which the communities are, as well as indirect costs such as increased fire incidence. For some areas or ecosystem units these costs may be warranted, but for other areas these costs may not be warranted. In these instances GNP management may be better off seeking incentives to persuade communities to voluntarily relocate.

The coupling of park ecosystems to ecosystems outside of the park (particularly hydrological couplings with Gorongosa Mountain), and hence outside of GNP management control, means that for GNP to survive ecologically, park management must also seek to develop fully functional co-management relationships with the local communities responsible for managing these external ecosystem elements.
Looking east, from the miombo woodlands of Nhanchururu, down to the rift valley of Gorongosa National Park.
As part of CIFOR’s project to identify the value of landscapes to local users the Tropical Resource Ecology Program (TREP) at the University of Zimbabwe was contracted to undertake a short term research project to establish the value of landscapes to local communities. A startup meeting was held in Harare, Zimbabwe on 29th and 30th of January, 2001, at which the TREP team presented their suggested approach, and also suggested implementing the project in Gorongosa National Park (GNP) in Mozambique. The principal reason for electing to implement the project in the logistically more difficult Mozambican site, was the opportunity for the project to directly contribute to the GNP planning activity in which the team leader (Dr. T. Lynam) was already involved.

Several communities live within the boundaries of GNP, whilst others straddle the boundaries, together amounting to an estimated total population of some 10 to 15 thousand people living within the park (Figure 1). The Administrator of GNP and other senior National Parks staff had clearly indicated the importance of addressing the question of people living within and adjacent to the park. A notable component of the GNP planning activity was expected to be the development, in consultation with all relevant stakeholders, of a management strategy for the buffer zone or co-management areas of the GNP. Thus, the CIFOR project would be able to contribute directly to a real need, and hence had considerable support from the GNP Administration.

Conducting the assessment in and around GNP would serve three major purposes. The first was the provision of information to park planners and managers, on what is of value to the local communities living within and around the park, and some indication as to where these values might be in conflict with GNP management objectives. The second, and equally important objective, was to ensure that the views of local communities were clearly expressed in the park planning exercise. In essence this would involve working with the local communities and translating their needs and views into information that would be useful to the Park Administration. The third purpose was to enhance the capacity of Mozambican partners in the project to conduct similar assessments.

The approach adopted was to develop method to estimating local values for landscape units, to generate corresponding biodiversity conservation values, and then to compare these two sets of...
values. A combination of participatory research methods, Bayesian probability modelling and spatial data analyses of baseline digital data sets and remotely sensed images, were used to generate and iteratively improve understanding of the factors determining the value that local people assign to specific landscape elements or locations. Vegetation analyses of the same areas were carried out using standard scientific techniques of firstly interpreting satellite imagery and then carrying out ground sampling to validate the resultant maps and to provide details of species composition for each type. These data provided the basis for the subsequent generation of biodiversity conservation values. The local landscape values were then overlain with the conservation importance indices to identify areas where conflicts between village use and conservation were likely to be high.

It is important to clarify what is meant by the term value as used in this project. There is a considerable literature, both in the economic as well as in the social fields, as to what value means and how it is measured. It is not necessary for us to review that literature here. What is important is that we have a clear definition of what is meant by value and what limitations there are on the use of the term in the context of this project. We use the term value to reflect an index of preference ordering. The value of a good or service is the relative degree to which that good or service is preferred in comparison with other goods and services available at that time and location. This last point is of fundamental importance. In our conception of the term there is no such thing as “THE VALUE”. Value is a dynamic and relative concept - value varies across individuals, and varies through time as the relative abundances and needs for various goods and services change. What we have striven to obtain, in our implementation of this project, is a value estimate that is averaged across a community and is expressed by individuals selected by that community to represent their views - it is thus a social value. We have also sought to average that estimate of value across a limited time domain - perhaps only meaningful over at most a year or two. The important point to reflect upon is that the estimates we have succeeded in making are appropriate at a given time and in a given location - they are not necessarily generalisable across a wider spatial or temporal domain.

Following this introduction, the remainder of the report is structured into a further five main sections (Sections I-V). Section I describes the process of selecting research sites, and provides brief descriptions of the two chosen areas: Muaredzi and Nhanchururu. The following section deals with the community landscape valuations (Section II). This includes both methods and results concerning the development and confrontation of the models, the GIS data sets, and the participatory community assessments. Details of the vegetation assessments and generation of biodiversity conservation values are then presented in Section III. Section IV concerns the overlay of the community and biodiversity conservation valuations. The final section (Section V) comprises a synthesis which draws the various threads together and spells out the implications of the research findings in terms of the land use planning process for GNP.
Assessment of the value of woodland landscape function to local communities in Gorongosa and Muanza Districts, Sofala Province, Mozambique

Figure 1. Boundary of Gorongosa National Park with major tracks and roads as well as major areas of human settlement and possible human incursion into the park.