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OPTIMISATION OF DIFFERENT LAND USE REGIMES IN THE MHALA DISTRICT, MPUMALANGA

H.N. Balyamujura and H.D. van Schalkwyk¹

Communal, commercial and nature conservation land use alternatives occur together at the perimeter of Manyeleti Game Reserve in Mhala district. The different land use alternatives were compared with one another with the purpose of determining the best possible land use. Communal households and the Seville scheme households perform poorly in support of household welfare. This holds disastrous implications for future generations if nothing is done. The Uthla scheme households perform better and generate larger incomes, but at the expense of communal households. Both schemes are highly subsidised by government. Manyeleti Game Reserve is mismanaged and the worst land use alternative in the area, providing no benefit to people living at its perimeter and needs government support for its continued survival. Using multi criteria analysis a combination of communal and conservation land use alternatives is found to be the best alternative, maximising the communities' welfare and conserving the environment.

OPTIMISERING VAN VERSKILLENDIGE GRONDGEBRUIKSPATRONE IN DIE MHALA DISTRIK, MPUMALANGA

Kommunale, kommersiële en natuurbewaringsgrondgebruiksalternatiewes kom saam voor in die omtrek van die Manyeleti Wildtuin in Mhala distrik. Die verskillende grondgebruiksalternatiewes is met mekaar vergelyk met die doel om te bepaal wat die beste moontlike grondgebruik sal wees. Kommunale huishoudings en die Seville-skema huishoudings presteer swak in terme van die ondersteuning van huishoudelike welvaart. Dit sal rampspoedige implikasies vir toekomstige geslagte inhou as niks daaraan gedoen word nie. Die Uthla skema huishoudings vaar beter en genereer groter inkomstes, maar dit geskied en koste van kommunale huishoudings. Beide skemas word hoog deur die regering gesubsidieer. Die Manyeleti Wildtuin word wanbestuur en is die swakste landgebruiksalternatief in die gebied; dit bied geen voordele vir die mense in sy omtrek nie en benodig regeringshulp vir oorlewing. Multi-kriteria-analise het getoon dat 'n kombinasie van kommunale en bewaringsgrondgebruik die beste alternatief bied; dit maksimeer die welvaart van die gemeenskappe en bewaar die omgewing.

1. INTRODUCTION

Communal, commercial and nature conservation land use alternatives occur together in the Mhala district. Nature conservation is one of the main forms of land utilisation. Manyeleti Game Reserve, one of the nature conservation areas is operated on 22 700 ha proclaimed in 1967 in an area that had been predominantly used for cattle ranching (Index & Setplan, 1993). It is located at a

¹ Department of Agricultural Economics, University of the Orange Free State, Bloemfontein.

sensitive interface between the Kruger National Park and land held and utilised by amongst others the local communities of Uthla and Seville. When the study was undertaken it was clear that the Manyeleti Game Reserve is mismanaged.

Communal land covers approximately 1 354 and 2 158 ha in Uthla and Seville respectively. Arable land in the two areas amounts to 369 and 390 ha respectively (Department of Agriculture, 1995; Engelbrecht & Papenfus, 1995). Communal households in Uthla and Seville perform poorly with regard to the general welfare of their members (Balyamujura, 1995). The poorer households are bigger and they own less livestock. These households are in favour of the communal ownership of all land including the Manyeleti Game Reserve. The wealthier respondents are in favour of agricultural schemes for a selected few and the enforcement of rotational grazing.

The Uthla and Seville grazing schemes were set up under the Amashangana and Mnisi tribal authorities, on land previously used by the entire communities of Uthla and Seville. The Seville scheme is operated on 994 ha and is divided into 7 camps. It was planned to accommodate not more than 20 farmers at a time. Each participating farmer had to place at least 6 cows into the scheme programme. At the end of 1994 the scheme catered for 13 farmers with a total of 79 cows and 42 calves. The aim of this scheme is to improve management, knowledge of animal production and also the productivity of the cattle and the grazing. The Uthla scheme operates on 2 593 ha and accommodates 8 cattle farmers at a time, 2 in each paddock. The main aim of the scheme is to serve as a demonstration unit to disseminate better cattle management practices in the area. The Uthla commercial land use regime supports its household with larger incomes, but at the expense of those from whom land was taken away. It is therefore indefensible. The Seville scheme has a positive impact on income per household, but performs poorly per adult equivalent. Both schemes are highly subsidised.

The beneficiaries of the communal and commercial land use regimes clearly have competing claims on the area used for the grazing schemes. However, they all prefer that the Manyeleti Game Reserve be opened up to support household survival strategies (Index and Setplan, 1993). Access to this resource became denied upon the establishment of the conservation area.

While conservation sites may be assets to the national economy, they are being run in an environment which contains, at their perimeter, communities of which the majority are in a state of poverty. It is also important to note that most protected areas were originally established with little or no regard to the local people. This is also true in the case of the Manyeleti Game Reserve. Few of the local people could benefit from tourism, particularly since park management

commonly adopted a policing role aimed at exclusion of the local people (Machlis & Tichnell, 1985). The plight of such communities is highlighted by models suggested by Van Zyl *et al* (1995). They argue that these communities should be reincorporated into the conservation areas, or be allowed to share in the income generated, or at least be given rights to resource extraction, or that the communities should be involved by giving them a share of the equity of eco-tourism ventures.

This study's primary concern is to determine the land use regime that would best improve the welfare of the community living next to the Manyeleti Game Reserve. One of the basic aims is to develop a system of land utilisation and intensity of use that will yield an optimum long term social product from the land.

2. METHODOLOGY

The communal and scheme households produce crops and animal products, which are consumed or sold. In the communal system the emphasis is on the former whereas in the scheme system it appears to be more oriented towards the latter. Manyeleti on the other hand is service oriented. Comparisons are made between the different land uses with the decision making units as the basis because it is the decision makers who will determine what benefit will be derived from the land. A multi criteria analysis² model with a trade off between economic, social and environmental objectives was developed and used to determine the land use or combination of land uses that will maximise the welfare of the community and at the same time conserve the area for future generations. The basic aim of multi-criteria analysis is to rank the actions that can be taken to solve a particular problem to which several alternatives but conflicting choices might exist. The ranking is based on set goals or criteria.

The various objectives and criteria which are to be optimised to lead towards the attainment of an increase in social welfare are listed in Table 1, according to their level of importance. The listed criteria will be used to evaluate the different land use regimes and to determine the best land use under the set objectives. This ranking can be done based on the decisions or objectives of the policy makers or may be done by the analyst.

For purposes of comparison, different land uses are outlined under different scenarios. The scenarios are divided into two categories: category 1 includes four scenarios in which the status quo is maintained and category 2 includes seven

² For a detailed discussion of multi criteria analysis refer to Van Huylenbroeck (1995).

scenarios in which changes to the current land use regimes are suggested.

Table 1: Rank order of objectives (level of importance)

Objectives or criteria	Rank
Maximise return from cattle (C1)	1
Maximise return from crop production (C2)	1
Maximise return from wildlife activities (C3)	1
Minimise livestock impact on the environment (C4)	2
Minimise human impact on the environment (C5)	2
Minimise risk to return in the various activities (C6)	3
Maximise community development i.e. building schools and health centres and benefits accruing to the local community (C7)	4
Maximise contribution to national income (C8)	5
Maximise the equity among the community members (C9)	6
Maximise community interaction i.e. promoted social linkages (10)	6
Minimise government support as a proportion of total income (C11)	7

The category 1 scenarios are aimed at comparing the present land use regimes and using the set criteria to determine which among them is the best. The category 2 scenarios are hypothetical and are formulated to serve as guidelines to evaluate some possible changes that could be considered for further investigation to achieve the desired goal of increasing the local communities' welfare. The different scenarios as specified under the two categories are outlined below:

Category 1

Scenario 1: The current land use regime at the Manyeleti Game Reserve is maintained.

Scenario 2: The communal land use regime in the areas of Uthla and Seville is maintained.

Scenario 3: The Seville scheme is maintained in its present form.

Scenario 4: The Uthla scheme is maintained in its present form.

Category 2

Scenario 5: The Manyeleti Game Reserve area is maintained in its present form

but its management and facilities are improved with an aim of improving its services to a standard comparable to that of similar facilities in the area. In addition to this the Manyeleti Game Reserve gets involved in community support projects, for example, contracting the communities to provide some items and by supporting the local communities directly or indirectly in the establishment of some facilities.

Scenario 6: The Manyeleti Game Reserve is expanded to cater for the growing tourist industry. This is done with better management to generate better returns. A financial contribution to the local and national economy is made. This implies a withdrawal of some land from the local community.

Scenario 7: The Manyeleti Game Reserve, and all the grazing in Uthla and Seville and arable areas are combined to allow both cattle and wildlife grazing activities. Crop production activities are maintained on the arable land. The community is directly involved in tourism activities. Tourists visit the local communities and buy handicrafts, etc., made by community members. The local community also benefits directly from income generated by Manyeleti and the community can determine how this income should be used to improve their quality of life.

Scenario 8: All the land including that under the Manyeleti Game Reserve is devoted to communal agricultural activities. The wildlife is transferred to other nature conservation areas. Through community leadership, the community members are encouraged to control livestock numbers and keep them well within numbers not detrimental to the environment.

Scenario 9: This scenario is similar to scenario 8 but the community leadership support is not attained for the control of livestock numbers. The grazing land is therefore likely to be overstocked, and will naturally lead to over grazing.

Scenario 10: All the land including that under the Manyeleti Game Reserve is devoted to commercial agricultural activities, similar to that of the present Uthla scheme.

Scenario 11: All the land including that under the Manyeleti is reverted to commercial agricultural activities similar to those of the present

Seville scheme.

Preference indicators were calculated for each pair of alternatives. Different types of preference functions can be used depending on the nature of the data; these are described as 0-1 criterion, 0-1 criterion with indifference area, Multilevel, Linear, Rank order and the Gaussian criterion (Van Huylenbroeck and Martens, 1992). In this study the 0-1 criterion and the Multilevel criterion are used. The 0-1 criterion, the usual criteria used in PROMETHEE, is characterised by an infinite discriminating power (Van Huylenbroeck, 1995). Any difference in score immediately implies a total preference. The level of dominance with the Multilevel criterion (pseudo criterion) depends on the difference in evaluation scores. This kind of preference function permits the use of information measured on a schematic or interval scale. The preference indicator $P(a,b)$ measures the degree of dominance of a over b and likewise, $P(b,a)$, measures the degree of dominance of b over a . The comparison of both preference indicators makes it possible to analyse the degree of conflict between the two alternatives. It is for this purpose that indifference and incomparability thresholds are introduced to distinguish a so called preference, indifference and incomparability or conflict situations (PIR test). This follows a flow pattern as depicted by Van Huylenbroeck (1995).

3. APPLICATION

Enterprise budgets were compiled for all the land uses. This information was used to determine scores. The nature of the different qualitative aspects of the households and the scenarios under the different land use regimes caused it to be better, allowing more comparability, to transform the quantitative data into a schematic form that includes both the qualitative and quantitative aspects. A positive score sign means that the scenario under consideration is better than the reference situation or a no action situation. A negative sign indicates a negative effect. For the purposes of this study the maximum and minimum score values are (+ + + +) and (- - - -). The zero (0) refers to the reference situation or a no action situation. The scores assigned to each scenario under a particular criteria are shown in Table 2.

4. RESULTS

The rank orders may differ depending on the priorities of the decision maker at the time. The preference intensities were calculated and a conflict analysis performed. The results can be sensitive to modifications in the criterion scores or the ranking of the criteria and also to the nature of the preference function used (Van Huylenbroeck, 1995). In this study, sensitivity has been tested for, using the following:

Table 2: Data for comparison of the different scenarios

Category of scenario	Scenarios	Criteria										
		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
Category 1	1	0	0	+	---	---	0	0	+	0	0	0
	2	+	+++	0	-	-	-	0	0	+++	+++	----
	3	+++	+	0	--	--	-	0	0	++	+	--
	4	++++	+	0	--	--	-	0	0	+	+	-
Category 2	5	0	0	++	---	---	0	+	++	+	+	--
	6	0	0	+++	---	---	0	+	+++	0	0	0
	7	++	+++	+++	--	--	---	+++	++	+++	++	0
	8	++	+++	0	-	--	--	0	0	++	+++	----
	9	+	+++	0	--	-	-	0	0	+++	+++	----
	10	++++	+	0	--	--	-	0	0	++	++	-
	11	+++	+	0	--	--	-	0	0	+++	++	-
Priority ranking of criteria		1	1	1	2	2	3	4	5	6	6	7

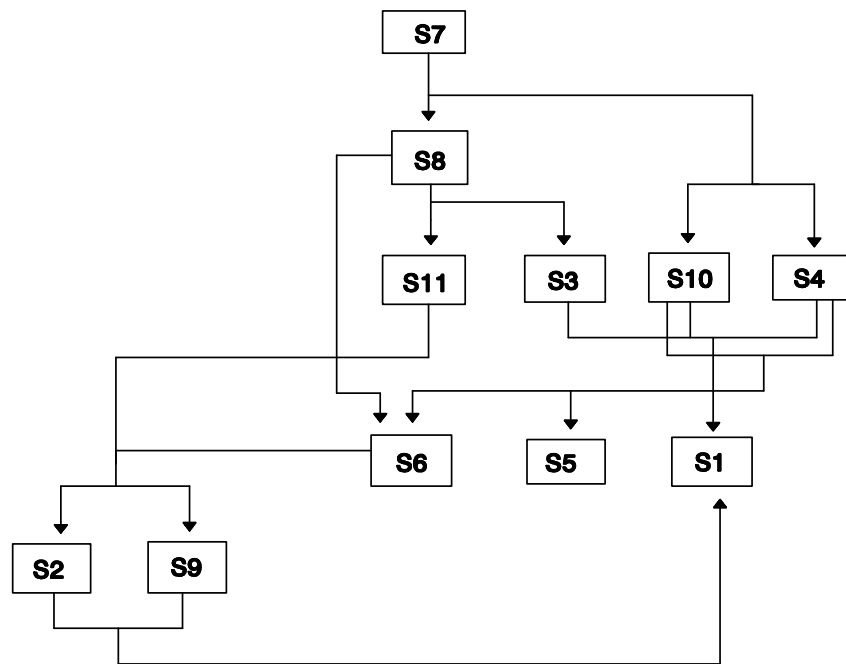


Figure 1: Rank order 1 (Multilevel preference function)

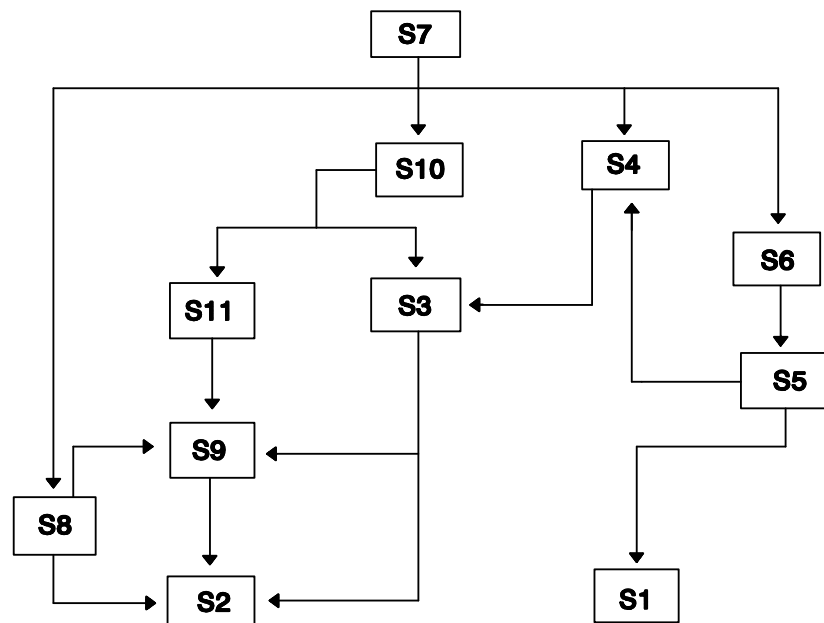


Figure 2: Rank order 2 (0-1 preference function)

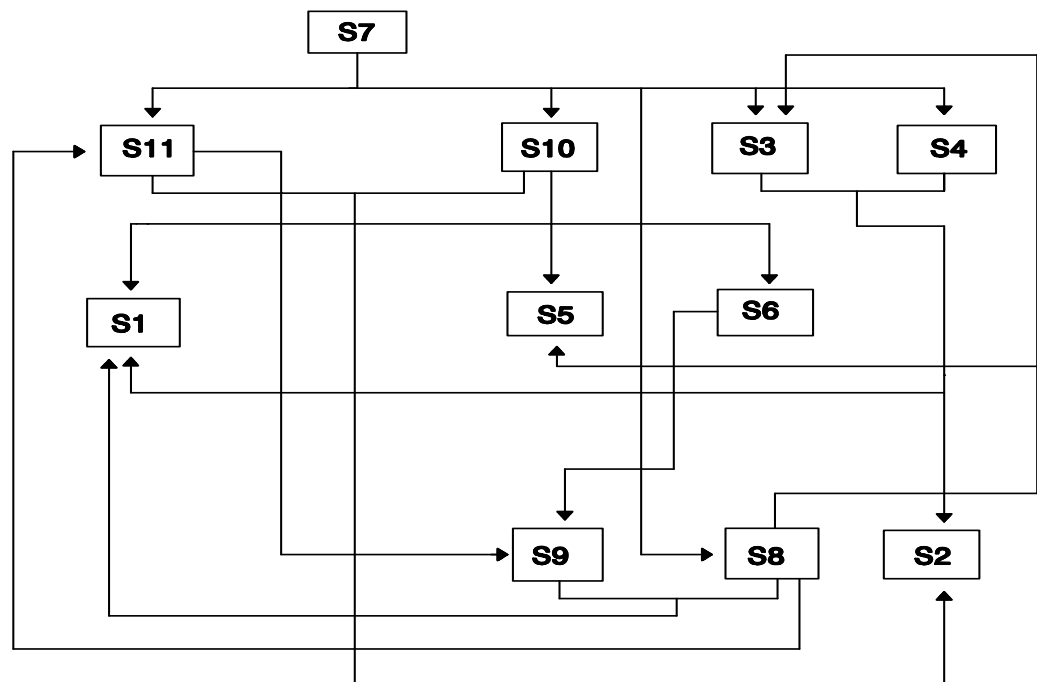


Figure 3: Rank order 3 (Different ranking of criteria)

- 1) changing the preference function used from the multilevel criteria to the 0-1 criteria; and
- 2) by changing the rank order of the criteria, shown in Table 1 to the following: criteria 4 and 5 ranked as 1, criteria 1, 2 and 3 ranked as 2, criterion 9 as 3, criterion 8 as 4, criterion 7 as 5, criteria 6 and 10 as 6 and criterion 11 ranked as 7.

The results of the conflict analysis are represented in Figures 1, 2 and 3. The multilevel criterion function, shows that S7 (a combination of wildlife and agricultural activities in the study area) is a better choice, while S1 (Manyeleti Game Reserve in its current form) appears to be the worst choice. The 0-1 criterion function also shows S7 to be the best choice with S1 still being rated as the worst, though this is in conflict with S2 (communal land use regime in Seville and Uthla). The multilevel criterion function is however a better preference function to use in this study, especially if it is considered that some of the scores used were transformed from quantitative data to schematic format to allow a better and easier comparison. The sensitivity test shows that even with a change in the weights, which might be a result of a different panel of analysts, scenario 7 remains the best choice with reference to the criteria used. Scenario 1 remains the worst.

The multicriterion functions shows scenario 8 (the opening up of the game reserve to support rural livelihood through a communal system), to be the second best alternative. The opening up of Manyeleti to support rural livelihoods through a system based on the Uthla or Seville structures of grazing schemes are the third best choices. The present schemes of Uthla and Seville are also ranked third but all these choices are indifferent to one another. The 0-1 criterion rates scenario 4 and 10 as the second best choices but they are again indifferent to one another. A change in the ranking of the criteria results in scenario 3, 4, 10 and 11 being ranked as the second best choices.

Among the present land use alternatives $S_4 = S_3 > S_2 > S_1$, implying that scenario 4 (Uthla scheme) is the best land use and the Manyeleti Game Reserve the worst alternative. The 0-1 criteria shows that $S_4 > S_3 > S_2 = S_1$; scenario 4 is clearly the better land use alternative under the present circumstances, while the communal land use and Manyeleti Game Reserve could be described as being almost the same in their attainment of the set objectives, if the level of difference in the preference intensities is ignored. A change in ranking as depicted in Figure 3 still leaves S_1 and S_2 as the worst choices. It is clear from the conflict analysis that the Manyeleti Game Reserve is at present the worst land use alternative in achieving the set objectives

5. CONCLUSION

Among the present land use regimes, the Manyeleti Game Reserve is evaluated as the worst and the Uthla scheme as the best land use alternative. It should however be noted that the Uthla scheme is available only to eight farmers. This also applies to the Seville scheme which is available only to twenty farmers at a time. Under such circumstances communal land use would obviously be a better option. The phenomenon that the Uthla scheme is the best land use alternative despite its lack of equity, clearly highlights the importance of selecting the best land use scenario. Scenario 7 (expanded wildlife activities to involve community participation) is evaluated as the best land use alternative and therefore highlights the need for an integration of the local community into wildlife management activities. The development of this scenario into reality will require further research to investigate how best this could be implemented. The opening up of the Manyeleti Game Reserve to support communal activities ranks rather highly but just as is the case with scenario 7, this will require further investigation to establish whether the land would be able to support agricultural activities and the ways and means in which some of the wildlife would have to be relocated as may be required with scenario 8.

6. ACKNOWLEDGEMENTS

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