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Inter-active and dynamic approaches on forest and land-use planning in Southern Africa

-proceedings from a training workshop in Botswana,

December 3-17 2001

Arbetsrapport 97 2002
Working Paper 97 2002

SWEDISH UNIVERSITY OF
AGRICULTURAL SCIENCES (SLU)
Department of Forest Resource
Management and Geomatics
S-901 83 UMEÅ
Phone: 090-786 58 25 Fax: 090-14 19 15, 77 81 16

ISSN 1401-1204
ISRN SLU-SRG-AR--97-SE

EXECUTIVE SUMMARY

This document summarises the outcome of a regional training workshop, "Interactive and dynamic approaches on forest and land use planning in Southern Africa". It was organised in December 2001 by the government of Botswana in cooperation with organisations in Zimbabwe and South Africa and with Swedish financial and technical support.

The workshop aimed at exposing the participants to new cross sector approaches on strategic forest and land use planning, including the Area Production Model (APM) and concept, and to provide a platform for possible future development work in this field. It concerned such issues as the role of planning in relation to policies and local development, information and data needs in planning, the use of scenario modelling in land use planning, how to narrow the gap between "planning from above" and "planning from below", and the roles and interaction of different stakeholders in the planning process.

The workshop had been proposed by the participating countries following an international training programme on policy and strategy development in Sweden. The 18 participants from three countries included central and local government staff concerned with forest and land use planning at the national and sub-national level, researchers and NGOs. The workshop consisted of two weeks of lectures, seminars and field based case studies and a concluding seminar, in which the participants presented their experiences and conclusions about the APM concept to a broader group of decision makers.

Some of the main conclusions drawn by the participants were that the APM was a useful tool for promoting dynamic and multi-sector planning. At the same time the Model has a number of technical shortcomings that needs to be addressed. Those shortcomings were identified and discussed throughout the workshop. The need to keep the model simple and transparent was acknowledged. It was proposed that "homes" should be identified for the model in each country. Those homes should build up and maintain capacity to develop and adapt the model to the local conditions and priorities.

PREFACE

In December, 2001, a regional training workshop for Southern Africa, "Interactive and dynamic approaches on forest and land use planning in Southern Africa" was organised in by the government of Botswana with the support of Sweden. The workshop had initially been proposed by the participating countries South Africa, Zimbabwe and Botswana and had been preceded by a long planning phase.

This document summarises the aim and outcome of the workshop. Its purpose is, besides reviewing the outcome of the workshop, to provide a platform for future development work in relation to the Area Production Model and concept in Southern Africa.

The participants and resource persons, who took part in the exercise, have provided the input to the document.

Mats Sandewall
Editor

Photo: The participants in the workshop after the community seminar in Mabeleapudi.

READING THIS DOCUMENT

This report is organised into five sections that reflect the programme of the workshop (see Annex F1, part 2.4). **Section A** introduces the background of the workshop and its major objectives.

Section B consists of papers linked to presentations during the first week of the workshop.

Paper B1, prepared by Bo Ohlsson, is based on a recent mission in which he was involved. It is an up-to-date *review of land use and forestry related issues in the Sub-Region of Southern Africa*, including natural resources, various products and its use, ownership, policy issues and investments. It also discusses what *driving forces* are likely to influence forest and forest land in the future (until 2020) and proposes two *scenarios* considering the current situation and the driving forces.

Paper B2 is a short summary of the information presented by the District Agriculture Officer of the Central District concerning the area where the workshop took place.

In **Paper B3-B5**, the teams of Southern Africa, Zimbabwe and Botswana present the land use situation in their countries respectively. In **Paper B3** (Botswana), rapid economic and population growth, poor land productivity, overgrazing by livestock, unclear tenure and institutional arrangements are identified as sources of land use conflicts. **Paper B4** (Zimbabwe) is derived from a Power-point presentation describing various aspects of land-use and illustrates the uneven tenure situation within different parts of the country. Although the paper does not give full credit to the pedagogic presentation in the seminar, it contains crucial information. In a comprehensive way, **Paper B5** (South Africa) describes the macro-economic policy environment in which forestry is a part, the social and human aspects of forestry, different land uses and the main products. Further, it identifies a case, Manubi State Forest, where the potential of the APM Concept may be explored

Papers B6-B10 are technical papers describing components of the APM Concept, including the APM Model and various methods for data capture that have proven to be applicable elsewhere.

Section C includes some documents presented or generated in relation to case studies.

Paper C1 is a case study prepared by one of the groups during the first week, based upon available documents. It illustrates how it is possible to adapt local conditions to the classification system of the FAO version of the Model and gives some examples of output tables. **Paper C2** is a checklist elaborated by the participants while planning for data collection in the village case study during the second week. The checklist was also found useful by the teams in their work. **Paper C3** is a first presentation of the new Excel-version (draft) of the APM, which was introduced during the workshop. This paper has to some extent been developed after the workshop based on ideas and input of the participants.

Section D from the final seminars includes the outcome and findings of the workshop.

Paper D1 describes the outcome of a participatory "community seminar" that was held by the end of the case study week in the village of Mabeleapudi, where many of the participants collected their data. **Paper D2** summarises the course of the program of the final seminar, while **Paper D3-D5** reflect the different presentations. **Paper D6** describes the discussion held in the seminar and the outcome of the conclusive group discussion.

Section E includes a reflecting and conclusive paper prepared after the workshop

The **Annexes,** contains the Terms of Reference, course schedules and lists of participants. In addition the outcome of the course evaluation, which was made by the participants at the end of the workshop, is presented.

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ADDRESSES

For any further communication concering the content of this report, the following persons or their respective office will be helpful:

Senior research officer Mats Sandewall, SLU, Department of Forest Resource Management and Geomatics, SE- 901 83 Umeå, Sweden, phone +46 90 786 5815,
E-mail: Mats.Sandewall@resgeom.slu.se

Project leader Erik Sollander, National Board of Forestry, SE-55183 Jönköping,
phone +46 36 155600, E-mail: erik.sollander@svo.se

Professor Nils-Erik. Nilsson, Bäsinge 6, SE-775 96 Krylbo,
E-mail: planalys.nils-erik.nilsson@swipnet.se

In addition, a list of all the participants in the workshop is found in Annex F2.

INTRODUCTION

The workshop "Interactive and dynamic approaches on forest and land-use planning in Southern Africa" was arranged in Botswana in December 2001. It aimed at exposing the participants to new cross sector approaches on strategic forest and land use planning, including the Area Production Model (APM), and to provide a platform for possible future development work in this field. The workshop was the concluding step of a process that had been running for several years. It provides important lessons on approaches to cross-sectoral land use planning in Southern Africa.

The process started in 1998, when there were several participants from Botswana, South Africa and Zimbabwe in an annual international course "Development of National Forest Policies and Strategies", organised by the Swedish National Board of Forestry and funded by Sida. Those participants strongly suggested that the Area Production Model, (APM), which had been demonstrated during the course, might be highly relevant in Southern Africa.

As a response, the Country Capacity Building (CCB) project (a Sida funded project aiming at forest policy issues), set up a training programme in discussions with the three countries. As a first step, key personnel from the forest authorities in Botswana, South Africa and Zimbabwe, underwent a post-graduate course at the Swedish University of Agricultural Sciences (SLU) in Umeå, Sweden. The course took place in March 2000 and was focused on the ideas and applications of the APM.

In a second step, a workshop designated for a wider audience, including governmental as well as non-governmental organisations, was planned for mid 2000. The workshop was originally intended to be a two-phase arrangement. The first phase to be arranged in Zimbabwe, focusing on model theory with only limited field work, and a second phase, were the participants would split up and work a realistic case in a designated study area in each of the three countries involved.

Unfortunately, the political situation in Zimbabwe during spring 2000 made it necessary to postpone the workshop. About a year later, in spring 2001, it was agreed among the interested countries to move it to another country in the Region, after the Ministry of Agriculture, Botswana, had generously accepted to host the workshop. The two-phase design of the workshop was by now reduced to a single event, with the joint study-area around Serowe in the eastern part of Botswana.

The APM is a simulation model developed by Professor Nils-Erik Nilsson in co-operation with FAO. The Model, including an application concept, has been further developed by the Swedish University of Agricultural Sciences (SLU), Department of Forest Resource Management and Geomatics. The Swedish team of resource persons in the Botswana workshop have all been instrumental in the previous development work of the Model. The APM has been field tested on numerous occasions in South and Southeast Asia.

This workshop, however, is the first occasion the model is used in Southern Africa. In spite of the simplicity and flexibility that characterises the model, the new setting was considered a major challenge when planning the workshop. The workshop results have given new and partly unexpected results in terms of both usefulness and applicability of the model.

The Country Capacity Building project focuses on forest policy development. In modern terminology, nfp (national forest programmes) is a highly relevant term. Key strategies include support to demand driven processes, investment in human knowledge and, not least, a belief that personal commitment is as important for success as political commitments.

On behalf of the organisers, I would like to thank the Ministry of Agriculture, Botswana, and the key-persons from Botswana, South Africa and Zimbabwe. Without their commitment and enthusiasm, the positive outcome of the workshop would not have been possible

Erik Sollander

Project Manager, CCB

SECTION B

Lecture Notes

KEY ISSUES, DRIVING FORCES IN FORESTRY AND FUTURE SCENARIOS IN THE SUB-REGION OF SOUTHERN AFRICA

Lecture notes by Bo Ohlsson

1 KEY ISSUES IN FORESTRY TO YEAR 2020

Introduction

The following presentation is based upon the lecturer's participation in the Forestry Outlook Study for Africa until 2020 for the Sub-region of Southern Africa. The draft is not yet finalised and approved and the views and interpretation found in the lecture notes are those of the lecturer. The FOSA until 2020 is carried out as a joint exercise with the African Development Bank (AfDB) and the FAO.

The work on the FOSA until 2020 was divided into two parts. One part related to the Key Issues, as defined by the (AfDB) and the FAO. The second part addresses the Driving Forces in forestry.

Not all key issues or driving forces are addressed in this lecture note. This does not imply that these issues and forces are of less importance. The part "driving forces in forest" discusses some of the factors and forces, which are likely to affect forestry development in the Sub-region. The scenarios for forestry development are based upon the key issues and driving forces identified.

1.1 Forest resources - natural forest, plantation forest and trees outside the forest.

Angola and South Africa are the largest countries in the Region, comprising some 40 % of total land area. Lesotho and Swaziland have around 1% of the total land area respectively (Table 1).

Table 1: Total land area (la) and natural forest area (nf), closed forest area (cf), woodland area (wla) and plantation forest (pf) area in the sub-region

Country	Total la, hectares	Total nf, hectares	nf, % of la	cf, % of nf	wla % of nf	pf, hectares	pf, % of la
Angola	124 700 000	76 067 000	61	18	43	140 000	0.1
Botswana	58 200 000	26 190 000	45	25	20	1 200	0.0
Lesotho	3 035 000	0	0	0	0	12 990	0.0
Malawi	11 848 400	4 147 000	35	15	20	110 000	1.0
Mozambique	79 938 000	57 555 000	72	22	50	46 000	0.0
Namibia	82 426 800	12 364 000	15	0	15	130	0.0
South Africa	122 100 000	41 514 000	34	7	27	1 486 900	1.2
Swaziland	1 736 400	139 000	8	0	8	160 500	9.2
Zambia	75 275 700	58 715 000	78	42	37	60 000	0.0
Zimbabwe	39 075 700	25 790 000	66	22	44	156 100	0.4
Total	598 336 000	302 481 000	51			2 173 820	0.36

Source: FAO: FRA 2000 home page and the FOSA national reports

Natural forest comprises some 50 % of the land area in the Sub-region. Angola accounts for 25 % of the total area of natural forests. Zambia has the highest coverage, some 78 % of its land area. Lesotho has no natural forest and Swaziland has a coverage of 8 %. Only Angola, Mozambique and Zambia has natural forest outside protected areas and national parks. The estimates of the forest coverage are

based upon different data basis. Zambia latest forest inventory was in the 1960´s. The natural forests and wood lands are generally not in good condition. Encroachment, illegal and legal logging, out take of produce for subsistence and lack of appropriate management have contributed to this.

There is a total of 2,173 ha of plantation forest of which South Africa accounts for 70%. Angola, Malawi, Swaziland and Zimbabwe have bigger areas of plantations, comprising some 5-7% of the total plantation area in the region. The plantations in Malawi, Mozambique and Zambia are presently under used. Most of the production is for roundwood and very little for fuelwood. In Zambia, there are community-based plantations for industrial purposes.

Trees outside the forest are a large resource, presently being used for subsistence and possibly also increasingly for commercial (fuel-wood for urban areas) purposes. "Trees outside the forest" is defined by FAO as "trees and tree systems occupying lands other than those defined as forests or other wooded lands". It is found in several land use systems such as around urban and peri-urban areas, trees associated with permanent and annual crops, in silvi pastoral systems, parts of Savannah land etc.

The major threat to natural forests and wood lands are the fast ongoing deforestation caused by subsistence farming systems in all countries in the Sub-region. The emerging commercialisation of this poses another serious threat in the future. The deforestation rate varies between the countries, ranging between 0.5% to 2.5% per annum with an average of some 0.7%. Malawi, with the highest population density, has the highest rate of deforestation. Zambia, with a low population density, also has a high rate of deforestation, related to high deforestation rates around densely populated areas around Lusaka and the large industrial centres in the copper belt (Table 2)

Table 2: Deforestation rate in the sub-region 1990 to 2000

Country	Annual deforestation rate, %
Angola	-0.91
Botswana	-0.18
Lesotho	0.00
Malawi	-2.37
Mozambique	-0.21
Namibia	-0.87
South Africa	-0.09
Swaziland	+1.09
Zambia	-2.35
Zimbabwe	-0.79
Average	-0.79

Source: FAO, FRA home page

Areas of arable land per capita is low in the Sub-region. When increased food stuff is required, this is frequently achieved not by increasing yields on existing fields but rather by engaging more land for subsistence farming. This is sometimes refereed to as subsistence deforestation. Assuming no changes, there is a risk that in Botswana, Malawi, Namibia, Swaziland and Zimbabwe, the natural forests and woodlands outside national parks and other protected areas will disappear by 2020.

1.2 Ownership patterns

The major part of the natural forests and woodlands are owned by the government and some of it are under communal or tribal management. Only in Namibia and Zimbabwe, there are substantial areas in

private ownership. The major parts of the plantation forests are in private hands and as privatisation of those will continue in Malawi, Namibia, Zambia and Zimbabwe, virtually all plantations will be privately owned by companies or individuals.

1.3 Forest production functions

Of the total round wood production, some 25% comprises the industrial round wood share. The industrial round wood production at present in South Africa and Swaziland exceeds the consumption by 6% and 37% presently and in the other countries, it is slightly below consumption (Table 3).

Table 3: Sawn-wood consumption and production by country, cubic meters

Country	Year 2000		Year 2020	
	Consumption	Production	Consumption	Production
Angola	7 000	5 000	9 000	0
Botswana	0	0	0	0
Lesotho	0	0	0	0
Malawi	57 000	47 000	71 000	59 000
Mozambique	31 000	28 000	40 000	34 000
Namibia	Na	Na	Na	Na
South Africa	1 818 000	1 563 000	2 141 000	1 725 000
Swaziland	122 000	102 000	144 000	120 000
Zambia	425 000	354 000	502 000	418 000
Zimbabwe	243 000	266 000	297 000	336 000
Sub-regional total	2 703 000	2 365 000	3 203 000	2 692 000

The current trade in industrial round wood in the sub-region is rather limited. There is no export to countries outside the sub-region or import to the sub-region. The main trade is between South Africa and its neighbour countries Mozambique and Swaziland, from which countries South Africa is importing saw-logs and pulpwood. Countries as Botswana, Lesotho and Namibia with limited forest resources import limited quantities of saw-logs from their neighbour countries South Africa, Zambia and Zimbabwe.

In year 2020 the situation would be, based on future consumption and production estimates, and expressed national plans, the following:

- South Africa will continue to import saw-logs and pulpwood from Mozambique and Swaziland.
- Botswana and Lesotho will continue to import limited quantities of saw-logs from their neighbour countries South Africa, Zambia and Zimbabwe.
- Namibia will import veneer logs from Angola and the Democratic Republic of Congo to their planned veneer plant in Walvis Bay. Also their future saw-log import will from Angola and the Democratic Republic of Congo. A precondition for the import from these countries is of course that the conflicts in the countries have been settled.
- When the conflict in Angola is settled the country has a potential for export of limited amounts of indigenous hardwood saw-logs.

The main part of the industrial round wood is today extracted from forest plantations. That will also be the main future situation. However, trees grown outside the forests will, in the future, become an important new source of industrial round wood. Especially in countries which are short of land to be allocated for forest plantations.

The only countries where there is a future potential to extract limited quantities of industrial round wood from natural forests are Angola, Mozambique and Zambia. In the other countries these forests have to be allocated for conservation and wood fuel production.

The forecasted production 2020 of industrial round wood is bigger than the consumption in South Africa, Swaziland and Zimbabwe. This is based on the fact that these countries do not need any import and can to some extent expand their consumption or export industrial round wood to the other countries in the sub-region. The forecast for the other seven countries shows a slightly bigger consumption than production of industrial round wood. There are at least the following viable option to solve the deficit of industrial round wood, decrease the wood fuel consumption: allocate more land for industrial round wood forest plantation, and/or pay still more attention of growing trees outside the forests.

Policy issues related to the forest industry

The objective with the privatisation of forest plantations carried out in Malawi, South Africa, Zambia and Zimbabwe is to improve the management of the plantations and thus increase the production of these forests. The improved management of the plantation forests are expected to considerably increase the realised annual yields.

Studies in South Africa indicates that there is currently, in all forest plantations, both private and government owned, a considerable gap between the potential and the realised yields. This due to poor management, such as under-felling, wrong rotation periods, delays in replanting after clear-felling, not utilising fast-growing high-yield seedlings, etc. It is estimated that the annual yield per area unit could through improved management be increased by 30 - 40%.

The forest industry in South Africa is implementing a very successful small grower scheme. It can be mentioned that excellent results have been achieved in Kwazulu-Natal to the extent that there are now more than 10,000 growers involved on a total area of 14 000 hectares. Schemes like this could adapted to some other countries in the sub-region. These countries could thus increase the industrial round wood supply. Efforts should also be carried out to drastically increase the growing of trees outside the forests as these trees in addition to being a source of wood fuel could be a source of industrial round wood which will give the farmers a well needed income.

Concession agreements in government owned forests carried out in the frame work of good governance could be alternates to privatisation. However, in some countries the experiences of the use of concessions are negative.

The increased pressure from conservation point of view to design forests as protected areas will indirectly have an influence on the industrial round wood supply as it will increase the demand of wood fuel from forest plantation. The dualistic role (positive and negative) of forests and trees in watershed management, is in South Africa predicted to have an negative impact on future development of commercial and community forestry in the country. The same will most probably, during the coming years up to year 2020, be the situation in other countries in the sub-region. This will of course have an effect on the industrial round wood supply.

1.4 Policy issues

There is an ongoing privatisation and commercialisation of government forests presently in Malawi, South Africa, Zambia and Zimbabwe. Outgrower schemes are being introduced, i.e. in South Africa.

The potential of trees outside forests have up to now been grown rather randomly in the countries in the sub-region. Most trees outside forests are at present found around homesteads and in connection

with different agro-forestry systems. However trees outside forests represent an important potential for wood production both for wood fuel and for industrial round wood. There are examples from Asia where farmers are growing trees outside forests and they form an important source for local supply of construction timber, wood fuel, etc., but also give the farmers an extra income as an essential amount are sold to the forest industry as industrial round wood.

Governments and the forest industry should strongly and systematically start to encourage and support farmers to increase the planting of trees outside forests, around homesteads, along linear features like roads and boundaries, as hedges, fences and scattered trees in the fields. In some countries (e.g. Botswana, Zimbabwe) the governments have already launched programmes to promote tree planting. These efforts are intended to reduce pressure on the natural forests and woodlands, enhance environmental conservation, increase food production through the planting of food-yielding and multi-purpose trees and increase wood production in general.

Forest industry products role in the economies of the countries in the sub-region depends on the size of the forest industry in each country. The size of forest industry sector varies very much in different countries, from no primary industry at present in Botswana, Lesotho and Namibia to a forest industry of internationally important size in South Africa.

Only South Africa has a more diversified export and import of forest industry products. The other countries have only export of sawn timber and mainly import of board and paper products. The most significant trade of forest products inside the sub-region is that of sawn timber. The domestic trade in the countries is dominated by wooden building construction material. It can be anticipated that sub-regional trade in paper products will increase essentially until year 2020. The population growth, income changes, growth in literacy levels are factors, which considerably will increase the consumption of paper products in the sub-region. This will be an opportunity for South Africa to expand its export to the other countries in the sub-region.

The forest based industries in the sub-region are concentrated to South Africa. This country is the major player in this sector with a well established, developed and functioning forest industry including all important branches of this industry. South Africa's forest industry is at present also a significant player in a global context despite a relatively small but productive resource base. Comparing the forestry sector of South Africa with that of New Zealand shows that they are almost identical concerning afforested areas, annual harvests, outputs, export earnings employment, and contribution to GDP.

A few other countries have functioning forest industries to a lesser extent. These are Zimbabwe (sawmills, board mills, pulp and paper mills), Zambia (sawmills, board mills) and Swaziland (sawmills, board mills, a pulp mill).

At present the operations of the forest industry in Zimbabwe is negatively influenced by the current internal political situation. There is a limited potential to further develop the forest industry in the country if the present internal development takes a direction creating a favourable development climate/conditions for the forest industry. The country has well-established forest plantations and the sawmill industry has adopted certification as an important mean of maintaining their sawn timber market in Europe. The country has not any raw material potential to increase their board, pulp and paper production for export purposes. These industries should be maintained for the local market.

Zambia has at present a small, rather well established sawmill industry with limited export. The country has limited possibilities the raw material bases for this industry due to limited land resources available for new forest plantations. The sawmills should be further developed to meet the growing local demand of sawn timber until year 2020.

Swaziland has a small but well-established sawmill and board industry based on raw material from forest plantations. The pulp mill with a production of 217,000 ton annually is also based on raw material from forest plantation. There are indications that this mill will be closed down before year 2020 due to its age, which causes the South Africa based owner to move the production to bigger and more modern mills in South Africa. This will give the sawmill and board industry in the country a potential for expansion, the new situation will also increase the export of industrial round wood to South Africa.

Countries with no primary forest industry at present are Botswana, Lesotho and Namibia. In Botswana all timber operation were suspended in 1992, based on a decision of the government. Botswana has limited possibilities to restart timber operations until 2020. Lesotho has no potential for any primary forest industry based on raw material produced in the country.

Namibia has plans to establish a plywood mill in Walvis Bay during the next decade. The raw material supply is planned to come from Angola and the Democratic Republic of Congo. Namibia also plans to restart the sawmill in the Caprivi Strip based on raw materiel from Zambia. Furthermore, Namibia has plans to expand their charcoal production (there is already an export of charcoal) and establish small scale chipboard and waifer board mills.

In Angola the forest industry is practically closed down due to the war going on in the country. This country has a considerable potential to develop a flourishing forest industry based on both indigenous and exotic industrial round wood.

Malawi has a small primary wood processing industry consisting of a few smaller sawmills, complemented with a few board mills and furniture factories. An important feature in the saw-milling sector in Malawi is a considerable pit sawing operation that takes place in the country. Due to scarcity of land, which could be allocated for new forest plantation Malawi does not have any potential to increase its forest industry production based of an increased raw material bases. The only possibility to expand the production is a more efficient utilisation of the present raw material basis.

Mozambique also has a small primary wood processing industry consisting of a few small sawmills, a board mill and a mill processing recycled paper. Mozambique is exporting industrial round wood to South Africa. The country has potential to develop its forest industry with the aim to process the round wood exported at present in its own industries. Mozambique is together with Angola the only countries in the sub-region which have potential for production of limited amounts of hardwood sawn timber.

South Africa's forestry and forest industry sector is one of the most significant contributors to the national economy, generating 2% of the gross domestic product (GDP). The forest industry ranks amongst the top five non-mineral exporters and provides direct employment for 135,000 predominately rural based employees. The forest product sector is the fourth largest manufacturing sector in the country. South Africa has far reaching plans for the development of its forestry sector. The plans covering a period until year 2025, represents a annual growth of 2.0% in physical production and 4.0% real annual growth in value of output.

1.5 Wood fuel and energy

The heavy reliance on wood fuel is unlikely to change drastically in the sub-region until year 2020, due to the predicted continuation of fast population growth and the limited scope for substitution with alternate energy sources.

Total non-industrial round wood (wood fuel) production amounts to 72 million m3 which is about 74% of the total production of round wood (Table 4)

Table 4: The total non-industrial round wood (= wood-fuel) consumption and production by country, cubic meter

Country	Year 2000		Year 2020	
	Consumption	Production	Consumption	Production
Angola	6.566 000	6 504 000	8 256 000	8 178 000
Botswana	2 014 000	1 993 000	2 977 000	2 705 000
Lesotho	902 000	893 000	1 273 000	1 260 000
Malawi	13 707 000	13 569 000	19 471 000	19 276 000
Mozambique	20 303 000	20 100 000	29 560 000	29 274 000
Namibia	n.a.	n.a.	n.a.	n.a.
South Africa	9 950 000	10 361 000	5 347 000	6 119 000
Swaziland	1 023 000	1 135 000	1 095 000	1 625 000
Zambia	9 324 000	9 273 000	11 095 000	11 736 000
Zimbabwe	8 316 000	8 247 000	10 656 000	10 584 000
Sub-regional total	72 104 000	72 072 000	90 451 000	90 999 000

Source: Wood and Wood Product Supply and Demand in Africa to 2030, Working Paper for FAO, May 2001

If South Africa is excluded, almost 90% of the roundwood production is used as wood fuel, charcoal included. Consumption and production in 2000 was in balance when the woodfuel harvested/collected from deforestation areas is included in the current production. To this must be added other biomass used for energy purposes. Woodfuel remains the most important source of energy in all countries in the Sub-region except South Africa where wood fuel amounts to 23%, electricity being the dominant energy source at some 47%. (table 5)

Table 5: The patterns of energy sources in the Sub-region (indicative)

Source	Percent of energy
Woodfuel	23% - 95 %, average 70 % including charcoal
Electricity	2% - 47%
Paraffin	0% - 21%
Coal	0% - 19%
Other	0% - 27%

In South Africa other sources than woodfuel is already the dominating energy sources for both the rural and urban population, electricity (47%), petroleum products (23%) and coal and other sources (6%). However this situation is a result of a long lasting development process in this country.

As seen there are many alternate energy sources, some of which are already used to some extent also in other countries. Further sources, which are under development, are solar panels, wind power, natural gas, etc. The main constraints in being able to change the energy source pattern are the availability and accessibility of these alternate sources but also there are cultural and traditional obstacles, People are since long ago used with woodfuel. This source has a well rooted place in their culture and tradition.

There are in most countries in the sub-region a lot of serious ongoing efforts to develop the use of the main energy sources and make alternate energy sources more attractive for the rural and urban poor people. The privatisation and communalisation of natural forests, woodlands and forest plantation is

one main effort in several countries to improve the management of these resources and move against sustainable management of these resources.

Improved utilisation of wood fuel through development of more efficient means to produce energy through burning wood (e.g. development and introduction of more efficient stoves. Pricing of the alternate energy sources is another possibility, which has been used in a few countries. South Africa has through the successful electrification of rural areas and by selling electricity to a price affordable for the poor population been successful to increase considerably the use of electricity and decrease the use of wood-fuel.

Botswana has recently embarked on promoting the use of coal as substitute to fuel wood with the aim to reduce the pressure on natural woodlands. The success rate of this programme has been modest due to many factors, some of which are cultural. They have learnt that generally people are reluctant to switch to coal because they do not have the right technology (stoves) to burn coal, The available coal is of poor quality for home use, they have never used coal before, they do not have easy access to it particularly in the rural areas, they consider it expensive although it is heavily subsidised, and they are more comfortable with what they understand better and that is the use of wood fuel. Despite this the government continues to make efforts to promote the use of coal as an alternative to wood fuel.

1.6 Non-wood forest products (NWFPs)

A major NWFP is the food security the forest provide. In general, NWFP in the Sub Region contains a large variety and also quantity of products which is collected and harvested, both for subsistence and for the market. The goods harvested ranges from construction poles (Mopane), various species of (traditional) medicines, oils (Marula), nuts and kernels (Mangetti), insects, worms, roots, fruits, thatch grass and palm fronds, honey, mushroom, cane furniture.

The extent of trade for some of the above produce is very extensive although it is difficult to find good data. It is estimated that in South Africa, there were some 27 million consumers of traditional medicine and 100,000 traditional healers in 1997. Although NWFP plays an important role in the economy, very little is known about the management and trade.

1.7 Conservation and bio-diversity

In 5 countries, 13 - 39% of the natural forest is under protection with the remaining countries having 3-8% under protection. These areas are also important for the growing tourist industry.

1.8 Socio-Economic Functions of Forests

The population's reliance on forest resources as a source for fuel, food, construction materials, medicines and livelihood in general is a key issue in the Sub Region. This is related to a large extent to poverty and to the lack of alternatives. Most of the forest and forest land/wood lands in the Sub Region are dry and do also support the largest number of people and livestock, compared to other eco systems in the Sub Region. The human and development pressure on these areas is very high.

Forest in a wider context (forest, forest land, trees outside the forest) is very important in terms of provision of food security and income generation. The actual employment in the forest sector is limited. However, the collection of NWFP and the production of wood fuel engages a substantial number of people. A gender dimension to this issue would very likley show that there is a large number of women engaged in this.

1.9 Financing and Investment Climate

The investment climate for the Sub-region is not good. Very little investment reach the forestry sector although here are a few exceptions such as the acquirement of plantations in South Africa. Donor inputs are being reduced, public spending has been held a constant or slightly increasing levels and direct foreign investments have been maintain the same level or decreasing over a period.

Table 6: Foreign aid (grants plus concessional loans as % of GDP) in the sub-region

	1990	1991	1992	1993	1994	1995	1996	1997
Angola	1,2	1,1	2,3	4,0	8,0	5,1	3,4	1,1
Botswana	11,6	12,8	9,0	9,2	9,1	4,4	0,3	n.a.
Lesotho	-6,6	14,7	18,7	-1,4	23,2	31,6	28,5	24,2
Malawi	11,1	10,6	15,3	15,1	18,4	25,2	11,4	3,4
Mozambique	30,8	29,7	43,3	38,7	42,8	28,8	24,1	12,9
Namibia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
South Africa	0,2	0,1	0,1	0,1	0,1	0,1	0,0	0,0
Swaziland	20,3	20,5	22,3	18,7	18,5	16,6	15,7	14,0
Zambia	10,5	23,8	27,0	19,5	17,3	18,6	15,2	4,9
Zimbabwe	2,2	2,1	7,2	5,5	5,3	3,3	1,6	n.a.

Source: *Population, Income and Forest Resources in Africa, A Review of Selected Trends with Projections to 2020, FOSA Report, Feb. 2000*

Foreign aid has decreased during 1990-97 (Table 6). Only Lesotho received more foreign aid 1997 than in 1990. During the period, there has been a slight increasing trend in direct foreign investments in five countries whilst four countries have remained on the same level (Table7).

Table 7: Foreign direct investments (as percent of GDP) in the sub-region

	1990	1991	1992	1993	1994	1995	1996	1997
Angola	-3,3	5,4	5,0	5,7	4,2	9,3	2,4	2,4
Botswana	2,6	-0,4	-0,3	-7,2	-0,6	0,6	n.a.	n.a.
Lesotho	2,7	1,3	0,4	2,1	2,5	3,7	3,0	n.a.
Malawi	0,0	0,0	0,0	0,0	0,0	0,0	1,3	1,0
Mozambique	0,5	1,1	1,6	1,9	1,9	2,3	3,2	2,3
Namibia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
South Africa	0,0	0,0	-0,6	-0,3	0,2	-0,2	0,1	0,5
Swaziland	2,6	6,6	5,1	4,1	-0,6	-1,9	2,6	3,2
Zambia	0,0	0,0	0,0	0,0	1,3	2,8	3,5	5,1
Zimbabwe	-0,4	0,1	0,1	0,4	1,2	2,2	0,4	n.a.

Source: *Population, Income and Forest Resources in Africa, A Review of Selected Trends with Projections to 2020, FOSA Report, Feb. 2000*

Public investments have in six countries remained on the same level (Table 6.1.d). In Lesotho and Malawi they have decreased. The public investments have in most countries been considerably higher than the direct foreign investments (Table 8)

Table 8: Public investments (as percent of GDP) in the sub-region

	1990	1991	1992	1993	1994	1995	1996	1997
Angola	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Botswana	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Lesotho	43,3	52,0	51,8	46,9	54,2	n.a.	n.a.	15,5
Malawi	8,0	8,1	9,4	7,4	15,1	9,4	5,1	6,2
Mozambique	14,8	10,6	11,8	11,4	12,9	11,0	9,3	10,0
Namibia	7,8	7,3	9,7	8,2	8,4	7,2	7,9	8,1
South Africa	6,8	5,9	5,2	4,7	4,4	4,3	4,6	4,7
Swaziland	7,2	12,1	12,2	10,3	9,3	6,3	6,9	6,6
Zambia	6,2	7,8	6,7	4,5	4,2	5,4	5,7	5,2
Zimbabwe	3,4	3,5	3,8	3,6	3,1	2,7	2,5	3,2

Source: *Population, Income and Forest Resources in Africa, A Review of Selected Trends with Projections to 2020, FOSA Report, Feb. 2000*

1.10 Summary and Conclusions, Key Issues

The major issues for development of forestry in the future are good governance and institutions. Superior technologies, result of research, good plans and intentions, protection of private and public investments etc. will not come into play unless there are functioning institutions, supported by the government and the public at large. This requires good governance, which is a very loose term but connotes transparency, responsibility, recognition, accountability and opportunities for the public at large to voice their opinion in a free manner. The development towards a market economy, which is taking place, will not support socio-economic development unless good governess is in place. Good governess will ensure that government policies are implemented, that the citizens investment and work is protected by the law and that dysfunctional systems are displaced. Institutions refer to issues such as land tenure, which enables a productive and functioning interaction between man and land.

Most of the countries in the region have well thought out forest policies and legislation. The problem is that there are in some cases a lack of good governance and that the institutions which are supposed to implement those policies and legislation are under-funded, under educated, understaffed and also that the institutions are too weak to carry out this task.

For instance, plantation forestry is a well-known and recognised activity. Technologies and management systems exist, are available "off the shelf". However, there are very few cases of commercially successful plantations, even in very wood deficit areas. The problem is not technological but rather related land tenure issues, unclear owner ship and management responsibilities and lack of institutions which are supportive of e.g. private plantation forestry. In some countries, there are donor driven government fuel wood plantations around urban areas. The intentions are to provide the urban areas with wood fuel. What in effect results is a poorly managed plantation, run by an understaffed and under-funded state organisation, the Department of Forestry. At the same time, the plantations are surrounded by small farmers, short of land, wood and gainful employment opportunities. They have to encroach upon the plantations, steal wood or convert the plantations into farm land in order to survive. In essence, they are forced to carry out illegal activities. In the end, the farmers are loosing an opportunity to engage in plantation forestry, the Department of Forestry is involved in a task they were not designed for and it generates conflicts between the different actors. A seemingly better option would, for instance, be to assist farmers in becoming small plantation owners, managing the plantations and earning money by selling the wood to the urban area. It requires land tenure, legislation and access to the market to support this development that would put a value on the trees that would result in the farmers taking care of their own plantations.

2 DRIVING FORCES

The Driving Forces includes forces, which are likely to affect forest and forest land in the future until 2020. Such forces, discussed in this section, are demographic forces, economics and social development, agricultural-forestry interface, changing energy needs, environmental awareness, technological changes, socio-political and institutional changes, conflicts and wars and natural disasters. At the end of this section, some future scenarios are discussed. In this lecture note, not all the above driving forces have been included. Rather, some have been selected and also illustrated with Sub-regional based statistics.

2.1 Demographic forces

In general, the increased population is assumed to have an adverse effect on the forestry sector in terms of deforestation. However, population growth per se is not necessarily adverse towards forestry development. It is because the effects of population growth and its effects upon forestry and forest land is related to institutional factors such as land tenure, both traditional and those formalised in legislation. In combination, this have contributed to a dichotomy of land tenure - one for commercial, large scale farms and one applying to the majority, the small scale farmers. For the latter sector, increased yields are related to engaging new land, which in effect means the conversion of forest land into agricultural land. This option is more common than increased investments in high yielding varieties, technologies and management. Actually, there are instances, if we look outside Africa, where the extent of forest degradation and lack of wood raw material has resulted in major investments by small farmers in wood lots. (Bangladesh, Java in Indonesia, Vietnam, Lao PDR) Due to physical and institutional (laws against encroachment and illegal village based logging has been enforced) factors, the farmers have actually become major producers of wood, both for subsistence and for the market through "outgrowing".

Table 9: Population, density and population growth in the Sub-region by country

Country	Population 2000 in 1,000´ Projection	Population density, pop./km2	Population growth 1995-2000	% rural population 2000
Angola	12,878	10	3.20	65
Botswana	1,622	3	1.91	26
Lesotho	2,153	71	2.22	77
Malawi	10,925	92	2.44	85
Mozambique	19,680	25	2.48	59
Namibia	1,726	2	2.24	59
South Africa	40,377	33	1.49	57
Swaziland	1,008	58	2.88	63
Zambia	9,169	12	2.25	55
Zimbabwe	11,669	30	1.42	69
TOTAL	111,207			

The total population of the Sub Region amounts to 111,207,000 with Swaziland having the least number of people and South Africa the highest, 1,008 and 40,377 respectively (Table 9). Population density varies between 3 person per km2 for Botswana and 71 for Lesotho. Four countries have below 12 persons per km2 (Namibia, Zambia, Angola and Botswana) and with some countries having very high population density such as Malawi 92, Lesotho 71 and Swaziland 58 persons per km2. Population growth is high in Angola, 3.2, with countries such as Zimbabwe (1.42), South Africa (1.49) and Botswana (1.91) at the lower end. The rural population out of the total hovers around 55 - 85%, Malawi having the highest percentage. The exception is Botswana with a rural population amounting to some 26% .

The urban population is increasing very fast and at 2020, it is expected that the urban population has doubled, from some 50 million to 100 million. This will put a heavy pressure on urban areas to provide services and facilities, including energy. In a demographic perspective, the countries are very heterogeneous and have different starting points in terms of demographic future. The age structure is uneven with a substantial proportion being below 15 years of age (Table 10)

Table 10: The age structure of the population in the sub-region

Country	Population 2000 in 1,000´ Projection	Below 15 years of age at 2000, %	65 and above 2000
Angola	12,878	46	2.8
Botswana	1,622	42	2.5
Lesotho	2,153	40	4.2
Malawi	10,925	47	2.7
Mozambique	19,680	45	3.3
Namibia	1,726	42	3.8
South Africa	40,377	35	3.6
Swaziland	1,008	43	2.7
Zambia	9,169	47	2.2
Zimbabwe	11,669	41	2.8
TOTAL	111,207		

A number of diseases affect the population growth and also health condition of the population in the Sub-region. The extent of HIV and aids also includes the professionals - in one country, the Department of Forestry lost 3 professionals during a year due to this disease. The bulk of the population is affected not only by HIV and aids but also a number of other diseases affects them such as malaria, TB and river blindness. The mortality of these diseases is larger than those for aids. In toto, the effect on the population is not only the mortality but the suffering, the physical obstacles towards work, towards planning, investments (by small farmers e.g.) and the fulfilment of household livelihood strategies become very difficult for those affected.

Changing fecundity and mortality, including AIDS

Table 11: The expectation of life at birth of the population with and without AIDS in the sub-region

Country	2000 With AIDS	2000 Without AIDS	2015 With AIDS	2015 Without AIDS
Angola	44.6	46.5	49.0	52.5
Botswana	44.4	67.6	43.0	73.0
Lesotho	51.2	61.4	37.8	67.9
Malawi	40.7	51.2	43.1	57.3
Mozambique	40.6	47.0	41.0	53.0
Namibia	45.1	62.1	53.6	68.6
South Africa	56.7	63.3	42.0	69.6
Swaziland	50.8	60.2	39.2	67.2
Zambia	40.5	57.6	52.1	63.6
Zimbabwe	42.9	66.5	50.2	71.4

Source: UN World Population Prospectus, the 2000 Revision

HIV is reducing life expectancy at birth with some 20 years (Table 11). The challenge for the future is twofold. One is related to numbers and quality of life. A reduction of the population growth and increased quality of life in terms of health, reduction in infant mortality and activities to reduce the prevalent major diseases such as HIV/aids, malaria etc. would very much enhance the opportunities for forest and forest land development. However, this alone is not sufficient. Good governance and functioning institutions are prerequisites for this - as well as this is a prerequisite for improved health.

Being exposed to diseases is not a new phenomenon to the population in the Sub Region. Aids have added another dimension in terms of affecting not only the poorest in rural areas but also the urban population, including the professional cadres. This have long term effects on the age structure - some age classes have been heavily exposed to HIV/aids such as the 20 - 30 year of age population. It is also a heavy burden for the health and social welfare systems, both the "modern" and the traditional. It certainly also does affects the outlook of people not affected and is a substantial obstacle towards social development.

The demographic changes have immediate and long term effects for forestry and the forest land use. Coupled with a socio political and institutional environment which is not conducive to sustainable and productive relations between people and land, the impact is very negative - sub optimal use of forest and forest land, deforestation and land degradation. On the other hand, in an environment where the socio political and institutional factors are conducive to sustainable and productive relations between people and land, population growth per se is not necessarily an adverse factor for sustainable forestry and forest land use. Each person is a also a potential resource, both as a producer and consumer.

The health situation in the Sub Region with endemic diseases is detrimental to the development in general as well as forestry and forest land use in particular. The Aids and HIV situation is depriving the countries of both people in active age classes and also affecting the cadre of professionals.

2.2 Economic and Social Development

Per capita incomes in the Sub-region varies as indicated in Table 12.

Table 12: GDP per capita; current prices

	1990	1991	1992	1993	1994	1995	1996	1997	Mean annual growth rate
Angola	1 112	1 281	588	522	389	470	686	670	*-5.0*
Botswana	2 652	2 994	2 931	2 953	3 039	3 162	3 335	3 110	*2.2*
Lesotho	349	321	356	369	392	430	425	460	*4.0*
Malawi	212	249	207	220	125	148	223	236	*1.4*
Mozambique	144	140	107	109	110	111	128	149	*0.4*
Namibia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	*n.a.*
South Africa	3 142	3 249	3 407	3 270	3 339	3 615	3 354	3 370	*0.9*
Swaziland	1 117	1 109	1 184	1 169	1 218	1 408	1 282	1 305	*2.1*
Zambia	422	421	385	385	362	367	368	429	*0.2*
Zimbabwe	901	863	657	623	643	698	757	776	*-1.7*

Source: *Population, Income and Forest Resources in Africa, A Review of Selected Trends with Projections to 2020, FOSA Report, Feb. 2000*

An overall perspective is one of weak economic performance with some exceptions such as Botswana. Migration is still a major demographic phenomenon, based upon uneven economic growth.

The share of the agricultural sector of the GDP varies from around 30% for Malawi to 1.9 % in Botswana (table 13). The manufacturing sectors in South Africa, Zimbabwe and Zambia amounts to more than 16% of the GDP in 1997 while it is less developed in the other countries.

Table 13: Basic data about the agricultural sector in the sub-region

Country	Agricultural land, hectares per capita		Agriculture relative share in
	1997	2020	% out of GDP of countries
Angola	0.30	0.16	9.3
Botswana	0.22	0.14	1.9
Lesotho	0.16	0.11	Na.
Malawi	0.17	0.12	32.7
Mozambique	0.17	0.12	27.8
Namibia	0.51	0.45	11.5
South Africa	0.42	0.43	4.0
Swaziland	0.19	0.10	13.3
Zambia	0.61	0.38	16.0
Zimbabwe	0.29	0.27	24.3

Source: Population, Income and Forest Resources in Africa, A Review of Selected Trends with Projections to 2020, FOSA Report, Feb. 2000

Per capita income is low and the majority of the population live under poverty conditions. Reliance on forest and forest land as a resource for food, fuel, construction materials, medicines etc. is a key issue in the Sub-region and very much rooted in poverty.

The majority of the woodlands in the Sub-region is dry. When comparing the different ecosystems, the dry forest and woodlands support the largest number of people and livestock. Because of this, the dry forest and woodlands are central to food security and face a higher human and development pressure than any other forest type.

HIV will have long term consequences for the population structure. Substantial portions of the productive age classes are affected and there will be less number of person in the productive age classes to cater for a larger number of people in non-productive age classes.

2.3 Agricultural-forestry interface

The agriculture sector is characterised by a dualistic pattern with large scale commercial farms on one hand and small subsistence farming on the other hand, carried out by a vast majority of the population.

The agricultural land available per capita is low. The share of agricultural land of total land area has diminished in Botswana and Swaziland whilst the has been considerable increases in Lesotho, Malawi, Namibia and South Africa (Table 14).

Table 14: Basic data about the agricultural sector in the sub-region

Country	Total agriculture land, hectare	Agriculture land % of total land area	Change 1980 - 1997 in %
Angola	3 500 000	2.81	2.94
Botswana	346 000	0.61	-14.36
Lesotho	325 000	10.71	11.30
Malawi	1 710 000	14.43	28.38
Mozambique	3 180 000	3.97	3.25
Namibia	820 000	1.00	24.81
South Africa	16 300 000	13.35	22.98
Swaziland	180 000	10.37	-4.76
Zambia	5 265 000	6.99	3.07
Zimbabwe	3 210 000	8.21	25.15
Total	34 836 000	5.82	

Source: *Population, Income and Forest Resources in Africa, A Review of Selected Trends with Projections to 2020, FOSA Report, Feb. 2000*

The livestock management in the sub-region is divided into two sectors, the commercial sector where livestock is raised for beef and other meat or milk products and the traditional sector where livestock is raised for a variety of reasons which include food (milk and meat) income generation, meeting social obligations, such as banks and security. The table 15 gives an indication of the huge number of livestock in the sub-region 1996.

Table 15: Number of livestock 1996

Country	Cattle	Sheep	Goats
Angola	4 500 000	280 000	990 000
Botswana	1 500 000	401 000	1 837 700
Lesotho	580 230	1 113 750	749 135
Malawi	748 900	90 000	894 400
Mozambique	292 000	41 918	392 781
Namibia	2 031 353	2 409 699	1 616 090
South Africa	11 300 000	32 500 000	6 900 000
Swaziland	640 111	24 282	435 080
Zambia	2 630 000	35 000	9 373 000
Zimbabwe	5 178 000	5 500 000	2 530 000
Total	**29 389 594**	**42395649**	**25 258 186**

Source: *SADC Issues Paper on Community Building in Crop, Food Security, Livestock and Research and Training Sectors 1996*

2.3.1 Change in livestock and pasture land management

Livestock raising is a major use of land throughout the sub-region and is in many countries an essential part of the subsistence farming system. In some countries livestock accounts for more than 50% of agricultural GDP and virtually the main part of all agricultural export. Production of meat is in the sub-region an important part of the livelihood of the poor rural farmers. Bush meat, wool and mohair are also important products in some of the countries.

Livestock production is in many of the countries in the sub-region limited by poor grazing land and

high incidence of livestock diseases. Further crop cultivation has resulted in reduced grazing land and increased dependency on crop residues as feed for the livestock. This has also resulted in the reduction of the grazing land and woodland. Wood fuel scarcity has also led to an increased use of cow dung for fuel resulting in the serious circle of loss of soil fertility, reduction in food production and the need for more land for farming.

Most of the cattle are under traditional herders. Overstocking on grazing land has in many areas resulted in bush encroachment, severe erosion in many areas and contributed to the deforestation. Livestock is in many areas in the sub-region an essential part of the subsistence farming. When this livestock breading often is based on uncontrolled grazing it has an important contribution to the deforestation process going on in these countries.

Countries with an important commercial livestock sector are Botswana, Namibia, South Africa and Zimbabwe. The meat export of these four countries are an important part of the agricultural sector export, an export with growth potential as the cattle is brought up under ecologically sound conditions. Therefor these countries are paying much attention on development of pastureland management and cattle breading.

2.3.2 Interaction between wildlife management, crop production and animal husbandry

In Botswana, Malawi, Namibia, South Africa and Zimbabwe the governments are putting more and more attention on wildlife management as a viable, legitimate and sustainable land use system, which may be appropriate in agriculturally marginal areas. A growing number of game ranches have been established and are under the process to be established in these countries.

An encouraging example of the interaction between wildlife management, small scale crop production and animal husbandry is the inception of the *Communal Area Management Program for Indigenous Resources (CAMPFIRE)* in Zimbabwe. As a result of CAMPFIRE, communities now perceive wildlife as an asset with value and not merely posing a threat to life, property, crops and domestic animals. 33 of the country's 55 Rural District Councils are participating in this program, involving about 103 000 households.

Also in some other countries in the sub-region similar programs are carried out:

- Administrative Management Design (ADAMA) project involving 30 game management areas in Zambia.
- Living in a Finite Environment (LIFE) in four regions in Namibia.
- Community Based Natural Resources Management (CBNRM) Programme involving about 21 000 people on 30 sites in Botswana.

2.4 Changing energy needs

Wood is the predominant source of energy in the Sub-region. Around 74% of round wood harvested in the Sub-region is wood fuel. Excluding South Africa, the figure is approaching 90%. Wood is likely to remain the major source of energy in the future. Demand for wood fuel will increase and replacement of sources as electricity, petroleum products and coal will not be widely accessible. The increased urban population might decrease the demand for wood fuel.

2.5 Environmental awareness

There is a growing awareness of the importance of environmental issues in the Sub-region. Deforestation, soil erosion, fertility loss, watershed degradation and loss of bio-diversity are the most pressing environmental problems in he Sub-region. In order to address environmental issues, a

number of initiatives have been taken. National policies and legislation are under preparations or already put in place in some countries. National Bio-diversity Strategy and Action Plans have been or are being prepared in line with international conventions. Major constraints are poverty and financial and institutional resources for implementation.

2.6 Technological changes

Technologies are available for technological improvements in terms of forest management, plantation management, agriculture yields and so forth. There is a lack of driving forces to adapt many of these available technologies. Lack of institutions to carry out the introduction of these new technologies area also in many cases not existing.

2.7 Socio-political and institutional changes

The present trend is for decentralisation. This put a large pressure on the institutions involved. Decentralisation cannot be viewed as a panacea for development but requires skills and capability development, and transparency. Attempts at participatory management has been carried out in most countries and there are some success stories but its application on a large scale remains to evolve. Privatisation represent a major driving force but also has a number of inherent problems and requires functioning institutions, both on the private and government side to achieve the desired effects.

2.8 Conflicts and wars

The sub-region has been plagued by a number of conflicts and wars as in Angola and Mozambique, which has had a significant impact upon the economic and social development with direct and indirect effects upon the forestry sector. Political instability also contributes to a negative impact.

2.9 Natural disasters

The Sub-region has been affected by a number of natural disaster such as the floods in Mozambique and South Africa and in the Okawangu delta in Botswana. Droughts are a recurring phenomena affecting the population. In effect, the natural disasters vacillate between droughts and floods. The variation of rainfall might not be defined as disasters but do certainly affect the population and generates pressure on the forest.

3. FUTURE FOREST SCENARIOS

What happens to the forestry sector, to the forest and the forest land, will largely be based upon what happens outside the sector, in particular the political, social and economic development of the society. The scenario developed contains several components.

1. Market forces, which today has an important influence in all countries of the Sub-region. It puts a heavy pressure on institutional development.

2. The operating environment in which the forestry sector is operating. The following major driving forces have been identified:

Driving forces	**Extremes**
Policies and markets	either success or failures
Institutions	either strong or weak
Governance	either good or malfunctioning
Human resources	either development or degradation
Informal sector	either recognised and supported or unsupported

3. Land-use and forestry development conditions is one of the most important driving forces. There conditions are identified: subsistence forestry; Developed subsistence forestry and High value land-use and forestry.

4. Four land use and forest development steps towards 2020 have been identified:

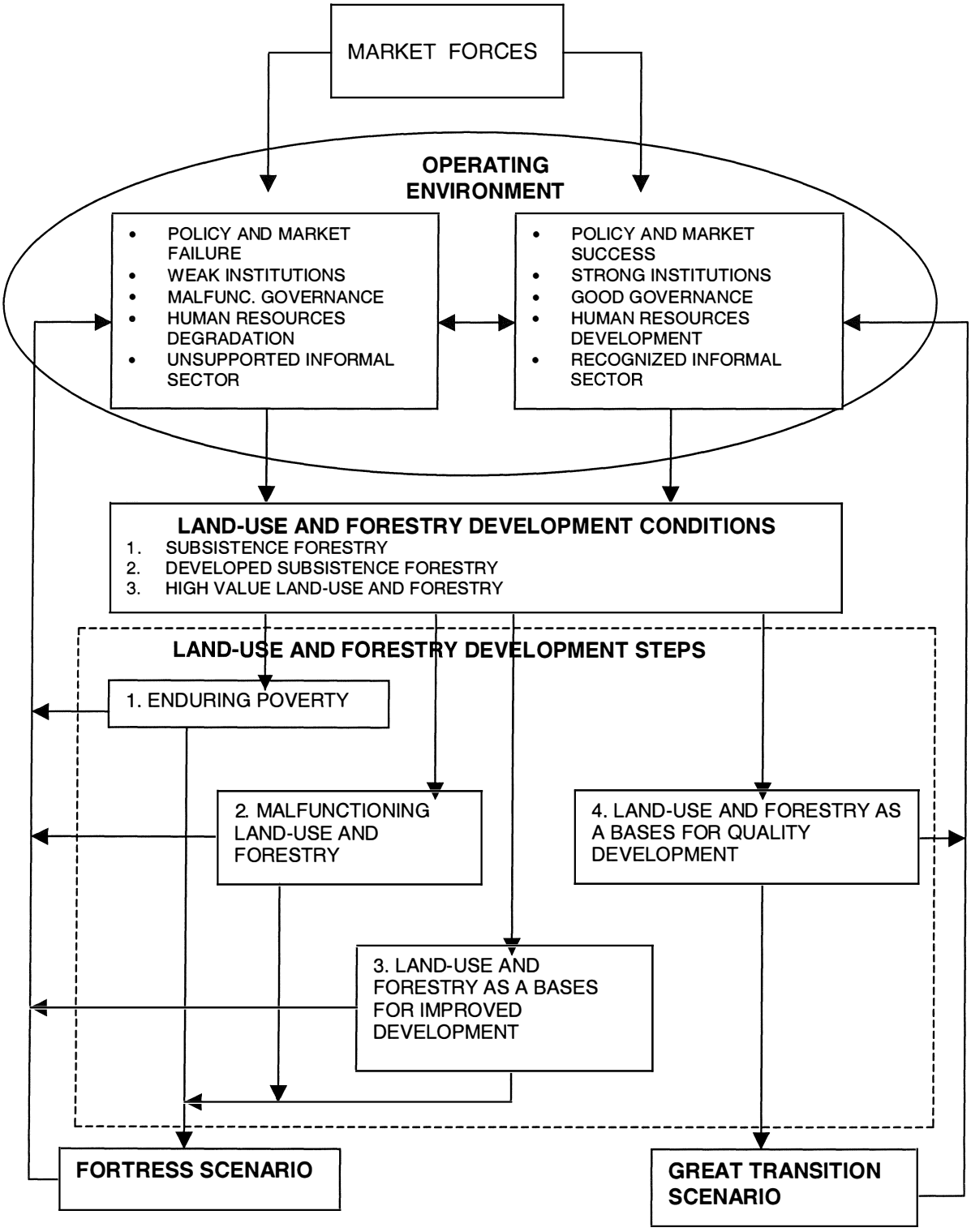
Step 1. Enduring poverty, a "worst" scenario
Step 2. Malfunctioning land-use and forestry, "less worse"
Step 3. Land-use and forestry as basis for improved development, "better"
Step 4. Land-use and forestry development for a quality development, "best"

For 2020, two possible end scenarios have been identified based upon the driving forces and forestry development conditions. Scenario one is the "Fortress" which is the "worst" scenario and represents a "business as usual" perspective. Scenario two represents the "Great Transition" and is the "best" scenario.

The worst scenario, the "fortress" is a situation where market forces have failed to address critical social and economic problems and the absence of policy interventions. The Great Transition scenario is certainly an uphill task but the present awareness of the need to bring about fundamental changes in the way the economy and society is organised, the ongoing discussion on "African Renaissance", regional integration and strengthening democratic institutions and enhancing transparency, emphasise on human rights, protection of the environment and the reorientation of the roles of the government vis á vis the private sector all contribute to the possible accomplishment of this scenario.

Finally, there are of course number of wild cards which might affect the outcome such as internal conflicts and wars and natural disasters.

Scenario summary



BACKGROUND, SEROWE DISTRICT - PAJE/MABELEAPODI STUDY AREAS

(Content of presentation by Mr Thabone Regional Agriculture Officer, Central Region)

GEOLOGY, RAINFALL

- PARTS ON HARDVELD (LOAMY & CLAY SOILS)
- PARTS ON SANDVELD (MAINLY SANDY SOILS)
- RAINFALL: 350 - 600mm/annum
- LOCATION OF VILLAGES: 20Km outside Serowe or 50km from Palapye

TOPOGRAPHY AND HYDROLOGY

- HILLY WITH SOME FLAT AREAS USED FOR AGRICULTURAL PURPOSES
- WELL FIELDS BETWEEN MABELEAPODI AND PAJE

LAND USE ZONE PROFILES

- ARABLE = 9,182 (30%)
- GRAZING = 19,824 (63%)
- FORESTRY = 183 (1%)
- RECREATION = 1,712 (6%)
- TOTAL = 30,904Km^2

LAND TENURE SYSTEMS

- COMMUNAL LAND
  - Pasture, Arable, Cattle Posts & Residential
- FREEHOLD
  - Khama Rhino Sanctuary
  - TGLP Ranches
- STATELAND
  - BLDC Ranch, BDF Camp and Morupule AI

SOCIAL AMENITIES

- ALONG SEROWE/ORAPA HIGHWAY AND TARRED SECONDARY ROADS
- CLINIC, SCHOOLS, Ads OFFICE AND TRIBAL ADMIN. OFFICE
- ELECTRICITY
- TELEPHONES

FORESTRY

- VEGETATION
  - HILLY WOODLAND AND SCRUBLAND
- AFFORESTATION
  - TREE NURSERY AT SEROWE
  - COMMUNITY WOODLOT (PAJE)
  - 1999 PRA EXERCISE (MABELEAPODI) - F.A.B
  - ANNUAL N.T.P.D. ACTIVITIES.
- DEFORESTATION
  - RIFE DUE TO PROXIMITY TO SEROWE (FIREWOOD COLLECTION)

LAND USE TRANSFER/CONFLICTS

- EXPANSION OF BDF CAMP
- DERMARCATION OF TGLP Ranches
- VILLAGE/SETTLEMENT EXPANSION

CONTEMPORARY ISSUES OF LAND USE PLANNING/POLICY IN BOTSWANA - A PAPER PRESENTED AT A WORKSHOP ON Interactive and Dynamic Approaches on Forest and Land-use Planning in Southern Africa during 3RD - 17TH December 2001

Paper prepared by DCPF AND DAPS

I. BACKGROUND

Botswana covers a total land area of about 582,000 sq. kilometres. Topographically or geomophologically, the country is flat to gently undulating, with rare groups of inselbergs/hills, mainly in the east. Deep Kalahari sands covers the centre, south and west parts and rock formations are located only in the east. Climatically, Botswana has a continental arid to semi arid pattern, and rainfall is characterised by extreme variability in time and space. The country as a whole has a pattern of wet and dry cycles each averaging some ten to fifteen years in duration (Tyson 1978). Average daily maximum temperatures are around 33 degrees Celsius is January and 22 degrees Celsius in July. Daily minimum average reaches as low as 5 degrees Celsius in July and frost is common in the southern and western parts of the country.

Botswana has a population size of 1.7 million people (CSO, 2001) with most people (30%) residing in the eastern side of the country. Second to the eastern part of the country, other major population concentration centres are Gaborone, Serowe/Palapye, Francistown, Selibe Phikwe and Maun with population densities of over 500 people per square kilometre. The lowest population densities of less than 0.5 per square kilometre occur in the western part of the country, which is in the Kalahari region. The population distribution is skewed mostly due to the following: -

- The distribution of natural resources e.g. amount of rainfall which determines the availability of surface and groundwater supplies and fertile soils for farming.
- Historical factors – early settlement of Bantu tribal groups
- Provision of infrastructure e.g. roads, railway line, telecommunications and other services.
- Ecological factors such as the prevalence of malaria, bilharzia and tsetsefly in parts of Chobe, Ngamiland and Okavango.
- Environmental factors such as harsh desert conditions in the Kalahari area.

Historical Perspective in land use

Pre – independence, Chiefs were custodians of the land, they had land overseers who controlled the production areas, fields, grazing land and tribal territories. During that time, traditional institutions were in place. In 1973 the Tribal Authorities were replaced by Land Boards as land authorities, land allocators, administrators and managers.
In 1975 the Tribal Grazing Land Policy was introduced which had provision for land zoning and gazettement procedures. Land Use committees – District Land Use Planning Unit (DLUPU contributed in land allocation and land use planning.

Current Issues

The scenario today is that land use planning, zoning, and gazettement for various uses is affected pressure on land, the available serviced land cannot meet demand.

Information systems: Determine lands parcel, inventorise its allocation, use, development, conflicts, opportunities, development of appropriate land use options. In Botswana studies have been conducted in Kanye, Mahalapye etc in order to produce district land use and village land use plans.

Forestry Information Dynamics

In forestry, one of the imperatives is to conduct forest inventory and monitoring to quantify the resource base and determine forest dynamics - productivity, condition, timber production, degradation/exploitation rates. Other activities are:

- Creation of database, baseline frameworks, forestry information service (an interactive process)
- Fuelwood studies – energy flow, fuel wood preference, availability and shortages.
- Community participation in forestry projects and management of natural forests. Indicators - number of backyard nurseries, plantations, woodlots, agroforestry projects, and community managed natural forests.
- International and global initiatives: Development of National Forest Programme, Action Plan, Forestry Outlook Studies etc.

II. LAND TENURE

The land tenure system is categorised into three types namely the Freehold Land, State Land and Communal land (tribal land).

Communal Land

Communal land comprises about 55% of the total national land area. There are twelve (12) land Boards holding all communal land in trust for the citizens of Botswana and allocate it to citizens for residential, commercial and agricultural uses. All Batswana are entitled to communal for their own use. On allocation the holder does not pay any price for the land dopes not acquire any exclusive or perpetual rights to it. However, in practice as long as the land is used for the allocated purpose it stays in the family indefinitely and is used as if exclusive and perpetual rights had been attained. In grazing areas, the holder has grazing rights and ownership of the borehole for watering the livestock holds de facto rights to the water and surrounding grazing resources. In addition 50-year leases have been introduced on part of the tribal land which has been zoned for commercial use such as in livestock TGLP ranches and arable farmers in Pandamatenga area.

Freehold Land

Freehold Land entitles the owner with perpetual and exclusive individual rights to the land, including the natural resources within the land with the exception of wildlife. It comprises about 3% of the total national land area in designated blocks along the southern and eastern boundaries of the country. This area is Botswana's most suitable agricultural land. Freehold is also in some blocks in the western part of the country. The bulk of the freehold land is made up of private commercial farms, which are dominated by the livestock sub-sector.

State Land

State Land comprises about 42% of the total land area. It consists of land that the government has reserved for conservation purposes and land covered by Botswana Livestock Development Corporation (BLDC) ranches.

Conservation areas cover about 98% of the State Land. They consists of National Parks, Game Reserves, Forest Reserves, Wildlife Management Areas (Sanctuaries e.g. Nata, Manyelanong etc; concession areas for community trust e.g. Chobe trust) which comprises 8%, 10%, 1% and 22% of the total land area respectively. The area covered by towns, cities and BLDC ranches is only 1% of the national total land area.

III. CHANGES IN LAND USE AT NATIONAL LEVEL

The share of total land under the three major land uses changed in the period 1974 to 1995. However, the most significant changes took place in Communal Land and State Land major tenure systems as a result of the re-allocation of part of the Communal Land to State Land. This was mainly due to the creation of Wildlife Management Areas (WMAs), which never existed in 1974 but had a share of 23.0% of the national land area by 1995 and the gazetting in 1981 of additional Forest Reserves. WMAs were established as natural resources areas that are allocated for multi-purpose uses though pre-dominant use is wildlife utilization. These areas provide corridors of land that allow for long term conservation of wildlife by providing extended habitats for it e.g. for migratory species, providing breeding ground and escape routes.

Subsequently the share of the total land area that fell under the Communal Land tenure system dropped form 459,601 sq., kilometres to 318,997 sq. kilometres while that of State Land increased from 103,170 sq. kilometres to 234, 304 square kilometres by the end of the same period. These changes in shares of the total national land are represents a loss of 24.2% for the Communal Land tenure system and a gain of 24.1% of State land tenure system. The share of the total national land area under the Freehold land tenure system increased by only 0.1 %(CSO, environment Statistics 2000). It is important to note that 99.9% of the total re-designed land was a result of the re-allocation of Communal Land to land reserved for conservation uses.

IV. A GENERAL OVERVIEW OF LAND USES IN BOTSWANA

Botswana's main natural resources are rangeland and arable land, a large population of wildlife and minerals. The country's main land uses is therefore skewed towards arable agriculture, wildlife, livestock production and mining.

a) Arable Agriculture

Arable Land is estimated at less than 5% of the country's land. Although this land is suitable for arable production, the land is still under-utilised because of low and variable rainfall. Arable agriculture in Botswana is mainly for production of field crops. The major crops grown are sorghum, maize, millet, beans and pulses, sunflower and groundnuts. Sorghum is the dominant crop followed by maize.

Yields are generally low (250kg/ha) due to scarce water resources, poor soils and limited use of farming techniques and inputs. The dominant type of arable agriculture is therefore dryland farming. In some areas of the country especially in northern part where the highest amount of rainfall (600mm) is received, few commercial farmers practise flood regime (molapo farming) crop production and irrigation. Arable agriculture is mainly on the eastern side of the country where conditions are favourable. Recurring droughts often lead to smaller areas being cultivated and hence low yields. In most cases farmers hardly have enough seeds for the next ploughing season. This poor performance of the arable sub-sector has resulted in an upward trend in the demand for imported foodstuffs.

Due to the slump in the contribution of the agricultural sector to the national economy and the poor performance of the sector the government of Botswana commissioned a consultancy to draw the National Agricultural Master Plan (NAMPAD). The NAMPAD study identified the following areas to revive the agricultural sector:

- Commercialisation of rainfed agricultural production through transformation into production of cutflowers, fruits and vegetables.
- Use of affluent water (recycled water) for irrigation purposes.
- Use of polluted well field e.g. Ramotswa well fields.

There were also indicators that pointed to dwindling interest in arable farming i.e.

- Arable land under fallow for a very long time (idle arable farms)
- Encroachment into lands that used to be used for arable farming e.g. Mogoditshane and other peri-urban centres.
- Shift from arable farming to other farming practices e.g. Tuli block farmers who used to be arable are now shifting to game ranching and livestock production.

b) Livestock Production

Most of the land in Botswana is suitable for extensive beef production. The cattle population is estimated at 2,104,255 (CSO 1997). Livestock production is the most dominant form of land use in Botswana. Livestock is held for socio-economic reasons. The animals most commonly found in Botswana are cattle, goats, sheep, donkeys and horses. The cattle population constitutes more than 505 of the total livestock population. Production in this sub-sector is also hampered by recurrent droughts, diseases such as foot and mouth, CBPP, Nagana, tsetse fly etc.

Efforts to improve production in this sub-sector were through:

- Export canning that generated over 200 million pula in revenues.
- Establishment of Tribal Grazing Land Policy (TGLP) ranches.
- Disease control through free vaccination, cordon fences, buffalo fences etc.
- Integration with game ranching where possible.

c) Wildlife Management Areas and National Parks

The wildlife resource of Botswana is considered one of the most significant in Southern Africa in terms of diversity, extent and abundance. Some of the last great population of wild animals left in Africa is found in Botswana. A total of 17% of the country's land area is protected wildlife area. Large areas of the country are designated as National parks and Game Reserves but a considerable number of game are found outside the reserves. About 21% of the northern part of the country have a large diversity in animal species. It is dominated by the wetland system of the Okavango delta. The southern and western parts of the country are characterised but dry and hot climatic conditions so they have less wildlife diversity compared to the northern part. The department of Wildlife and National Parks controls hunting of wildlife for conservation purposes. A quota system is used to regulate hunting. In economic terms Botswana has comparative advantage over her neighbours in wildlife driven tourism industry. The Botswana tourism industry is the engine of economic growth after the mining industry. However, we still have to develop our tourism sector by providing infrastructure, institutional development, involvement of nationals/citizens in the industry and provision of necessary support e.g. through financial and human resources. More attractive tourist features have to be developed. Botswana's neighbours have diverse tourist attractions comparatively.

Efforts have been made by government to involve communities leaving adjacent to tourist resources such as:

- Development of community trust (enclave)
- Concessions to communities
- Creation of awareness through educational programmes

In the recent past we have witnessed transboundary management of National Parks such as the Kgalagadi Transfrontier Park between Botswana and the Republic of South Africa (RSA) to boost the tourism industry.

d) Mining

A number of minerals were discovered in Botswana after her independence in 1966. Mining sites cover an estimated land area of about 1 059 square kilometres. This is less than 1% of the total land area of the country. The predominant mineral is diamond. Copper-nickel, soda ash and salt, gold and coal are also minerals of importance to the country. The government is engaged in the joint ventures with the corporate mining companies e.g. De beers, in mining these minerals. The sector contributes significantly (56%) to the economic and social development of the country. With the exception of coal, all mineral resources are for the foreign markets. Coal is consumed locally as a source of energy.

e) Forest Reserves

Botswana has six forest reserves located in Northern and north central parts of the country. These forest reserves cover about 1% of the total land area. The forest reserves were created to primarily to safeguard valuable timber resources. Forest Reserves were not established in the extensive woodlands and thickets further south in the hardveld. Forest resources in communal woodlands are not protected. This poses a problem in that, biodiversity conservation is threatened and there is no benchmark to judge land degradation. Some woodlands in the country have good stands of primary forest species e.g. Tsodilo, Tamacha in Ngamiland and some pockets of good timber species in the central district.

f) Veld Products Collection

The dividing line between a "wildlife" and a "veld product" in Botswana is subjective. Veld products are all from wild plants and smaller game they thus fit the newer definitions of wildlife. In this context wildlife is synonymous with larger mammals and birds. Veld products include wild plants/non timber forest products – mushrooms, fruits, medicinal plants, gums etc.

These smaller animals and plants do however play a major role in the diets and economies of rural people, especially the Remote Area Dwellers (RADs) community. Hitchcork (1988) comments on Basarwa utilising at least mammal and plant species foods. As opportunistic hunter/gatherers they have great knowledge of and are well adapted to veld product collection.

In recent years the use of selected products has grown in importance to the national economy, including the export sector (21 million pula). The conservation, sustainable utilisation and development of these resources is entrusted to the Agricultural Resources Board (ARB) and a number of Non Governmental Organisations (NGOs) specialize in their promotion, processing, development and management. Major veld products are listed below:

Local name	Scientific name
Mopane worm	*Goninmbrasea belina*
Morula fruits	*Sclerocarya caffra*
Motsotsojane	*Grewia retinervis*
Mmilo	*Vangueria infusta*
Moretlwa	*Grewia flava/bicolor*
Grapple plant	*Harpagophytum procumbens*

In terms of personal household economies the veld products are of considerable importance. They represent a "fall back resource" when other options – crop cultivation, smallstock, hunting may fail. Their collection is a family affair; most of them are used as subsistence food, not recorded in economic terms. Resource accounting and valuation would determine the value and importance of veld products. But it is obvious that any land use practises which negatively impact on the availability of these products has serious consequences for the RADs and other disadvantaged communities.

Land use planning initiatives must consider the collection of veld products as a major land use option and plan for its sustainable management. The policy on Wild Life Management Areas does not allow for the conservation, management and use of veld products, although experience suggests that the restriction of collection based on the 20 x 20 km settlement zones is not sustainable, ecologically and economically (Murray 1983).

V. ISSUES OF LAND USE (CONFLICTS)

a) Land Tenure Conflicts

There exists on communal rangeland a de facto control of land because of the private ownership of boreholes. But interestingly, the grazing land is considered communal and therefore the presumption is that no one individual grazier can in fact exclude another from grazing his or her herds on these rangelands. Implicitly, Land Boards are expected to protect these rights for communities from private appropriations

A further complication that arose from the 1975 TGLP rezoning is the existence of multiple or overlapping rights to parts of the communal land. Classic examples are wildlife Management Area, comprising 8% in State land and a further 17% in the tribal land) where, although communities are allowed access to the veld products in them, but are implicitly out of bounds for expanding the grazing of livestock into these areas. Technically, no boreholes can be drilled for livestock watering near or in WMAs. The other variant of complication is the existence dual grazing rights. In both instances some legal interpretations are in order. A study is however proposed on the issue of dual grazing rights before any legal interpretations can be attached.

b) Conflicting Land Uses

With the high rate of economic growth in the country there has been rural – urban migration in search of employment opportunities in towns and cities. This phenomenon has resulted in pressure on the land resources. Access to land for residential and other uses in urban and major centres of the country has become difficult because of shortage of land. In an attempt to address land shortage in cities and major village, the Government has bought land for residential purpose and in some cases land suitable for agriculture has been redesignated for residential purposes.

Livestock, agriculture and game often represent competing uses of marginal land; potential grazing land has been in some areas gazzetted for Wildlife Management Areas (WMAs) and water development are not allowed in the WMAs.

In most parts of the country pressure on the land is rapid population growth, poor productive capacity of most land and institutional arrangements. These factors interact to produce impacts that vary from place to place depending on the levels at which they interact.

Consistent pressure on land can result in land degradation. Land pressure is most serious in the livestock sector due to overgrazing. Rangeland degradation used to be concentrated to be concentrated in districts in eastern Botswana but has now spread to western parts of the country. Borehole technology development in the western parts of the country has contributed to increased land pressure in the more fragile western parts. These land degradation processes have led to reduced or loss of biological and economic productivity of rain-fed cropland, irrigated cropland or range, pasture, forest or woodlands.

The National Settlement Policy's Final Report (June 1998) states that the serious of concern under land use and tenure in Botswana are mismanagement of grazing land particularly in communal areas, unwarranted change of limited fertile arable land to other uses and land use conflicts. The report further elaborates on these issues as follows:

- Lack of institutionalised regulatory measures to control and ensure proper use of communal grazing land as TGLP and freehold ranch owners who have exclusive rights to their ranches continues to use communal areas for grazing their animals and return to their ranches when pasture is depleted in the communal areas.
- Overstocking which is a result of increase of livestock beyond the carry capacity of the land, leaving to degradation of the environment and a reduced quality of livestock.
- Subdivision and change of use of agricultural land and development of such land for other purposes, especially in and around the fast growing towns.
- The encroachment of settlements onto agricultural and wildlife areas, through the allocation of land outside the existing settlement's water works boundary. This practice which stems from individuals who exercise their constitutional rights of settling in preferable areas leading to land use conflicts and

- Lack of land use zoning plans and non-adherence to them in districts where they exist, result in improper and in-optimal land use (Environmental Statistics 2000).

VI. CONCLUSION

In conclusion land use issues in Botswana need to be reviewed to ensure proper management of the land resources.

Proposals

- Need to establish production models and forestry information systems.
- Creation of database to support the above initiatives.
- Establishment of task force or working groups to integrate land use options in forestry activities.
- Financial mechanisms should be provided through bilateral arrangements.
- Transfer of technology e.g. in using Remote Sensing, GIS, Forest Research capability and Capacity provided through exchange visits, training and joint project implementation or case studies.
- Land use planning programmes and projects are in different Ministries such as Agriculture, Lands, Housing and the Environment, Commerce and Industries. The need to collaborate, co-ordinate and share the information and data is a must.
- Data standardisation, storage and manipulation for land use planning must be looked into.
- Code of work between the Private Sector, Government of Botswana, NGOs and Community Based Organisations must be developed on matter of land use planning, data collection and use.
- Regional (SADC) and International bodies (FAO, ICRAFT) research institutions must be used and where possible networking mechanisms developed.

Interactive Approach

- Dialogue data accessibility, accuracy precision and real time (for land use planning and development.
- Storage, retrieval processes and formats for field surveys.
- Exchange protocol and procedures for information.
- Database creation, structure, and formats.

Dynamic Approach

- Simulation possibility, settlement patterns, management plans and strategies.
- Modelling of production areas, condition trends of natural resources.
- Computer skills, surveillance intelligence and decision making support and systems.
- Creation of scenarios (management, conservation and development options).

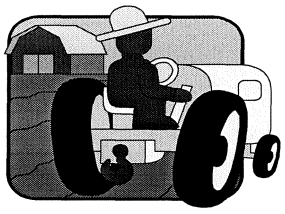
Zimbabwe's Land-Use System

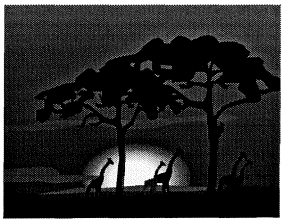
Interactive & Dynamic approaches on forest and land-use planning

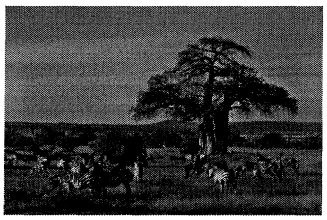
Presentation by

Baker S, Chidziya E, Gambiza J, Kwesha D, Nehanda G, Piloto M

Botswana 3rd – 18th December 2001



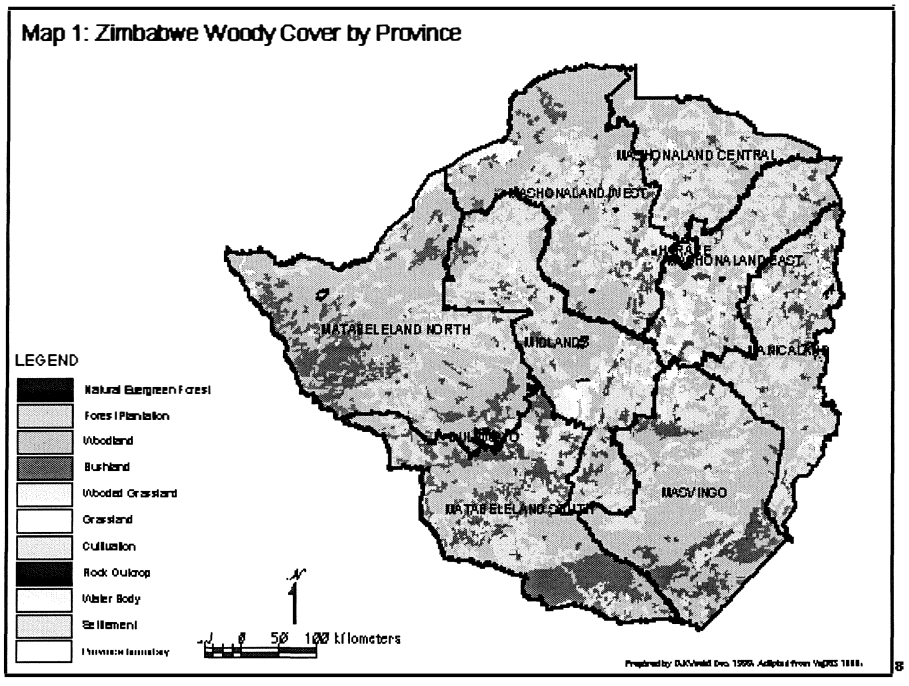




No.2

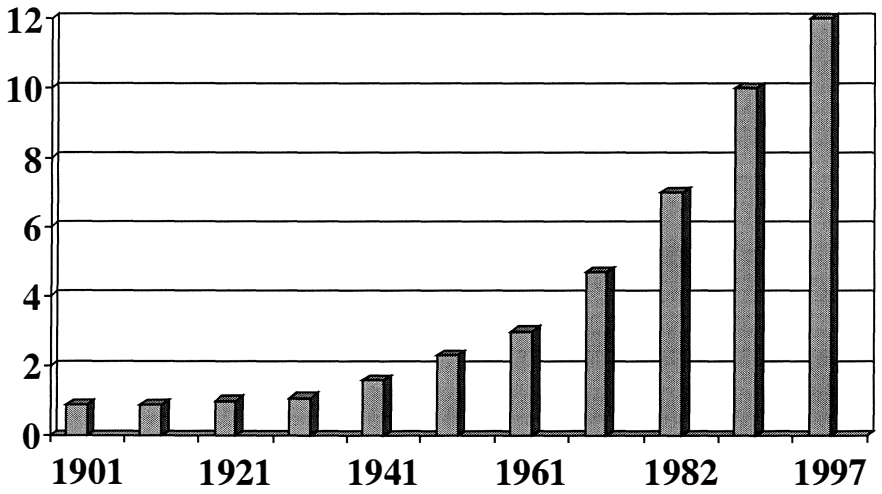

GURUVE
MZARABANI
HURUNGWE
MOUNT DARWIN
RUSHINGA
KARIBA
SHAMVA
MUDZI
BINDURA
UZUMBA-MARANGA-PFUNGWE
MAZOWE
MAKONDE
GOKWE NORTH
ZVIMBA
MUTOKO
GORO
MUREHWA
HARARE
MONZI
BINGA
CHEGUTU
SEKE
NYANGA
GOKWE SOUTH
KADOMA
MARONDERA
MAKONI
WEDZA
LUPANE
MUTASA
HWANGE
NKAYI
KWEKWE
CHIKOMBA
CHIRUMHANZU
MUTARE
BUHERA
TSHOLOTSHO
BUBI
GWERU
GUTU
SHURUGWI
CHIMANIMANI
UMGUZA
BULAWAYO
MASVINGO
BIKITA
UMZINGWANE
ZVISHAVANE
BULILIMA
INSIZA
CHIVI
ZAKA
CHIPINGE
MBERENGWA
MATOBO
CHIREDZI
GWANDA
MWENEZI
BEITBRIDGE

No.3


Map 1: Zimbabwe Woody Cover by Province
MASHONALAND CENTRAL
MASHONALAND WEST
HARARE
MASHONALAND EAST
MATABELELAND NORTH
MIDLANDS
MANICALAND
MASVINGO
MATABELELAND SOUTH
LEGEND
Natural Evergreen Forest
Forest Plantation
Woodland
Bushland
Wooded Grassland
Grassland
Cultivation
Rock Outcrop
Water Body
Settlement
Provincial Boundary
0 50 100 Kilometers

No.4

Zim. Population (mil) 1901-1997



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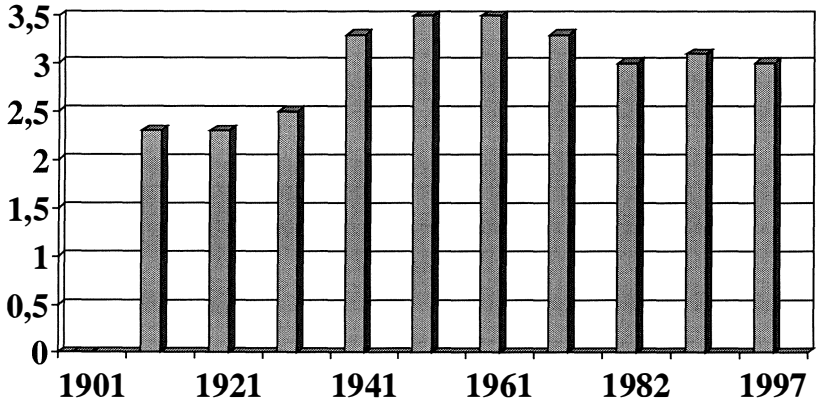
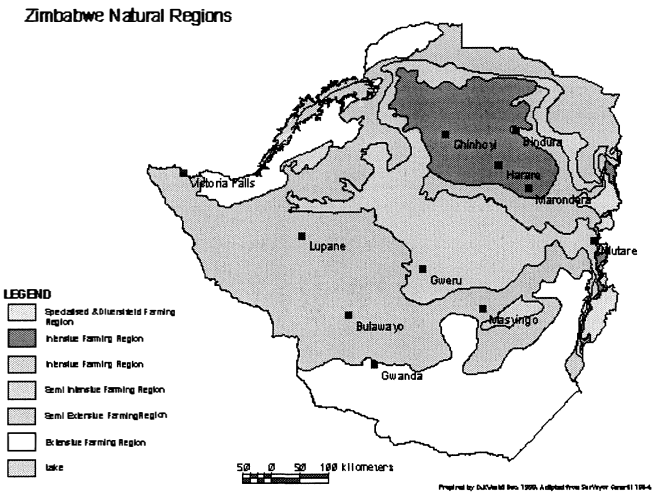
Zim. % Population Annual Growth 1901-1997



No.6

Agro-Ecological Regions



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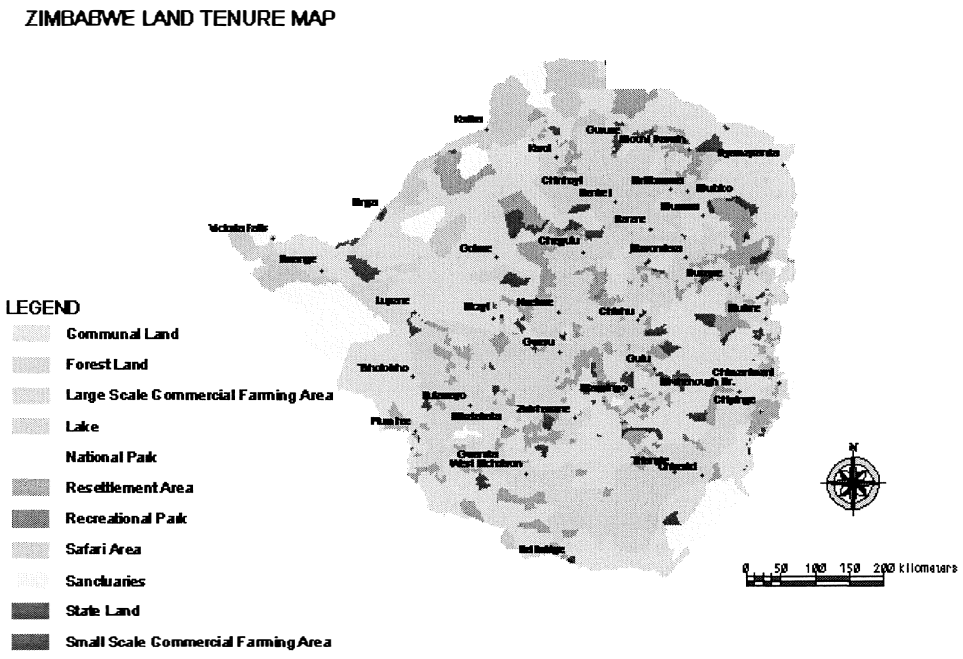


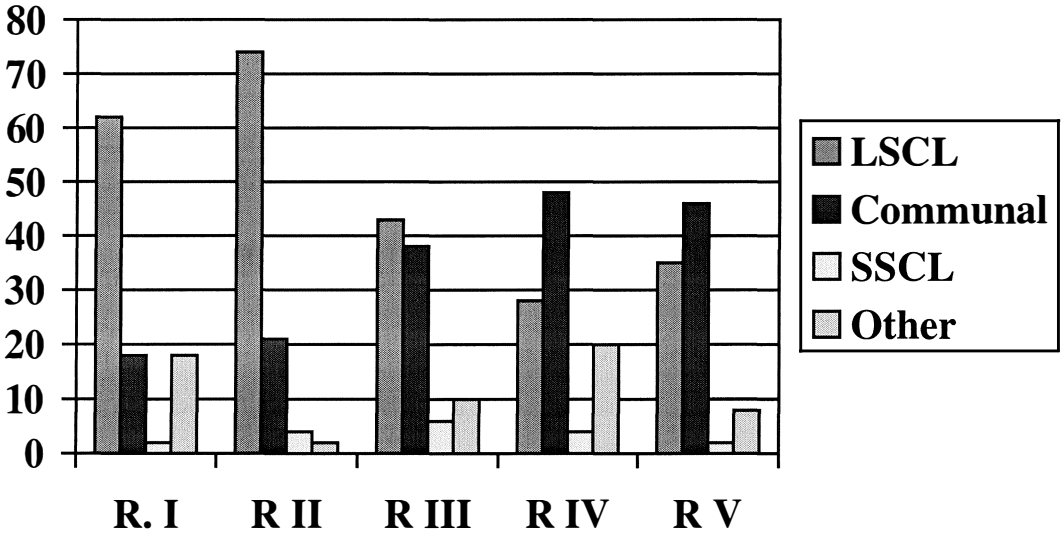
No.8

Land Tenure 1980-1997				
Land Category	1980		1997	
	ha million	% of total h	ha milli	% of total ha
Large Scale Commercial	15.5	39.1	12.1	30.6
Small Scale Commercial	1.4	3.5	1.4	3.5
Communal Areas	16.4	41.4	16.4	41.4
Resettlement Areas	0	0	3.6	9
NP & Urban Settlements	6	15.2	6	15.2
State Farms	0.3	0.8	0.1	0.3
Total	39.6	100	39.6	100

Distribution of Land According to Nat Regions @ Independence %					
Nat. Region	LSCL	Communal	SSCL	Other	Total
I	63	18	1	18	100
II	74	21	4	1	100
III	44	39	7	10	100
IV	27	49	4	20	100
V	35	46	1	18	100
Total	40	42	4	15	100

No.9

Land Tenure (% distribution)



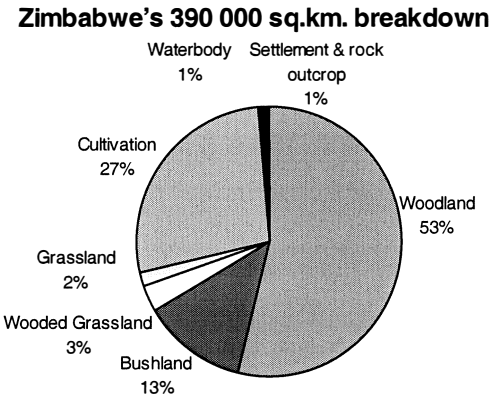
No.10

ZIMBABWE: LAND/VEGETATION COVER AREA ESTIMATES

PROVINCE	COVER CLASS - AREA IN HECTARES										
	Sum Province	Natural Forest	Plantation	Woodland	Bushland	Wooded Grassland	Grassland	Cultivation	Rock Outcrop	Waterbody	Settlement
BULAWAYO	46,660	0	0	2,248	8,549	0	0	2,514	0	134	33,215
HARARE	88,387	0	409	11,253	167	7,925	3,552	21,385	0	0	43,694
MANICALAND	3,582,033	11,554	140,818	1,364,417	288,694	41,417	112,369	1,590,354	23,293	779	8,337
MASHONALAND CENTRAL	3,084,624	0	4,422	1,782,607	85,698	70,254	41,212	1,089,649	7,759	902	2,121
MASHONALAND EAST	2,294,083	0	1,160	942,489	114,515	173,047	57,027	984,656	16,569	969	3,651
MASHONALAND WEST	5,775,421	0	2,391	3,610,872	417,509	188,225	57,002	1,301,730	685	185,422	11,584
MASVINGO	5,656,531	0	1,055	3,123,391	814,522	62,071	68,063	1,559,734	18,356	7,029	2,308
MATABELELAND NORTH	7,559,643	0	309	5,064,828	1,223,692	86,596	61,317	1,009,186	0	96,876	16,839
MATABELELAND SOUTH	5,420,752	0	0	2,351,426	1,632,498	178,028	6,656	1,235,611	7,544	5,471	3,518
MIDLANDS	5,581,442	0	5,288	2,543,873	388,286	397,199	282,009	1,943,257	4,274	3,319	13,937
ZIMBABWE	**39,089,575**	**11,554**	**155,853**	**20,797,405**	**4,974,130**	**1,204,762**	**689,208**	**10,738,077**	**78,481**	**300,900**	**139,205**

PROVINCE	COVER CLASS - PERCENTAGE AREA										
	Sum Province	Natural Forest	Plantation	Woodland	Bushland	Wooded Grassland	Grassland	Cultivation	Rock Outcrop	Waterbody	Settlement
BULAWAYO	100.00	0.00	0.00	4.82	18.32	0.00	0.00	5.39	0.00	0.29	71.19
HARARE	100.00	0.00	0.46	12.73	0.19	8.97	4.02	24.19	0.00	0.00	49.44
MANICALAND	100.00	0.32	3.93	38.09	8.06	1.16	3.14	44.40	0.65	0.02	0.23
MASHONALAND CENTRAL	100.00	0.00	0.14	57.79	2.78	2.28	1.34	35.33	0.25	0.03	0.07
MASHONALAND EAST	100.00	0.00	0.05	41.08	4.99	7.54	2.49	42.92	0.72	0.04	0.16
MASHONALAND WEST	100.00	0.00	0.04	62.52	7.23	3.26	0.99	22.54	0.01	3.21	0.20
MASVINGO	100.00	0.00	0.02	55.22	14.40	1.10	1.20	27.57	0.32	0.12	0.04
MATABELELAND NORTH	100.00	0.00	0.00	67.00	16.19	1.15	0.81	13.35	0.00	1.28	0.22
MATABELELAND SOUTH	100.00	0.00	0.00	43.38	30.12	3.28	0.12	22.79	0.14	0.10	0.06
MIDLANDS	100.00	0.00	0.09	45.58	6.96	7.12	5.05	34.82	0.08	0.06	0.25
ZIMBABWE	**100.00**	**0.03**	**0.40**	**53.20**	**12.72**	**3.08**	**1.76**	**27.47**	**0.20**	**0.77**	**0.36**

No.11



No.12

LAND COVER BY LAND TENURE

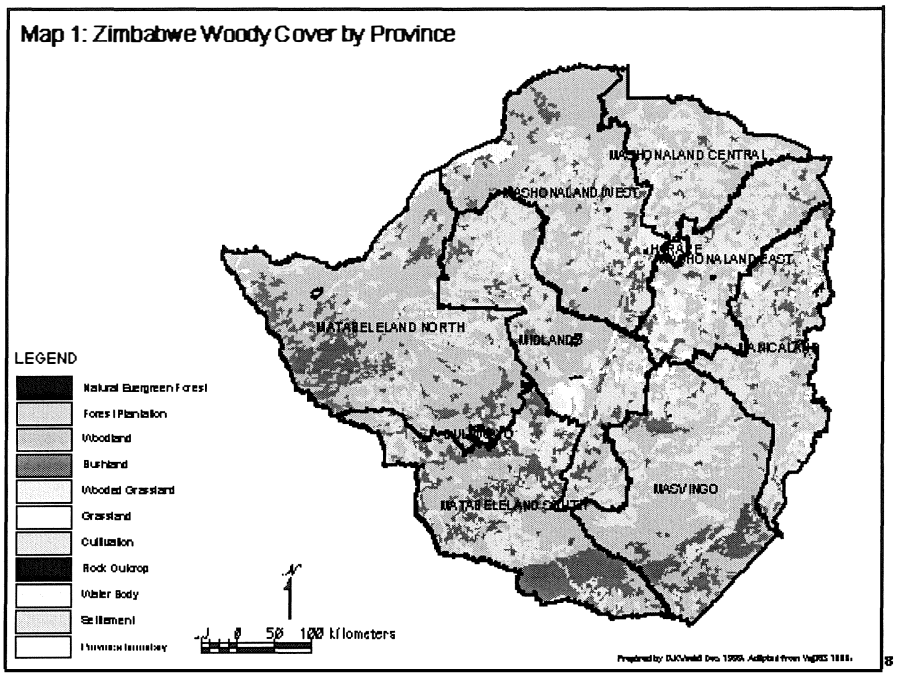
Land Tenure	Total Area In hectares	Natural Moist Forest	Forest Plantation	Woodland	Bushland	Wooded Grassland	Grassland	Cultivation	Rock outcrop	Water body	Settlement
National Parks	5045490	0.13%	0.13%	67.34%	23.51%	1.58%	1.22%	0.76%	0.09%	5.22%	0.02%
ForestLand	1335157	0.06%	3.97%	65.59%	5.46%	0.40%	1.89%	22.59%	0.01%	0.02%	0.01%
State Land	205255	0.00%	0.00%	81.94%	7.74%	0.00%	2.61%	6.49%	0.31%	0.45%	0.45%
Communal Land	15445686	0.00%	0.01%	42.26	9.68%	0.27%	0.32%	47.21%	0.25%	0.01%	0.01%
Resettlement Area	3958276	0.01%	0.17%	60.59	11.35%	3.08%	1.25%	23.42%	0.09%	0.04%	0.00%
SSCFA	1122781	0.00%	0.01%	50.42	9.67%	2.07%	2.43%	31.10%	0.18%	0.00%	4.11%
LSCFA	11893668	0.03%	0.73%	58.47%	13.79%	7.94%	3.88%	14.65%	0.08%	0.00%	0.45%
Town	99077	0.00%	0.29%	27.91%	3.32%	8.84%	4.79%	20.70	0.00%	0.22%	33.94%
	39 105 390	0.03%	0.40%	53.20%	12.72%	3.08%	1.76%	27.47%	0.20%	0.77%	0.36%

No.13

Irrigated ha

Sector	Area (ha)
Large scale commercial Farms	137 400
Small scale commercial farms	480
Resettlement areas	1 110
Communal lands	6 900
Total	145 890

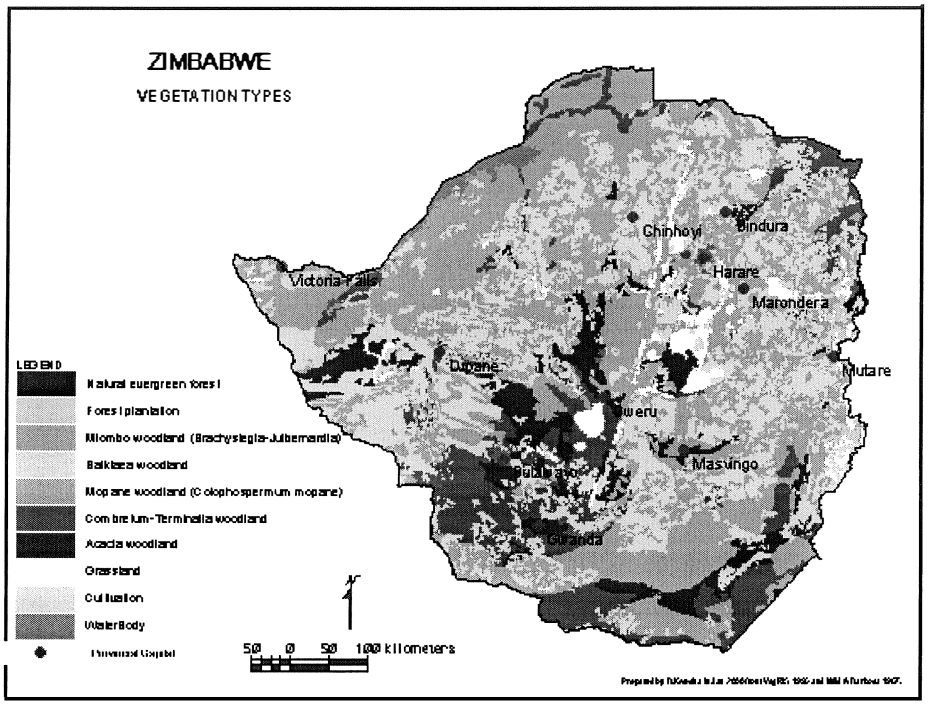
No.14



No.15

Vegetation/Land Cover Type	Area in ha	Area%
Natural Evergreen Forest	40 281	0.1
Forest Plantation	147 820	0.4
Miombo	9 493 533	24.3
Zambezi Teak	1 941 741	5.0
Mopane	7 343 044	18.8
Combretaceae	4 761 107	12.2
Acacia	3 080 801	7.9
Cultivation	10 400 927	26.6
Grassland	1 439 589	3.7
Rock Outcrop	5 017	0.0
Settlement	120 455	0.3
Waterbody	322 193	0.8
Total	39 096 508	100.0

No.16

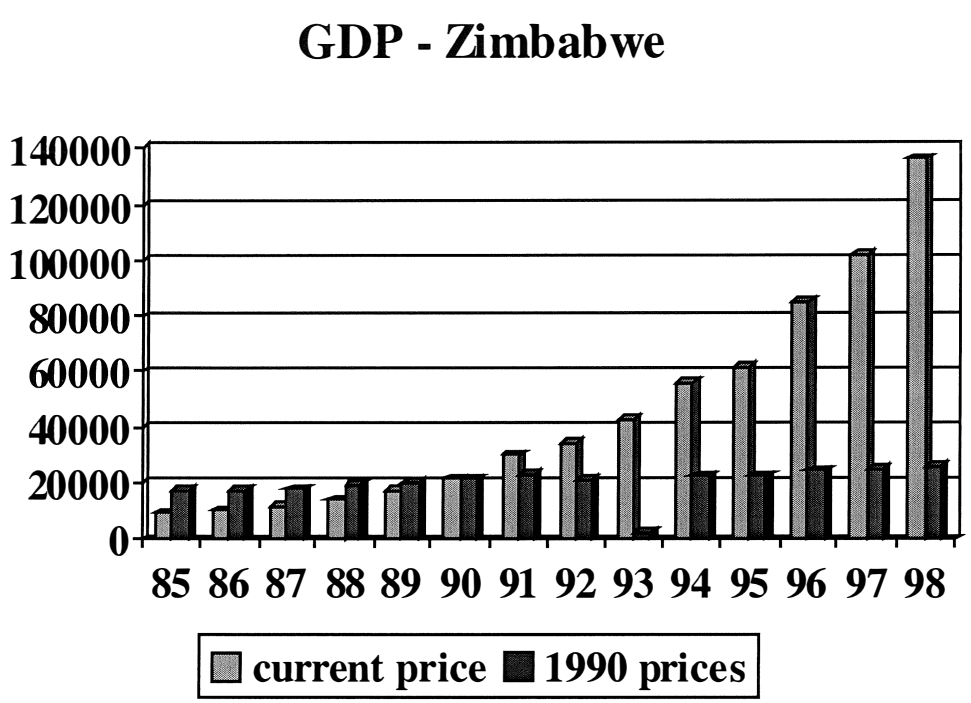


No.17

Definition of Vegetation Types

Vegetation type	Canopy cover %	Tree height
Natural forest moist deciduous	80-100	>15m
Plantation forest	80-100	<1 to >15m
Woodland	20-80	5-15m
Bushland	20-80	1-5m
Wooded/bushed Grassland	2-20	1 to >15m
Grassland	<2	<1 to >15m
Cultivated land		
Other		

No.18



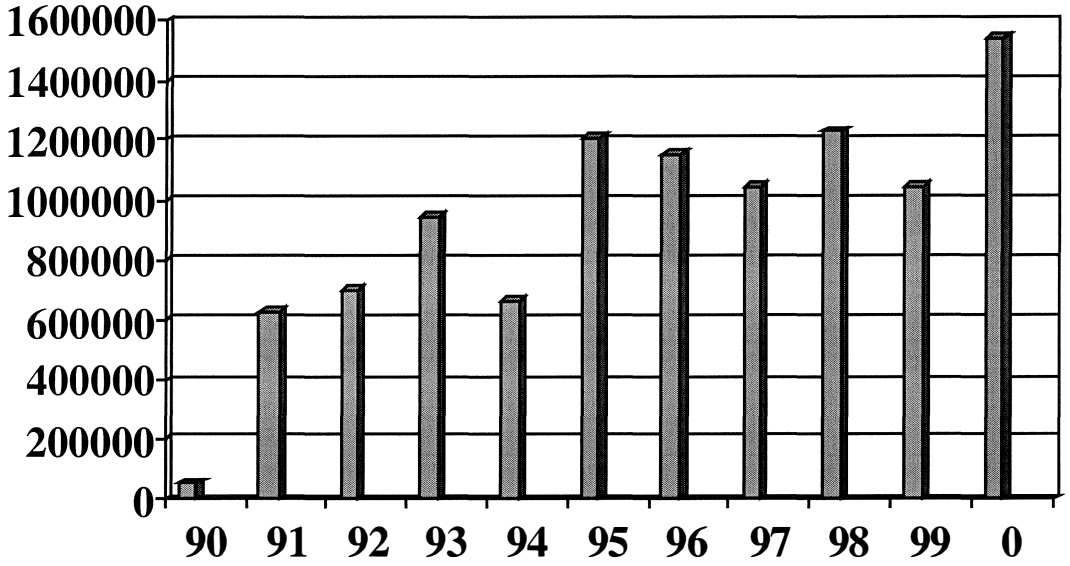
No.19

Structure of GDP & Employment by Sector

	1980	1985	1990	1997	1980	1985	1990	1997
	% of GDP				% of employment			
Agriculture	14	16	12	17	32	26	24	27
Mining	9	8	7	4	6	5	5	5
Manufacturir	25	24	25	18	15	16	17	14
Electricity	2	2	4	2	0.7	0.7	0.8	1
Construction	3	2	1	3	4	4	6	6
Finance	6	6	6	8	1	2	2	2
Distribution	14	10	11	19	7	7	8	8
Transport	7	6	6	8	4	5	4	4
Public Admi	9	10	10	4	8	9	8	6
Education	5	9	10	7	3	8	9	10
Health	2	3	3	2	6	2	2	2
Domestic S	2	2	1	1	11	10	9	8
Other	5	6	7	5	4	5	6	7

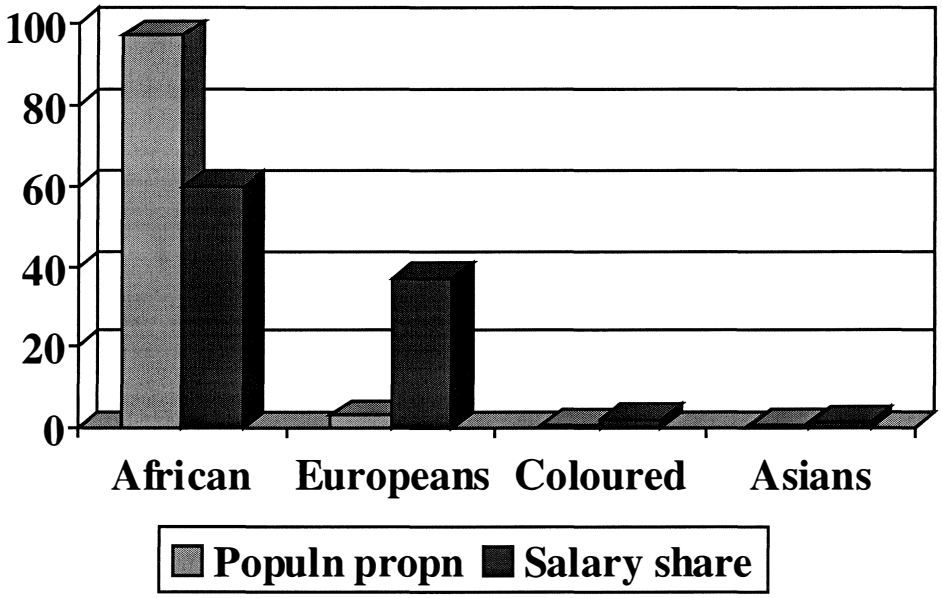
No.20

Tourist arrivals 1990-2000



No.21

Income Distribn by race (%)



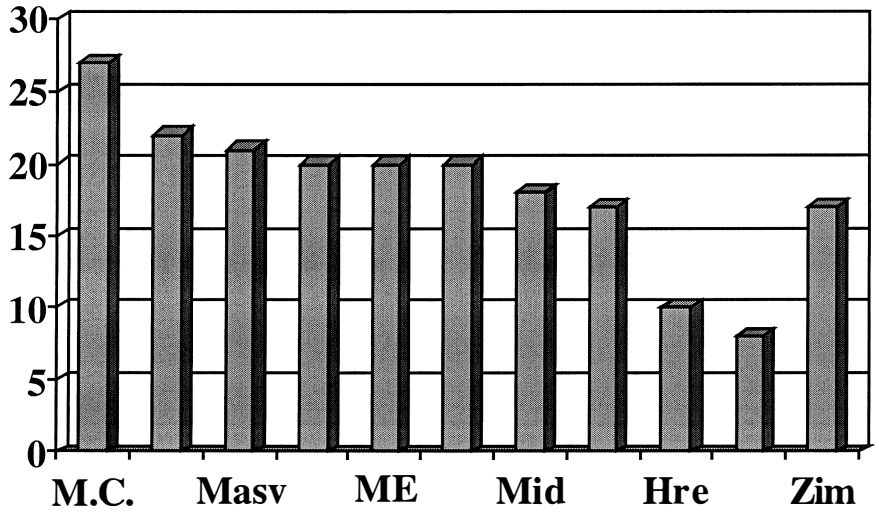
No.22

Human Poverty Index

- Non survival 40 years%
- Illiteracy%
- Under-weight children%
- No access to Health Care%
- Living standard deprivation%

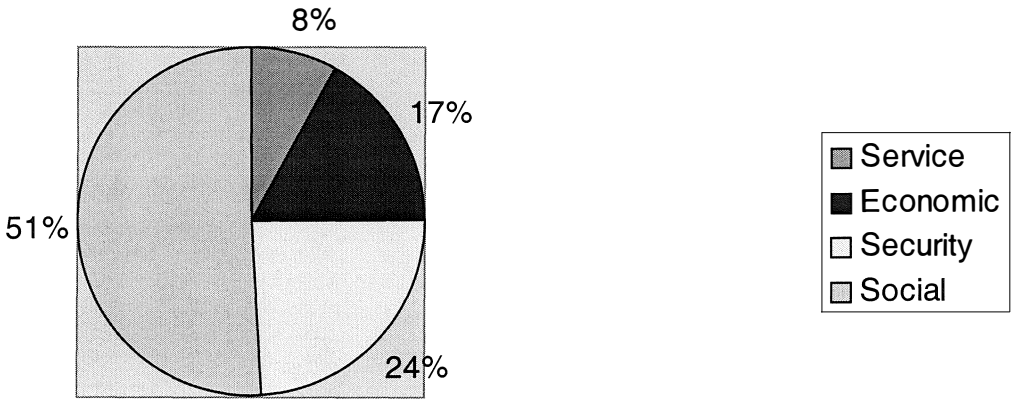
No.23

Human Poverty Comparisons.



No.24

2001 Budget Distribution by Sector



No.25

Natural resources Act	Dept of Natural Resources (MET)
Mines and Minerals Act	Min. of Mines
Atsmospheric Pollution Prevention Act	Min. of Health
Water Act	Min.of Rural resources and water devpt.
Forest Act	Forestry Commission
Fertilizer, Farm Feeds and Remedies Act	Min of Lands & Agric.
Communal Lands Forest Produce Act	Forestry Commission
Hazardous Substances and Articles Act	Min. of Health
Parks and Wildlife Act	Dept of National Parks
Regional Town and Country Planning Act	Min of Local Govt. & Housing
Rural District Councils Act	Min. of Local Govt & Housing
Land acquisition Act	Min. of Lands & Agric.
Agricultural Land Settlement Act	Min. of Lands & Agric.
Agricultural Development Authority Act	Min. of Lands & Agric.
Communal Land Act	Min. of Local Govt & Housing
Plant Pests and Diseases Act	Min of Lands and Agric.
Noxious Weeds Act	Min. of Lands and Agric.
Prevention of Cruelty to Animals Act	Ministry of Environment & Tourism

No.26

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SOUTH AFRICA FOREST REPORT

Paper presented at the APM workshop in Botswana
By Nicky Michelle and Sebueng Kelatwang
Workshop duration 3-18 December 2001

1. BACKGROUND

South Africa (SA) is a large, diverse country at the foot of the African continent. It is flanked in the north by Namibia, Botswana, and Zimbabwe and in the north- east by Mozambique and Swaziland. The country has a total land surface area of 122.3 million km^2. Of this, 42 million hectares is open savannah of which as little as half now remains as nature area, 400 000 hectares is closed canopy forest, of which 300 000 ha are in protected areas, and about 1.48 million hectares is industrial plantations managed for sustainable production. Most of the plantations are located where climatic conditions are suitable for afforestation, i.e. 41% in Mpumalanga; 37% KwaZulu-Natal; 11% Eastern Cape; 6% Western Cape and 5% in the Northern Cape. Afforestation is occurring at a rate of around 10 000 to 12 000 hectares per year.

2. MACRO-ECONOMIC POLICY FRAMEWORK

2.1 Proposed Policy Framework

The proposed policy frame work include among others the following key targets areas:

- The deficit in the budget will be reduced more, inter alia eliminating the government dissaving by 2.5% GDP. In other words free more capital for investment purpose.
- Import tariff reduction will be accelerated to contain imported inputs prices, facilitate industrial restructuring and enhance international competitiveness of the economy;
- Maintain a stable real effective Rand Exchange rate;
- Providing tax incentives to stimulate new investment in labour intensive project
- Restructuring of state assets, that will attract foreign investment, expertise and technology.

2.2 Achievements

- Overall macro-economic balance was restored to an important extent;
- The budget deficit of the national government was reduced faster than most observers had anticipated;
- The deficit on the current account of BOP was reduced in terms of absolute value and as a ratio of GDP;
- Inflation fell and inflation expectation diminished considerably;
- Productivity improved in the formal sector of the economy; and
- Fixed investment in the productive business sector of the economy has been increasing in recent years.

2.3 Drawbacks

South Africa has experienced a period of slowdown in economic activity and consolidation from the third quarter of 1996. Economic growth has been weak and the current indicator of employment in the formal sector of the economy has declined to its lowest level in 20 years. The main factors that adversely affected the economy are:

- Financial turbulence in emerging markets. The domestic financial market came under intense pressure during the past twelve months;
- Economic growth as measured by year to year change in real Gross Domestic Product decelerated from 1996 to 2001, reflecting the consolidation of real GDE and a decline in agricultural production;
- Declining employment and slow growth in private household disposable income were manifested in slow growth in the real value by trade sectors. The slowdown in the economic growth brought in its wake a further decline in total employment in the non-agricultural sectors of the economy;
- The turbulence in emerging market in the second quarter of 1998 and sharp decline in the surplus on the external capital account brought downward pressure to bear on the exchange rate of the Rand. The normal effective exchange rate of the Rand as such fell by about 20% in the seven months of 1998.

This event delayed the anticipated recovery in overall real economic activity.

3. SOCIAL AND HUMAN CONTEXT OF FORESTRY

South Africa has an estimated population of 42 million people. Making it the 24th largest country in the world with the 27th largest gross domestic product (GDP). The rate of urbanization is amounting to over 3% per annum, with more than 60% of the population currently urbanized.

The current relationship between forest owners and the neighbouring communities can be grouped into three main categories i.e. those related to:

- Access to land and other resources;
- Economic opportunities and
- Access to social service and infrastructure.

3.1 Access to land:

Statistics of families occupying forestland is estimated at 100 000 family members of employees alone. These families do not have any legal status and are vulnerable to evictions. The insecurity of tenure status of these families is sometimes a cause for instability and conflict. This problem is not confined to forestland only but it is common to state and privately owned land throughout South Africa both in rural and urban areas. The land reform programme is therefore very important in addressing some of these problems. Communities living in forestland require some livestock grazing and cropping land to supplement or sustain their livelihood. In some cases

big forest industry do allow communities to graze their cattle on forestland as well as allow them to collect firewood and other non-timer forest products.

3.2 Economic opportunities

Companies such as Mondi and Sappi also outsource some timber from communities using out-grower's schemes.

3.3 Social service and infrastructure

Big companies such as Mondi and Sappi have social programmes for their employees such as provision of education, health, housing and training facilities.

4. FOREST RESOURCES

4.1 Land ownership

- Of the total surface land area, 84.4% is farm land , 9.6% is nature conservation, 1.1% is forest land and 4.8% other land (DBSA 1994)
- Of the total farmland and nature conservation land, 23% is natural forest and woodlands and only 7% of this resource is conserved in national parks and nature reserves;
- White-owned farm land accounts for 87% of the total land area and the remaining 13% is black-owned subsistence farm land in former homelands;

4.2 Forest land ownership

Forest land is estimated at 1.48 million hectares (1.1% of the total land area). Out of the forest land:

- 46% is forest industry companies;
- 24% is private individuals;
- 17.2% is SAFCOL; and
- 12.8% is public.

5. LAND USE

5.1 Comparison of land use

Of the total land area;

Sugar cane	411 000 hectares;
Wheat	1, 382 million ha
Maize	3, 9 million ha
Forestry	1, 5 million ha

6. OTHER FORESTRY PRODUCTS AND ROLES

6.1 Fuel wood consumption

Biomass accounts for close to 10% of the net national energy consumption and amount to 11 million tons per annum. The major proportion of this biomass based energy is utilized by rural households and 6.6 tons/annum is consumed by semi-rural households in the homelands with the remainder being used by farm workers (3.5 million tons), other rural households (less than 0.5 million tons) and urban households (0.7 million tons).

6.2 Fuel wood supply

Source	Volume
Former homeland areas	Average 5.8 million tons per annum
Woodlots from former homelands	100 000 tons
Commercial forestry	Between 2 and 4 million tons of plantation residue
Invasive alien	2.5 million tons on commercial farms

7. FOREST MANAGEMENT LAW AND POLICY

The purpose of the New Forest policy is to promote the forest sector so that it is able to provide forest goods and services now and in future. It extends to any resource that provides forest goods and services and any other activity that relates to tree based resources. The new forest act as such provide for effective protection, management and utilization of all types of forest resources in order in order to promote the sustainable development of the forest including ecosystem and ecological resources they contain for the benefit of all the people in South Africa.

7.1 Sustainable Forest Management

The development of the forest sector comes with certain environmental and social costs and benefits. This development needs to be guided and directed by appropriate and effective environmental management systems, procedures and regulations. This is to ensure conformity with South African environmental policy and best practice internationally. The development of criteria and indicators will be able to improve resource use planning, to access the outcome of forest management, to provide a basis for continuous improvement and to assist with communicating the state of our forest resources.

7.2 Water conservation

The new water act endeavour to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways in which take into accounts the following among others:

- Meet the basic human needs of present and future generation;
- Promote equitable access to water;
- Protect aquatic and associated ecosystems and their biological diversity;
- Promote beneficial use of water in the public interest;
- Redress the results of past racial and future discrimination;
- Manage floods and droughts.

7.3 Indigenous people issues

- Poverty;
- Education;
- Land and
- Water.

8. POTENTIAL APPLICATION OF THE MODEL

8.1 Manubi State Forest - past and present

Manubi State forest is about 80 km to the east of Butterworth in the Eastern Cape, approximately 25 km inland from the coastal resort Mazeppa Bay. Manubi is a large; indigenous closed canopy forest occupying 1115ha surrounded by an estimated population of 11 938. There are 199,6 ha of planted *Eucalyptus* species. The indigenous forest is very varied. The forest near the coast, where the vegetation is low and dense, has bush-clump elements. Further inland there is high mesic wet-type forest, on flatter and deeper soils. Where there are a lot of rocks and shallow soils, certain species can be found which occurs nowhere else in Transkei region. Examples of these are *Buxus macowani, Homalium rufescens,* and *Commiphora woodii.* Manubi has an average rainfall of 800mm, and the only dry months are May, June and July.

The forest management unit is found in the Eastern Cape where:

- The population is approximately 6.7 million, with 70% living below poverty level.
- Unemployment is approximately 50%.
- 50% of population is over 65 years and under 15 years old
- This province has the highest percentage of the country's forests but only 2.2% of the province's land coverage
- Indigenous forests are important for subsistence utilization and traditional rituals as well as provide attraction to tourists in the area
- Indigenous forests provide the habitat for many rare, endangered and endemic species
- Manubi Forest Management Unit (FMU) comprising forests, grassland, agricultural land has a population of approximately 11 500
- In general water is scarce however in the vicinity of Manubi state forest there is an average rainfall of 800mm
- Manubi FMU is part of Centane Estate managed by the Forest Estate Manager

Total FMU area is 6600ha distributed on land use as follows:

- Indigenous Forests 20%
- Woodlot small patch forming part of 20 % indigenous forest
- Grassland 40%
- Agricultural land (maize) 30%
- Woodlands 10%
- State forest land
- Communal land comprising indigenous forests, grassland, agricultural land, homesteads and home gardens

9. HISTORICAL DATA

9.1 Pre-colonial forest conservation

Forest conservation in the Transkei region began before the colonial era. During the nineteenth century, the paramount chief of the Gcaleka tribe, Sarhili, prohibited people from hunting, cutting saplings for building huts, and collecting firewood from Dwesa and Manubi forests along the coast. Some believe that Sarhili conserved the forests to use them as a refuge during conflict with British colonialists, or as his own private hunting domain. Others believe they were protected for their natural beauty.

After Sarhili's conquest by the British in 1878, commercial woodcutters overran the forests. By the time a colonial forest service was established in the territory in 1888, woodcutters had already taken a lot of the timber out of the Transkei forests. Manubi, which had large quantities of *Podocarpus spp.*, was particularly exploited.

9.2 Manubi demarcated by colonial forest department

In 1895, along with the other large high-quality forests, Manubi was demarcated and controlled by the colonial forest department. The forest conservators at that time introduced the idea of wattle plantations to meet the wood requirements of the local communities. This meant that fewer laths (thin flat strips of wood used for building huts) and saplings were taken from the natural forests.

9.2.1 Management devolves to Transkei

With the institution of the apartheid homeland system in 1976, Manubi fell under the management of the Forestry Department of the Transkei. The Transkei department continued to practise planting gum trees (*Eucalyptus spp.*) and black wattle (*Acacia mearnsii)* to try to protect the indigenous forests from being over-exploited.

These trees were planted around the edges of the forest. People could get poles or "theza" from these plantation species rather than from the indigenous forest species. Many foresters believe that this has saved the indigenous forests from being totally destroyed.

9.2.2 Management of Manubi today

After the 1994 elections, management of Manubi was handed over to DWAF's Community Forestry division at the national level. The plantation has been classified as Category C and in the future it will come under Indigenous Forest Management. At present Manubi has 10 staff members:

One forester – from Indigenous Forest Management
Three assistant forest guards – under Community Forestry
Five forestry aids – under Community Forestry
One foreman – under Community Forestry

There are no permanent forest guards under Indigenous Forest Management. The forester has access to a two-way radio system for communication and a use of a bakkie. The forester is also responsible for managing another three State forests of about 5 000ha.

In the past, forestry guards were paid a commuted allowance, which meant that they got compensation for working weekends. This system has been stopped. One consequence is that forest guards no longer work on weekends.

9.2.3 Regulating access to forest products and resources

The forest contains important resources for local communities. The value of these resources is becoming more significant given the high unemployment and increasing rate retrenchment in the area. Household livelihoods have been badly affected by retrenched workers returning to the rural areas after being laid off from the mines and other key sectors of the economy.

The forest offers opportunities for many different people and forest management has to find a way to link up with different user groups in the surrounding communities to ensure sustainable use of the different resources.

9.2.4 Trade in medicinal plants

The forest has always been an important source of medicinal plants. However, as the trade in medicinal plants grows, this contributes to many indigenous tree species being seriously damaged by people over-harvesting bark. Species such as *Ocotea bullata, Curtisia dentata, Prunus africana* and *Trichilia dregeana* have been badly affected in this way. Some traditional healers and their business associates send collectors into the field to collect bark or roots illegally. This is cheaper and brings a quicker return than growing such species commercially. Unskilled collectors often ringbark the bottom of the tree entirely, which causes it to die.

9.2.5 Timber Resources

Manubi's three most valuable trees, which are all protected species, are:

- Sneezewood- used for railway sleepers
- Umzimbeet-used for poles

- Yellowwoods-used for furniture.

Many people from the local communities and further away make a living by illegally cutting and selling the umzimbeet and sneezewood. The woodcutters are often armed so it is very difficult and dangerous to arrest them, particularly as foresters are no longer armed. People also collect poles for their huts from the *Eucalyptus* plantation. Poles are also sold legally from the plantation, but many are felled illegally in response to demanding outlying areas. People may come from as far as Butterworth to buy poles.

9.2.6 Firewood

People use indigenous and plantation wood for firewood. Headloads are free. Bakkie loads should officially be paid for. However, there is not always the capacity to monitor this.

9.2.7 Hunting

Animal life has declined in the forest due to poaching. Bushbuck in particular are under threat. There is a lot of illegal hunting at weekends, when people who are not necessarily from the local community like ex-government officers, teachers, police and soldiers – come from far away to hunt as a leisure activity.

9.2.8 Grazing

In the dry winter months people drive their cattle and goats inside the forest to graze. Most of the fences around Manubi have been broken and stolen so it is very easy for people to enter with cattle. Although lice-stock in the forest can be a problem, the effects are not as serious as illegal felling, ringbarking and poaching of wildlife.

9.2.9 Other forest resources

There are many bees, so people take honey from the forest. They make bowls and plates from rolled Sneezewood branches for special celebrations. Sometimes people squeeze sneezewood branches and pour the sap into beer. Forest streams also provide quality drinking water.

In spite of all the problems and threats that Manubi faces, it is still a high-quality forest. Despite being one of the biggest forests in the region, Manubi's layout is very concentrated. It is generally accessible as it has gentle slopes and no steep areas.

9.2.10 Stimulating Eco-tourism at Manubi

The forest is also well located near the coast and is accessible to tourists. There are opportunities for developing hiking trails through the forest. The diversity of plant and bird life (including rare species such as the mangrove kingfisher and the spotted forest thrush) has the potential to attract as many as 100 visitors a month. However, there are concerns about lack of security for tourists. There is a perception that the area is not safe. Although crime around Manubi is not as bad as Umtata and Port St Johns, tourists are being put off.

9.2.11 The new forestry agenda

Indigenous Forest Management and community foresters working at Manubi face a complex set of issues. They must protect important natural resources. They must engage with local communities and better understand their needs and the importance of forest products for local livelihoods. They must regulate access to the forest in terms of the National Forest Act and ensure sustainable use of a wide range of forest products. They must enhance the eco-tourism potential of the forests and explore ways in which local communities can share in the benefits.

10 CONCLUSION

The APM can provide planning mechanism both at strategic and planning level in South Africa. Currently the government is advocating integrated development planning and the model has the potential of adding value to this process. It has advantages of creating conducive environment for planning and analysis of different scenarios as well for identifying information gaps in planning with due consideration of its limitations.

The Area Production Model – a tool and concept for sustainable land-use and forest resource management

MATS SANDEWALL
Department of Forest Resource Management and Geomatics
Swedish University of Agricultural Sciences, SE-901 83 Umeå, Sweden

NILS-ERIK NILSSON
Planalys, Bäsinge 6, SE-775 96 Krylbo, Sweden

Abstract: In developing countries, planning in the forestry sector has been seen as an appropriate instrument to prepare and implement government policies and programs. Despite its potential and recent advancements in e.g. remote sensing and infrastructure, tropical forest land-use planning is often formal and non-integrated with agriculture. It rarely involves all legitimate stakeholders and neglects taking into account the factual land-use. The socio-economic and environmental consequences of those shortcomings emphasise the need for alternative ways of approaching planning.

This article summarises the idea, structure and current status of the Area Production Model (APM), originally developed in the 1980s, which is now gaining interest as a land-use planning tool in Africa and Asia. It describes the development over time of production and consumption in agriculture and forestry within a defined geographical area under different assumptions on management, land use and socio-economic and macro economic changes. In a narrow perspective, the APM is a fairly simple computerised tool for generating scenarios. In a broad sense, it is a concept comprising the whole planning process including e.g. organisation, inventory, data analysis, consensus building and strategies.

A case study in Laos, based on verified data for a historical period of 45 years, and a review of different APM applications in the world over the last 15 years are presented as a base for conclusions about its potential and short-comings. In some cases where the APM concept was used in training courses and planning exercises, involving stake-holders, it generated a strong interest in collecting and analysing relevant information. It provides the means of addressing a number of the shortcomings in current planning.

Keywords: strategic, planning, change, developing countries, production, consumption, scenario, Laos

Strategic planning in a development perspective

The potential of "planning" as an instrument to effectively organise and implement forestry sector policies and programs in developing countries is acknowledged by governments, decision makers and donors. However, the way the planning concept is understood varies among cultures and political systems. In some countries it is a tool for centralised decision-making and control, in others it is a means for obtaining and analysing data to be used for strategies and management decisions. The overlapping roles of planning and management raise important questions. "How to couple the skills, time and inclinations of the planner with the authority, information and flexibility of the manager, to ensure a strategy making process that is informed, responsive, and integrative" (Mintzberg, 1994). Besides, who is the planner on public forest lands in the Tropics?

Strategic planning aims at elaborating and analysing strategies for how to approach various problems based upon a description of current situation and development goals. For reasons indicated below the outcome of such planning in relation to forestland use has been limited in the tropics.

- Land use planning is inter-disciplinary to its scope but often sectored in practice. Prevailing systems for decision-making tend to separate economic, environmental and social factors at the policy, planning and management levels (UN, 1993a). When foresters are involved, they tend to focus on timber and forest cover but be less concerned with farmers' agricultural objectives and the socio-economic development. While international environmental organisations express social and political concerns in relation to forestry issues, their actions are mainly based on environmental considerations (Nilsson, 1996).

- The planning approaches have been centralist and "top-down". Tropical (National) Forest Action Plans and Programmes have improved the knowledge of forest resources in many countries but these activities have been excessively donor driven and project oriented rather than continuous activities allowing the time required for local stake-holders to become involved (Lohmann and Colchester, 1990, Savenije, 2000).

- Centralised and formal land use planning has not been based on a good knowledge of past and current land use, production and consumption of goods and services. A typical example is the planning and development of the Bai Bang Pulp and Paper Mill in Vietnam. The eventual successful development of that project followed an expensive, successive learning process and was mainly a result of structural changes in the society (Sida, 1999). Decentralised and informal land-use planning by farmers is often rooted in local traditions.

- Data capture is expensive and time consuming. Modern technology is not always preferable to simple robust methods or applicable on all types of data. For example, tenure and historical aspects are often neglected in planning. For the local people, their previous experience is the base for management decisions. It is important to clarify what data are the important, how to make better use of existing data (analysis) and how to organise and integrate annual and ad hoc data capture.

Modelling and simulations are means of introducing dynamic elements in planning and analysing consequences of possible actions. Purposes can range from providing a general understanding of system behaviour through developing simple conceptual models, to evaluating specific policy proposals using detailed realistic applications (Constanza et al., 1993). Simulation models used in Sweden, e.g. the HUGIN system, are focused on forestry requirements and the use of the forestland. These models aim at describing forest policy options that could influence decision-making concerning numerous state and private forest enterprises with shifting objectives and incentives (Nilsson, 1986, National Board of Forestry, 2000). Other models, e.g. the CLUE model, developed for tropical conditions, (De Koning et al, 1999) describe land use changes, primarily as a result of consumption and demands of the agriculture sector.

One model including both forestry and agriculture components is of the Area Production Model (APM) described in this paper. It was originally developed about 20 years ago (Nilsson, 1982) and later upgraded by various actors. It has never been fully described in a scientific paper although it is being used in a number of developing countries.

This paper summarises the idea, structure, status and use of the APM. The first section hereafter describes the ideas of the model and its general structure. The subsequent case study, including Figure 2 and Table 3 serves three purposes. Firstly, it illustrates how a simulation model works, what input data are needed and what output is generated. Secondly it aims at testing how an APM scenario reflects the actual development. Finally, and together with the review of applications, it is used as a base for the concluding discussion on the applicability and potential of the model.

The Area Production Model - background and design

The concept of "area production" was introduced at an FAO/ECE workshop in Geneva in 1974 (Singh and Nilsson, 1974). Some years later, the first version of the APM was developed (Nilsson, 1982 and 1984). The Geneva workshop had been convened as a response to an increasing awareness of the fact that forestry has to cover a wider spectrum than timber production, which was later emphasised in Rio (UN 1993b).

The broad concept of area production was established to cover all commodities, services and environmental functions. Primary area production was defined as *a process within an area unit, which creates commodities and services that may be beneficial for man and could be utilised by him.* It may be past, actual or potential, natural or influenced by man. A classification system for primary area production should ideally satisfy the following needs:

- Identify all kinds of services and commodities produced by each area unit.
- Describe the actual production and, if possible, estimate the volume, value or importance of each kind of production.
- Indicate in which way the actual production is influenced by natural production factors and by man. It should also consider the stability of the actual production.
- Indicate potential production alternatives under given management conditions.

On the basis of these criteria a classification scheme for primary area production was proposed (Table 1). When working with the APM, one could consider each land use class in the light of that classification matrix, although the model cannot respond to all aspects of area production.

The APM aims at guiding strategic planning by simulating possible future developments of land use and primary area production. It can be used in connection with production and consumption studies on the level of e.g. districts or communes. The APM describes the development over time of the production and consumption subsystems within a defined geographical area under assumptions on management, land use and priority rules (Figure 1). If possible, an APM run should be based on a close analysis of current and past land use.

The following examples represent strategic questions that can be addressed:

- What land area can be used for primary forest production, considering the land required for agriculture production?
- What efforts in afforestation and silviculture are needed to satisfy prospected wood and energy demands for subsistence, industrial and environmental functions?
- What efforts for local socio-economic development could contribute to sustainable development?
- What inventory data on resources, production and consumption are most important for development of sustainable forestry and land use?

Table 1. Classification of primary area production in the Lao study area

Kind of production	**Productions class** (with examples)	**Natural production factors** Cl = Climate SW = Soil and water Fl = Flora Fa = Fauna	**Cultural influences** (-) = negative H = Harvesting Cu = Cultivation Sw = Swiddening Ir = Irrigation Fe = Fertilisation U = Urbanisation D = Devastation (wars, etc)	**External influence** A = Adjoining areas T = Trans-boundary influence
Services (=functions)	**Environmental services with impact <u>inside</u> area unit** • Erosion control • Soil improvement • Wind break • Shelter • Biodiversity conservation	Fl	H-, Sw-,Cu, D-	
		Cl, SW,Fl, Fa	Cu, Ir, Fe, D-	
		Fl	H-, D-	
		Fl	H-, D-	
		Fl, Fa		
	Environmental services, also impact <u>outside</u> area unit • Climatic influence • Ground water control • Flood control • Anti-pollution effects • Recreation • Grazing	Cl?	H, Sw, D-	A
		SW, Fl	D-	
		Cl, SW, Fl	H, Sw- Ir, D-	
		SW, Fl		A
		SW, Fl, Fa		
		Cl, SW, Fl	Cu, Sw,	
Commo-dities	**Minerals** • Rocks and minerals • Soil • Water	Cl		
		Cl	Cu	
		Cl, SW	Ir	
	Flora commodities • Food and wood • Trees • Grasses • Crops • Plants	Cl, SW, Fl, Fa	H, Cu, Sw, Ir, Fe	
		Cl, SW	H, Cu	
		Cl, SW	H, Sw	
		Cl, SW	Cu, Ir, Fe	
		Cl, SW	H, Cu, Sw, Ir, Fe	
	Fauna commodities • Mammals • Fowl • Fish	Cl, SW, Fl, Fa	H, Cu, Sw	A
		Cl, SW, Fl, Fa	H, Cu, Sw,	A
		Cl, SW, Fl, Fa	H, Cu, Ir	A
Services and commo-dities	**Urban services and commodities** • Urban sites • Infrastructure	Cl, SW SW	H, U H, U	A, T

Modelling principles

When dealing with the subsystems of the Model, the production and consumption must ultimately balance out so that PRODUCTION = CONSUMPTION (dis-regarding the import/export options and change of stock). There are four possible methods:

- Let the demand steer both consumption and production (even if it leads to depletion of existing resources).
- Let the production possibilities govern consumption (even if it leaves some demand unsatisfied).
- Let import and export fill the gap.
- Let stock bridge periods of over-production and over-consumption.

In the APM, the first three methods are used simultaneously but for different production and consumption sectors. No stocks are used, since these only can reduce short-term fluctuations, and the model is not aimed at studying such problems.

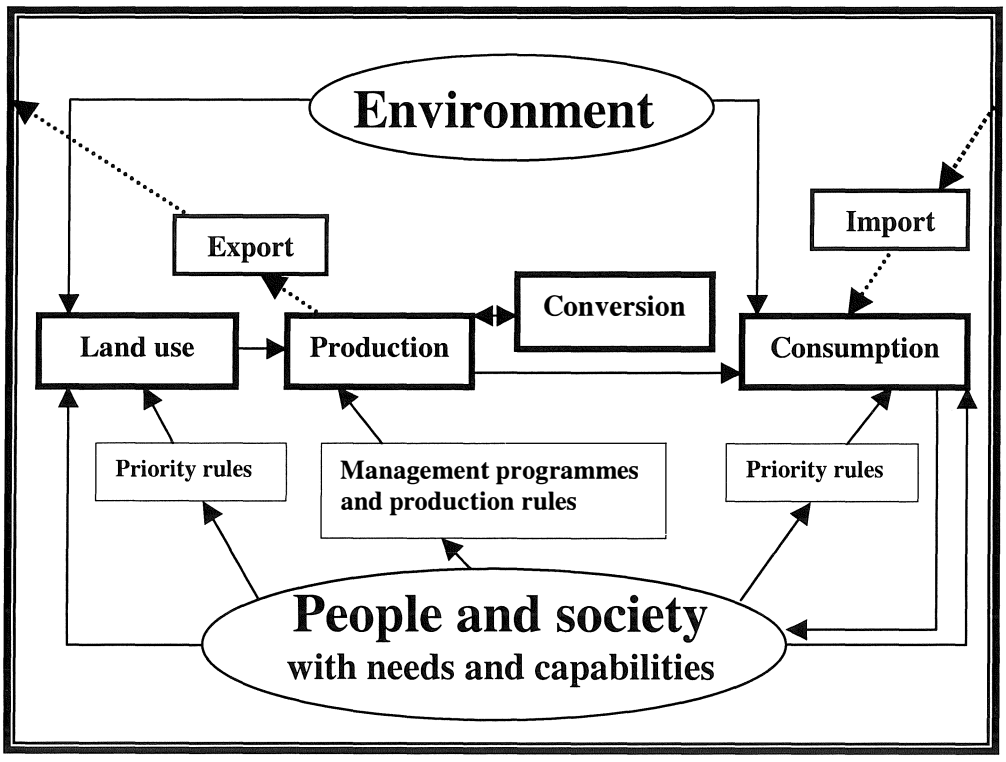

Figure 1. The Area Production Model – principle structure (excluding the time dimension).

The production sub-system

The production sub-system consists of area based production sectors defined by land-use.

Production sector	Size	Produced primary products				
		Crops	Residues	Grass etc.	Trees (wood)	Other services
Agriculture land	X	X	X	X	X	(X)
Forest land	X			X	X	X
Other land	X			X	X	X

The initial size of the production sector (e.g. how many hectares are used for agriculture production) is to be given at the start of the model run. The land classes are to be (re-)defined according to current or prospected use of land. The development over time will depend on management decisions as steered by production and priority rules.

Agriculture land is broken into the broad production classes subsistence, marketed food and cash crops. Forest land is subdivided into utilisation classes named farm forests, industrial forests and environmental forests, although a slightly different classification is used in the present FAO-version of the Model. The size of each forest sub-class is given by area, growing stock and, in case of plantations, also by mean annual production and rotation age. The development of the growing stock depends on production programmes and assumptions regarding markets, growth, yield and losses. In the FAO version the agriculture sector is generally demand driven while the industrial forest sector is production driven. Livestock is not introduced as a production sector. It could, however, be considered as a means for conversion of residues or crops to energy or food.

Conversion

Conversion from primary to secondary products is mostly handled by conversion factors out of which some appear as default values.

Primary product	Secondary products			
	Food	Energy	Household timber	Timber for the market
Crops	X	X		
Trees		X	X	X
Shrubs and bushes		X		

It is a complication that "growing stock" in the model refers to stem-wood, although much of biomass energy is derived from branch wood, brush etc. Local knowledge of harvesting practices is needed for an acceptable calibration of the model. It is necessary to distinguish between primary and secondary products, as the former can be split into parts or used for different purposes. Two examples:

1. Crops give, when harvested, both grains and residues. Residues can be used as an energy source. It can also be used for fodder or as fertiliser.
2. A tree can be used as timber, pulpwood, fuel wood, etc, depending on market access and quality restrictions.

The consumption sub-system

The various sectors of the consumption sub-system are defined by consumer groups.

Consumption sector	Size	Consumed (secondary) products				
		Food	Energy	Household timber	Timber for the market	Services, functions
Rural population	X	X	X	X		
Urban population	X	X	X			
Forest Industry					(X)	
"Society"						(X)
(Import and export)		(X)	(X)	(X)	(X)	

The size of the consumption sectors (how many people) is given at the start of a model run. A realistic calibration of the model is achieved by noticing that current production must be equal to current consumption, when disregarding export, import and change of stock. The further development of production and consumption will depend on assumptions regarding e.g. population growth and industrial expansion.

Production rules

Some production rules are represented by steering indices in the Model

- Production of subsistence food is based on the assumption of unchanged per-capita consumption. Hence, production must increase proportional to population growth. If the population increases at a higher rate than land productivity, more land will be used for production according to the adopted priority rules.

- Production of marketed food and cash crops is steered by change of an index, measuring general economic activity. It is assumed that this index would indicate a shift from subsistence to marketed production. A local index reflecting the "agriculture income" or sometimes an estimate of the GDP per capita can be used.

Priority rules

The technical tool to balance production and consumption is called "priority rules". The APM includes several such rules as exemplified below:

1. The order in which demands are to be satisfied must be determined. It is generally assumed that food production is to be satisfied in the first place.
2. The order of transfer of land classes when new land is needed for food production (or when land is not longer needed for that purpose) must be determined.
3. The order in which different sources are used in case several of them produce the same secondary product must also be determined. Rural energy production is an example of this. Agriculture residues (dung), trees, bushes and scrubs from different land classes, including from land cleared for cultivation can be used.

The APM simulation

In the current FAO version of APM, all required input data (see Table 3) is entered through four menus before simulation. Scenarios can be specified for a period of 5-50 years. Growth factors are specified for each five-year period and other input data including priority rules and conversion factors for the starting year of the simulation. Results are displayed in nine tables and two diagrams (the diagrams in Figure 2 have been prepared separately for the purpose of this paper). Evaluation of results, modification of growth factors or other data, and running new scenarios can be done instantaneously.

Table 2. Studies and projects where the APM has been used

Year	Country/ Province/ Type of area	Data source	Type of project	Specification	Reference
1984	India, Tamil Nadu State, all districts	Official sources	Case study	First real test of the Model	Lindgren (1984)
1986	Thailand, Ratchaburi Prov.	Official sources	Case study	Test of the Model in one scenario over 40 years.	Thammincha (1986)
1986	Indonesia, East Java Province	Official sources	Case study	Test of the Model in two scenarios over 40 years.	Shimada (1986)
1988	Peru		Case study		Contreras (1988)
1993	Indonsia, East Java, Water catchment area (Kali Konto)	Remote sensing + official	Research study	Multi-temporal analysis of photos/field data used for spatial component	De Gier et al (1996, 1999)
1995-96	India, Andhra Pradesh State, all districts	Forest survey + official	Case study	Aim to reform state/ district forestry planning. Scenarios on land use, energy, forest production	Grylle (1997)
1995	Thailand, Pharo District	Remote Sensing	Research study	Prediction of forest degradation	Hussin et al (1995)
1997-98	Laos, Luang Prabang, Nan catchment area	Field work	Research study	APM applied for a 45 years historical period in shifting cultivation area	Sandewall et al (1998a, 2001)
1997 - 98	Vietnam, Lao Cai, Ban Lau Commune, Lang Ha Village	Field work	Research study	Covered historical and future period 1970-2020. Analysis of official plans versus actual situation.	Sandewall et al (1998b)
1998	Uganda, Rutete Sub-county	Remote sensing	Research study	Assess impact of rural land use change on per capita energy biomass	Bamulesewa et al (1998)
1999	Vietnam, Vinh Phuc, Dao Tru Commune (bordering National Park)	Field work	Case study at training Workshop	Covered historical and future period 1979-2019. Two scenarios A) realistic guess of change in trends B) historical trends unchanged	Anon (1999)
1999	Laos, Vientiane Municip.Pakxap may village	Field work	Case study at training workshop	Analysed development 1979-99 and used as base for scenario 1999-2019	Anon (1999)
1999	Laos, Sayabouri two villages in Conservation Area	Field work	Research study	Historical and future scenarios in National Biodiversity Conservation Area	Sawathvong (2000)

Review of software packages and applications

Several computer versions of the APM (or part of it) have been developed over the years and applied in various studies and projects (Table 2). The Model was originally written in Arithmetic Programming Language in the early 1980s, then into Fortran (Lindgren 1984, 1986) and later into Windows (Grylle 1997). Parts of the APM were also included in a Windows based GIS package (ILWIS) developed at the International Institute for Aerospace Survey and Earth Sciences (ITC), the Netherlands (de Gier *et al.,* 1999).

Development of APM as a planning tool

The studies undertaken in Vietnam and Laos (Sandewall *et al* 1998b and 2001; Sawathvong, 2000) were focused on identifying and involving potential users of the model, generating primary data and developing methods for capture and analysis of data, such as field point sampling, air photo interpretation and Participatory Rural Appraisals. Studies were conducted in fairly large areas (e.g. districts) and smaller ones (communes, sub-water catchment areas or villages of a few hundred hectares). Instead of trying to figure out what villagers were doing, and might do in the future, based on official data or air photos, the researchers went to the field asking villagers and other stakeholders about their land use and discussing options for future development with them. The roles of the "planners" and "land users" were put in focus.

One step further towards a planning approach was taken at an international training workshop (Anon, 1999). Stakeholders in the land use and environmental sector (policy makers, central and district planners, researchers and local farmers) participated in the field based planning exercise. It concerned a strategic issue (consequences of establishing a national park) and included capture and analysis of data and APM scenarios.

INTRODUCTION TO THE AREA PRODUCTION MODEL SOFTWARE

Workshop exercise held in Palapye, Botswana, 4 December 2001

by Karl Gustafsson

Requirements:

- Basic knowledge on computer usage by at least some member of the group.
- A computer with the APM-software properly installed.
- Users guide to the area production model, APM.

Goal and input data:

This exercise aims to give the participants a brief introduction on how to operate the APM-software. The exercise is based on data from Ban Pakxapmay in Lao PDR. The starting year of the APM-run will be 1999 and it will simulate development until 2019.

Please follow the steps 1-3.

1. Starting the APM program

The APM program is generally found under the *Start-menu | program | APM* and is started by a single click on the left button of the mouse. The *Start* menu may look different on different computers depending on the installation.

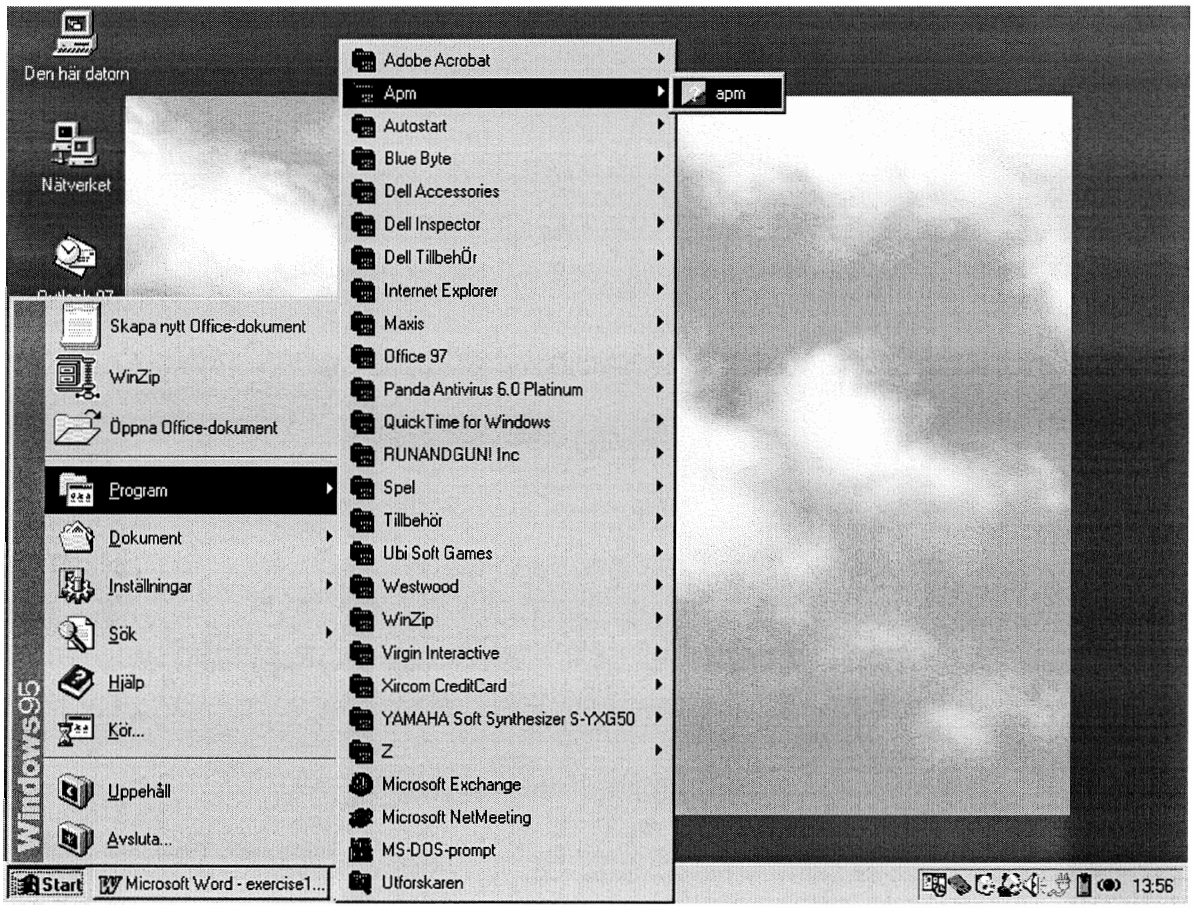

Fig. 1 Starting the APM program

2. Adding a new data set (Users guide, section 8.6)

As the APM is started You will be presented the main window of the program. Choose *Add data set* from the *Edit* menu. A window "*Adding data set*" will appear. The window consists of four sheets in which You will add the input data (the units of the input data can be found in the Users guide, section 8.6). The input data for the area is shown in the pictures following. The growth factors are the driving forces, which will alter the land use, production and population of the area. The model is simply deterministic and will present to You the results of a possible development in these variables.

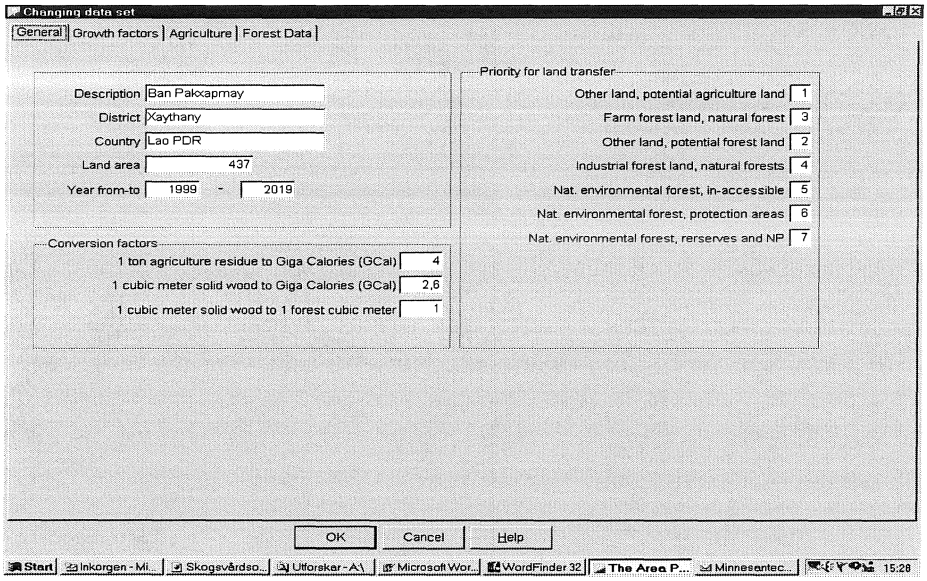

Fig. 2 General data input sheet (Users guide, section 8.6.1)

Please take the time to consider the priority for land use transfer. The current settings imply that if land needs to be transferred to any land-use class e.g. *subsistence food production* it will primarily be taken from the land use class *Farm forest land, natural forest.* Secondly, land will be transferred from the class *Other land, potential forest land.*

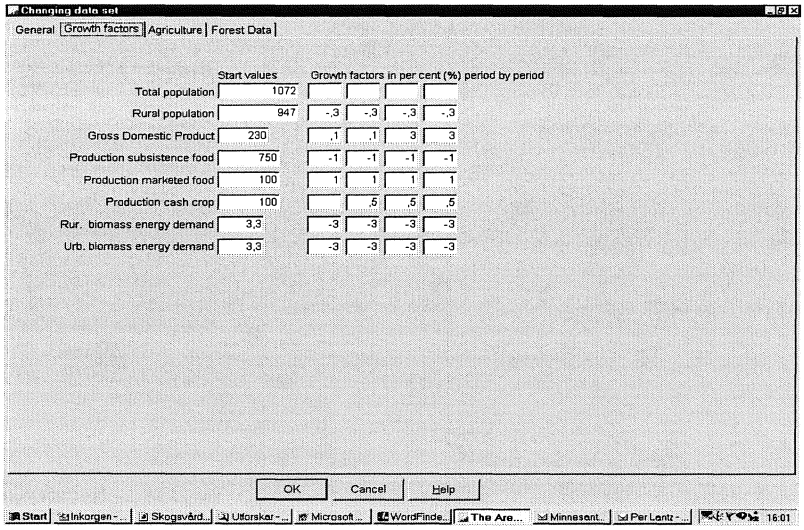

Fig. 3. Growth factors input sheet (Users guide section 8.6.2)

The starting values have been taken from available statistics and field studies from the area. Please add them as shown above. The growth rate has been estimated from experience of studies in the villages. Take time to discuss the growth rate of each element. It's the annual growth rate in percent that is to be entered for each of the four 5-year periods 1990 - 2010.

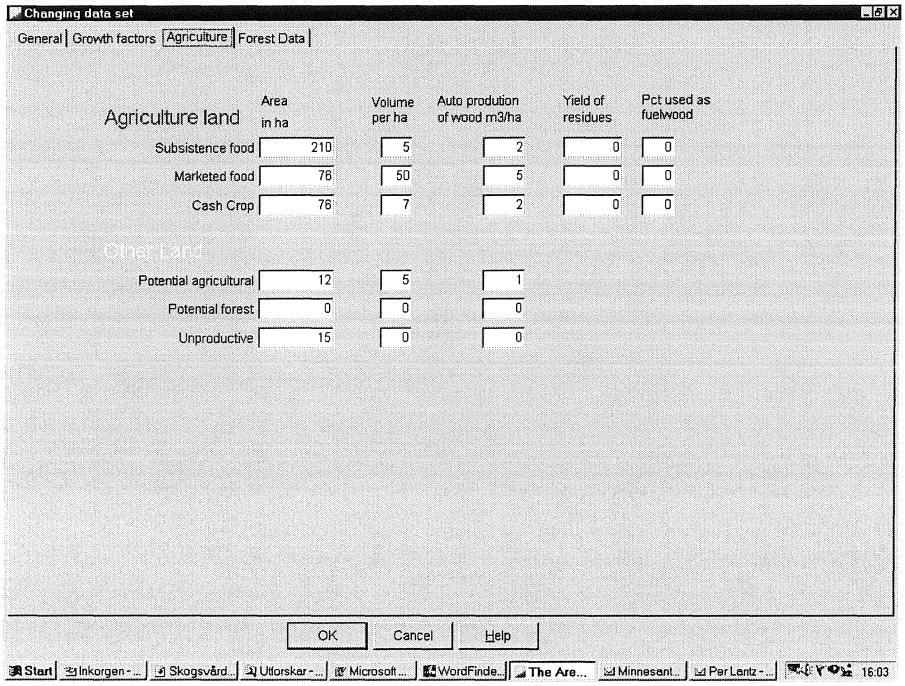

Fig. 3 Agriculture data input sheet. (Users guide section 8.6.3)

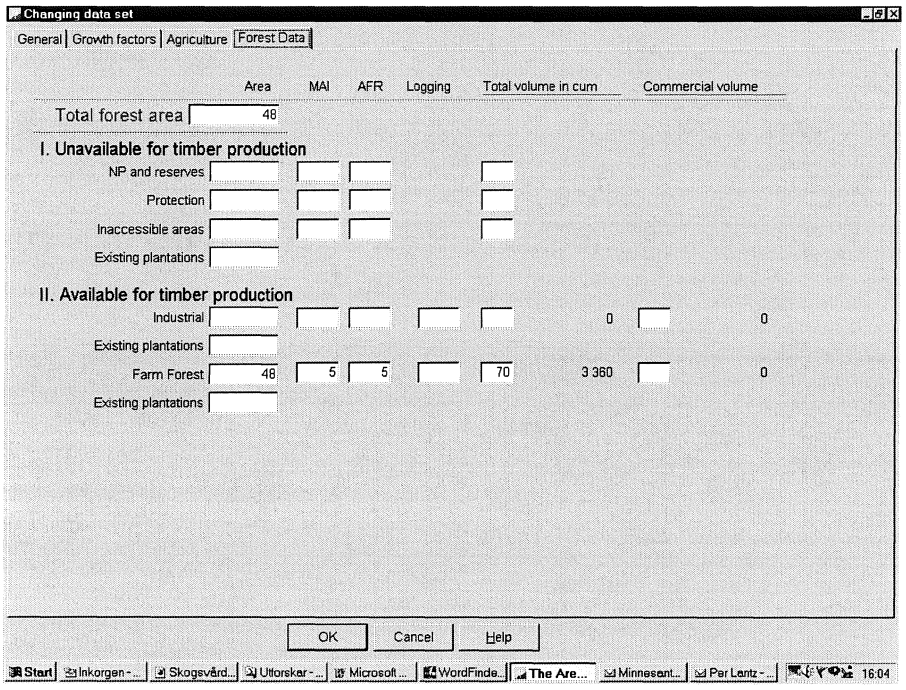

Fig 4 Forest data input sheet (Users guide, section 8.6.4)

Please fill in the agricultural and forest data as shown in fig 4 and 5. Note that the sum of areas of forest and agriculture land must match the total area as given under the general input data sheet. If this do not match the program will not run.

When the input is completed as above press "OK" to close the *adding dataset* window. Please try to anticipate the land use transfer and development of the population.

3. Running the model (Users guide, section 8.11)

To run the model, simply choose *run model* from the *file*-menu.
You will be presented a choice of report.

Mark the table You wish to see and press *preview*. There are also two graphs available on the sheet *graphs*, which You can study. Discuss the results. Does it reflect what You anticipated?

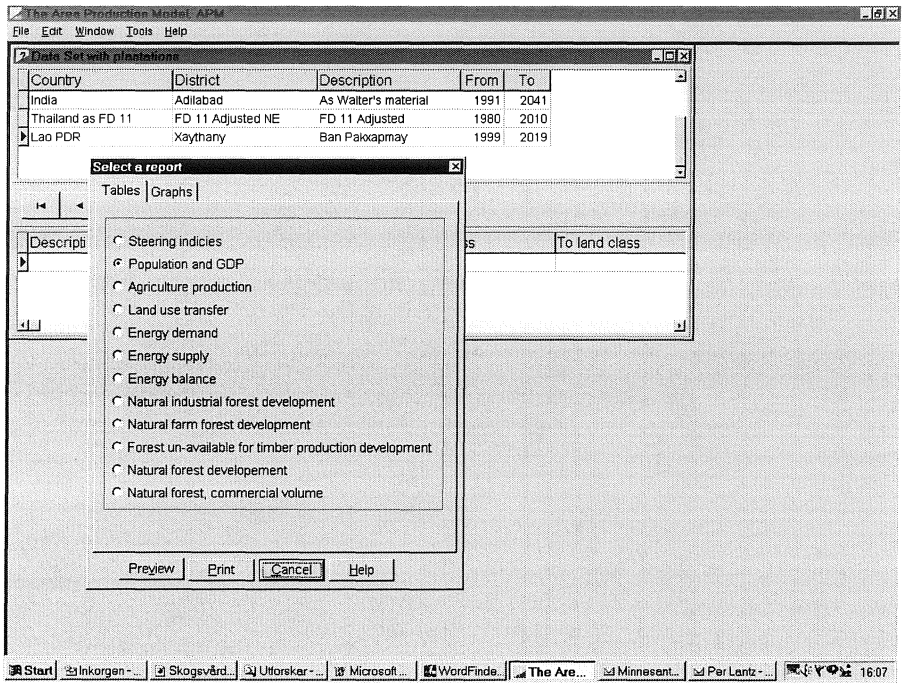

Fig. 5 The *select a report* window

4 Altering the growth factors

As mentioned it is the growth factors that is the driving force of the model. Try higher growth factors (2, 2.5, 2.5, 3.0%) for the growth in the production of subsistence food without altering the other growth factors. To do this, simply close the *select a report*-window and mark the Vietnam data set. Choose *Edit data set* from the *Edit*-menu in the main window. The input data sheets are now open for You to alter them and to repeat step 3 of the exercise. Before you run the model with the new growth assumptions please discuss how You think land use will change.

If there is time You may want to change other growth factors and see how they will alter the outcome!

Good luck!!

INTERACTING WITH THE LOCAL PEOPLE

by Kajsa Sandewall

This paper is related to the field exercise on data collection. It highlights ethical aspects of establishing mutual understanding between outsiders and local people. Participatory methods, which are essential in to-day's interactions between local people and outsiders, were adopted in the exercise.

1. Introduction

Throughout the world, rural societies are currently facing an enormous change in all aspects. In many countries, the accelerating change, such as the change of forest and land-use patterns, has been dramatic. The consequent issues thus need appropriate solutions. To respond to the need, planning is one of the core strategies. In its turn, an effective planning requires collection of accurate data and reliable information on the rural conditions and their affecting factors. This has brought a fact that conventional ways of obtaining information about the rural conditions should probably be changed, because the information becomes out of date very quickly.

It is important to remember that the best information comes from the local people, or farmers, who are direct resource-users. Their perceptions and understanding of resource situations and problems are crucial to learn and interpret, because solutions must be viable and acceptable in the local context. The range of accuracy and reliability of the information is depending upon the relationships between the interviewers and the local people interviewed. However, it is **not** incorrect to mention that it depends particularly on the behaviour of the outsiders, or the interviewers.

The title of this workshop implies its meaningful focus 'inter-active and dynamic approaches'. These approaches are defined, in this context, as follows.

'Inter-active approach' refers to the method of *bridging the gaps and improving communication* among all parts involved in the planning of forest and land-use, such as, among different sectors/organisations as well as among individuals - especially between the government staff and the local people.

'Dynamic approach' gives attention to *the time perspective*, emphasising what has happened in the past and what is going on related to the change of forest and land-use, when planning for the future.

In order to determine the outcomes of these two approaches, a combination of specific methods, tools and techniques is needed. In this regard, Participatory Rural Appraisal (PRA) approach has much to offer.

2. PRA in brief

A brief knowledge of PRA is summarised and adapted from various reference documents (listed in the last section of this paper), coupled with the author's own experiences.

The best PRA training may take several months, because a diversity of concepts, tools and techniques must be covered and trainees have to spend most of the time to practise in the field. Lectures are just the minor part of the learning. Due to a limited time-frame of the Workshop, the participants could therefore practise PRA approach just at the basic stage.

What is PRA?

PRA, or Participatory Rural Appraisal, is a related type of Rapid Rural Appraisal (RRA). Thus the story begins with the RRA.

Rapid Rural Appraisal or RRA is a powerful methodology for learning about rural conditions. It features an interdisciplinary team assessment that combines multiple techniques for data acquisition and analysis. The techniques require the team to talk extensively and informally with local people and observe local conditions, while also making use of secondary information such as administrative records and maps. RRA is used to obtain information in a timely cost effective, accurate and insightful manner, as a useful basis for development planning and action. It is not a type of 'formal survey' and it does not use 'questionnaires' in the procedures.

For many practitioners, Participatory Rural Appraisal or PRA is just a better name for RRA, because PRA emphasises its participatory nature and de-emphasises speed as a principal characteristic. Other difference between PRA and RRA is that PRA requires enabling local people to use particular tools (e.g. drawing sketch-maps of their own villages and the surroundings) and encouraging them to talk among themselves rather than with the interviewers (the outsiders).

Methods, tools and techniques

- The most commonly used and powerful methods in PRA approach are personally talking to the local people and direct observing local conditions.

- There is a large variety of tools, for instance, various forms of interviewing, measuring and estimating size/ volume/ mass, mapping, diagramming, and many more.

- The most widely used, and probably most powerful, general technique for discussing with local people is semi-structured interviewing.

To cross-check and improve the quality of information, the important methodological principle is that of 'triangulation'.

Do:s and Dont:s

There are particular suggestions from the experienced PRA-practitioners about what one should do and not do during the meetings and the interviews with local people. The suggestions are simply called "Do:s and Dont:s".

<u>Do:s:</u>

- Follow local greetings and etiquette.
- Adopt a clearly agreed but flexible procedure beforehand and explain it to the local people, as well as the purposes of the visits.
- Be patient and polite.
- Create an open and relaxed atmosphere to encourage participation and dialogue.
- Use observation to support your own understanding.
- Be supportive of each other (among the team-members).
- Be aware of conflict and gender issues.
- Use appropriate language so that everyone can understand.
- Start slowly and build up dialogue.
- Explain the purpose of any equipment and get consent to use it.

Don't:s:

- Be authoritarian, i.e. a 'chief'.
- Allow individuals to dominate a conversation.
- Be afraid to ask probing questions in interviews.
- Ask leading of very controversial/sensitive questions in group meetings.
- Make false promises.
- Conflict with or embarrass each other (among the team members) or the local people.
- Try to teach local people.
- Align oneself with 'factions'.
- Be rude or careless.

3. Clarification of Special Terms

Appraisal

The word 'appraisal' in RRA/PRA emphasises that this approach involves not just data and information gathering. It involves assessment and analysis at the same time, throughout the process.

Data and Information

The terms 'data' and 'information' have often been mentioned as replacing each other. In fact, these two terms have their own specific definitions.

- Data, refers to facts, figures, or statistics.

- Information is all the relevant details that lead to the most reliable data and make us understand our data.

In order to have access to information it requires great consideration, attention, patience, and time, before data are acqired.

Semi-structured Interviewing, Sub-topics, and Questionnaires

Rather often, 'semi-structured interviewing' has been mentioned that the interviews are structured by questionnaires. That is not clear understanding.

- Semi-structured interviewing is an informal interview. The interviews are not structured by questionnaires, but they do have topical guidelines, called "sub-topics" or "check lists".

- Sub-topics or check lists are the particular substantive issues, which the interviewers develop to guide the study. For example, if the topic of the study is "Land-use planning in Community X ," initial sub-topics might be things like 'historical background of the community,' 'demography,' 'socio-economic conditions,' 'all types of current land-use in the community', 'changes of land-use pattern overtime,' 'infrastructure,' and so forth.

- Questionnaire is a type of formal survey. It covers full-structured questions. The respondents give short answers, or make a choice for 'yes' or 'no', or fill in the figures required, etc. Questionnaires can thus even be sent to the respondents by postal service.

Inter-disciplinary and multi-disciplinary

PRA is inter-disciplinary, which is somewhat different from multi-disciplinary.

- Inter-disciplinary work implies "integration" of professional and disciplinary perspectives.
- Multi-disciplinary work implies the mix but not the necessary integration.

Triangulation

Triangulation means getting information from several points of view, usually a minimum of three, thus "triangulation".

4. Learning and Sharing Experience

The core component of this workshop is APM. It requires various types of input-data, such as data on 'land-use changes,' 'demography,' 'agricultural production,' 'forest degradation,' 'forest plantation,' and so on. The data are used for analysing why things have happened and what may happen in the future. It is important that the data are accurate and relevant for the purposes. Therefore, many kinds of related information are also needed.

Our main sources of information for this exercise are:

- related documents, including maps;
- interviews with concerned persons, dividing into two categories;
    - key informants (local officials, village leaders, and members of Village Development Council),
    - farmers' households.

Putting PRA into practice

When study the complexity and problems of rural condition, it is seldom possible for a single discipline or a single researcher to adequately understand all of the factors affecting the lives of the local people. In order to obtain the range of expertise needed to understand local situation, a team representing different disciplines is therefore required. That is one of the PRA-principles.

During the course of exercise on data capturing in the two villages, Mabeleapudi and Paje of Palapye Sub-district in Serowe District, the participants were divided into two main groups, working separately in each of the villages.

The main group in each village was further divided into smaller groups. Each group comprised three to four different disciplines, for instance, a forester, an agronomist, an economist, or alike. Each group was accompanied by one of those key informants assigned by the village leader, when interviewed the selected households.

Because of time constraint, the field exercise was carried out very concisely in two full days, from 9.00 a.m. to 5. 30 p.m. However, the participants had experienced the main process of

PRA, covering the methods, tools, and techniques mentioned in *Section 2* of this paper *(PRA in Brief)*. The series of suggestions, concerning the *DO:s* and the *DONT:s* were also complied with.

The methods, tools, and techniques were used in combination, so called *talk, walk, and touch* (or *walk, talk, and touch* - just easier to say it in rhyme). It means that while talking with local people, the interviewers made direct observation by walking around with them, some times with the key informant, in their homestead or in their activity areas and seeing/touching what was going on.

Experience gained from the exercise is described in *Paper D3 (Lessons learnt and knowledge acquired by the participants)*.

After the two-day field practice, the findings were analysed along with APM programme at the workshop locale in Serowe.

Before leaving Serowe District for Gaborone to perform the final presentation, the participants returned to the villages to present the outcome of the studies to the local people and obtain their comments. Unfortunately, there was an unexpectedly important event took place in Paje Village on the day scheduled for the presentation.
Therefore, all participants joined the presentation in Mabeleapudi Village.

The details of the presentation, discussions, and comments are described in *Paper D1 (The Community Seminar in Mabeleapudi)*.

5. Discussions and Conclusion

In many cases, specific information on land-use given by the local people (the farmers) was more accurate and more up-to-date than the data obtained from the documents. By visiting the farmers and discussing with them at their homes and in their fields, the interviewers (the outsiders) could directly observe the current condition. While listening to the farmers' telling about their lives in the past, which had influenced their current situation, the interviewers could be able to understand the farmers' thinking of the future.

Quality of the information obtained depends on how relationship is established between the farmers and the outsiders. The more the farmers trust the interviewers, the more accurate information can be acquired.

To be able to win the trust of the farmers, the outsiders should behave with respect, empathy, and flexibility in accordance with the circumstances. In other words, the outsiders should have a good knowledge of how to *interact with* the farmers.

Experience from working with the local people in Mabeleapudi Village suggests that mutual respect results in mutual understanding, and finally can create a basis of trust.

At the first meeting with the village leader, vice leaders, representatives of Village Development Council and the village's elders, after being accepted and being allowed to conduct field exercise in the village, the working team promised that the findings of the study would be presented at the village seminar. That promise made the village representatives satisfied. Nonetheless, during the period of working with the exercise many arguments, concerning time constraint, had occurred and indicated that the planned seminar in the village

should have been cancelled. Fortunately, in the end, it was agreed upon that a seminar could be arranged as planned, although very brief.

At the seminar, the presentation of findings was very interested by the local people, leading to lively discussions. By the end of the seminar, some of the elders mentioned that they had appreciated the working team's keeping promise. That meant, the working team and the local people had established a mutual respect. Such an experience could even be applied in other occasions.

Another experience the author has gained from this field work (also experience from previous work) is that to express 'apologies' and 'thanks' will never do any harm. It helps relieve (or even get rid of) irritation of the local people if some mistakes, related to culture, tradition, or local regulations, accidentally are made by the outsiders.

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CAPTURE OF DATA FOR STRATEGIC LAND USE PLANNING – A POINT SAMPLING APPROACH BASED ON LOCAL PEOPLE'S KNOWLEDGE

by Mats Sandewall

This is a modified version of a dissertation paper dated April 2001. To make it condensed, the literature review and details of an evaluation of the method (of the original paper) have been excluded. Because of time constraints, the method was never tested in the Botswana workshop, as was originally planned, but some references are made to the Botswana case. Persons interested in the entire paper are welcome to contact the author.

Abstract: In strategic land use planning in developing countries, there is often a shortage of accurate data on actual land use, its history and trends. Sometimes, data are structured or collected so that they do not provide information for the relevant questions, sometimes data are too old or they reflect official targets rather than the actual situation. Many inventory methods are expensive, time consuming, supply driven and neglect making use of existing knowledge.

In this paper, an inventory method for estimation of current and historical land use is presented. The method, named "field point sampling with local key informants", is primarily aimed for strategic planning and has been tested in Laos and Vietnam in areas from 100 hectares – 10 000 hectares. It is based on a systematic outlay of sampling points to be visited jointly by a planner and people with local land use knowledge (e.g. villagers, land owners, extension workers). Current land use is verified on the spot, the historical information provided by the local informant is verified through old aerial photos and satellite images.

The method highlights simplicity, flexibility, cross-sectoral approaches and integration of techniques from the natural and social sciences. Techniques for dealing with potential bias (related to subjectivity, missing data and activities of non-residents) and possibilities for further technical development are discussed.

Introduction

The objective of this paper is to present a sampling method developed and tested for the purpose of collecting multi-disciplinary forest land use data as a base for strategic planning in tropical developing countries

The method, "Field point sampling with local key informants", was developed and tested as part of studies in Vietnam and Laos. The main objective was to find a feasible method for estimating the actual land use and it's changes as a base for strategic land use planning. Based on the mentioned shortcomings experienced in

some previous inventories and new issues that have emerged in recent years various requirements were considered in the design (Table 1)

Table 1. Requirements on inventory used for strategic land use planning

Consideration	Requirements
Area coverage and details	a) Cover the whole area and not only, e.g. forest land. b) Provide data with sufficient geographic resolution.
Accuracy and precision	a) Provide unbiased data with known precision. b) Enable cross checking of data to improve accuracy.
Time perspective	a) Reflect current land use (the actual use of the land at the time of the inventory). b) Describe historical development, ongoing and expected future changes. c) Enable continuous monitoring of changes in relation to current policies.
Cost and robustness	a) Have an adequate degree of technology with respect to costs and existing human resources. b) Be robust and simple to plan, undertake, process and analyse and thereby provide data sufficiently fast. c) Be as independent as possible of local security and terrain difficulty.
Flexibility	a) Make use of local knowledge and enable incorporation of additional spontaneous information from field observations. b) Be applicable in different situations (with respect to budget, available tools, physical conditions and so on)
Data and information	Provide cross-sectoral data such as a) forest cover, b) stocking, c) current agriculture crops, d) over-lapping land use, e) land suitability for agriculture f) consumption-market issues, g) historical information, h) people's future plans, i) land tenure, j) official land status, k) population.
Inventory output	The data and information, should provide the general understanding of current situation and trends, which is needed in strategic planning. It should also enable analysis of optional strategies, e.g. through modelling of scenarios on future development under various conditions.

Design and outline

The general idea is to combine objective measurements or observations in the field with local information from persons with good knowledge of the past and present land use in the whole area.

The inventory design is based upon a systematic grid of sampling points covering the area. The distance between the plots is set to achieve a certain precision. Sampling points are allocated by use of alternative techniques depending on local situation and available tools, for example; 1) on a sample of aerial photos, 2) on the map grid or at certain co-ordinates of a topographic map, 3) along transect lines.

Data collection: A "surveyor" defines the location of the sampling points by use of e.g. map, photos and compass. The "key informant" (e.g. a senior farmer or extension worker with local knowledge) provides data on the present, past and intended future land use. If required, other persons can join the work and provide special information. The recording is made when the surveyor and the key-informant *jointly* visit the sampling point. Some data are recorded on each point. Historical data are collected for certain years (e.g. every fifth year) including those years when aerial photographs are available. The key-informant also provides other information on request or spontaneously.

Verification of accuracy: Some data are verified by observations during fieldwork. Other information and data, which cannot be verified during fieldwork (e.g. historical data), are controlled by use of old aerial photos and satellite images, when possible.

Complementary information: In order to obtain additional information about the area, for example demographic and socio-economic issues, field point sampling is combined with other data capture, such as structured interviews or Participatory Rural Appraisal, PRA.

Case studies

Two research studies are described herewith. The first one was undertaken in the Upper Nam Nan Water Catchment Area, Laos, which covers 9200 ha and seven villages. The second one, in Ban Lau Commune in Vietnam, included an area of 5400 ha with 20 villages, of which one was studied in details.

In the study in Laos, a grid of 74 sampling points was laid out on a sample of aerial photos, dated 1996 (Figure 1). The points were visited in the field 1997 and the current land use and land use history was determined. A local extension worker who had lived in the area many years joined all the fieldwork as key

informant. He told about what years in the past any point had been used for crops or other land use, how long time it had been used and he also provided other relevant details as he could remember.

The fieldwork took about four weeks to complete. To save time, some points in difficult terrain with closed forest were viewed and recorded from a distance. Simultaneously, a PRA and a historical and demographic survey were conducted. A first data analysis was made while the team was still in the area. Results where presented and discussed with villagers and district administration in a seminar.

Independently, the land use on the sampling points was estimated by aerial photo interpretation. Those points were identified on aerial photos dated 1982, a satellite image dated 1967 and aerial photos dated 1953, with following interpretation of land use. Technically, it was done by rectifying the various photos on to the topographic map before transfer of points. The interpretation was done by photo-interpreters that had visited the area. The data and information were used as an input to land use scenarios based on a planning tool, the Area Production Model.

In the Vietnamese study, there were not any aerial photos available. Totally 53 sample points were laid out in a 1.0 km square grid on the topographic map, scale 1:50 000 (Figure 2). The points were localised by use of map and compass and the exact position decided by the surveyor. The key-informant was a senior extension officer of the commune.

The survey took five days to complete (the terrain was hilly but without much disturbing vegetation at that time of the year). When the results of the survey were analysed and discussed with the commune, there were great discrepancies between official commune statistics and the inventory results (much more land was used for food production according to the inventory), which could not be sufficiently explained. Therefore, a second step of the inventory was undertaken on village level.

The area of the village was 110 ha. In this step 56 points were laid out along transect lines. The senior village key informant provided detailed information on land use, crops, yields, land users for a historical period of about 50 year. About 3 days were required for the survey and a fourth day used for an excursion to an area outside the official village area that turned out to be used by the village. The data, which mostly confirmed and also gave explanations to the commune level data were presented and discussed in a village dialogue by the end of the work session.

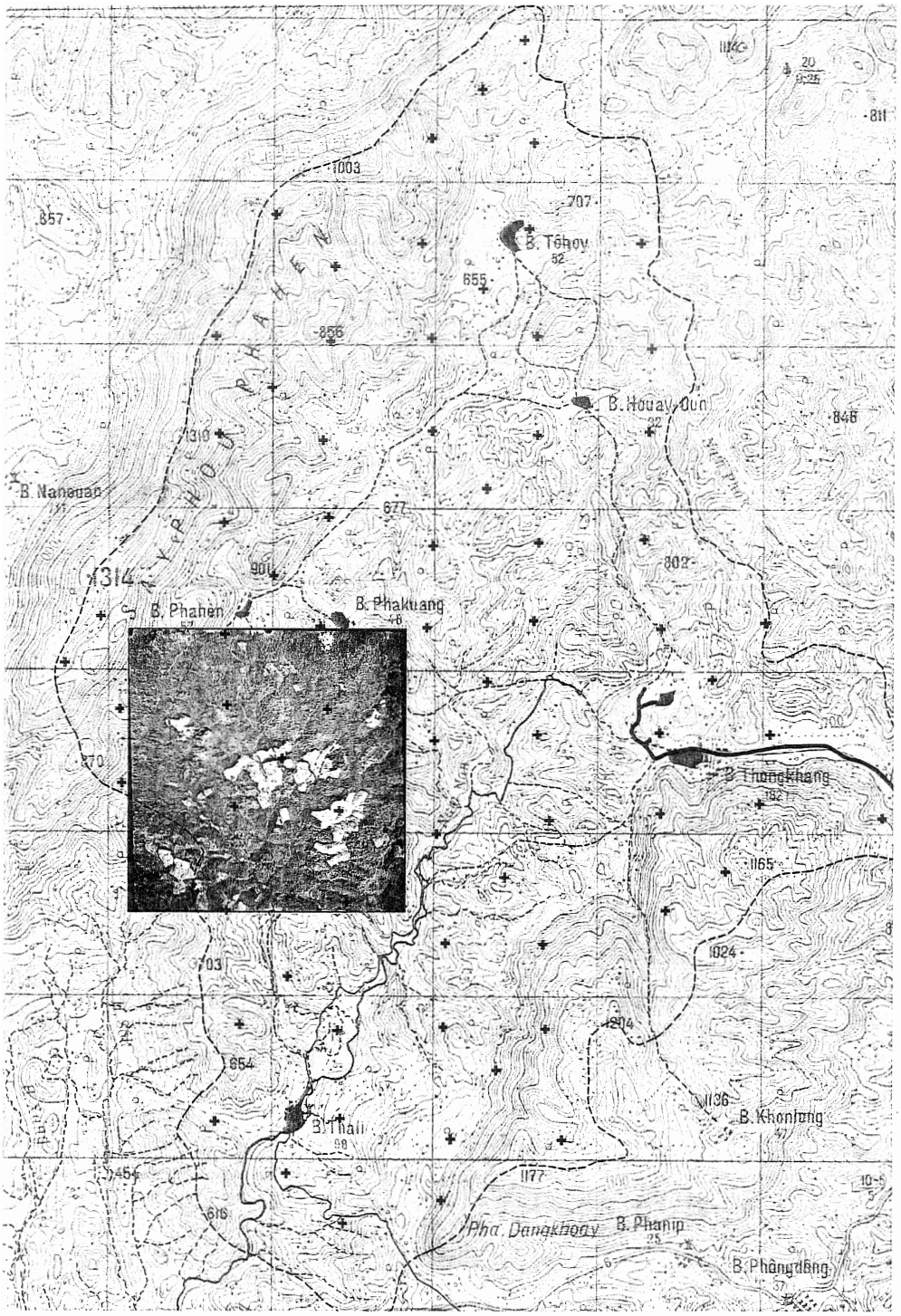

Figure 1. The field point sampling in the Upper Nam Nan Water Catchment Area, Laos. A pattern of five sampling points per photograph were allocated in the central part of each aerial photo used. The photo in the figure has been rectified to match the topographic map.

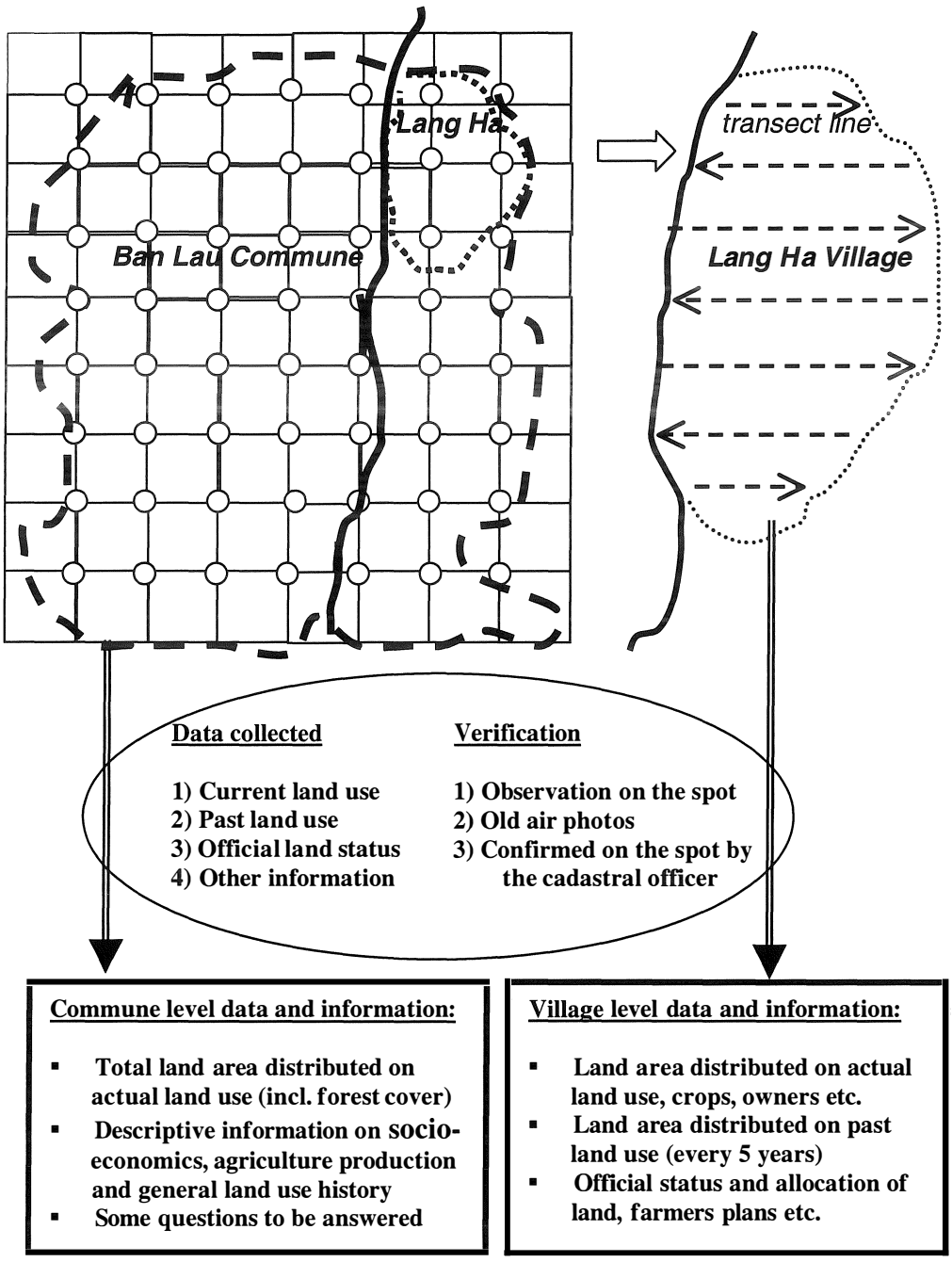

Figure 2. The field point sampling in Ban Lau Commune, Vietnam. In the first step sample points were allocated in a 1x1 km pattern (using the map grid as a base) and covering the whole Commune. In the second step a similar survey was done in one of the villages, with sample points laid out along transect lines.

The size of the sample

In systematic sampling the standard error cannot be correctly estimated. The formula for simple random sampling (e (P) = √(P*(1-P) / n) may, however, be used for the purpose of defining how many sampling points are needed to ensure that a defined required precision is achieved. In this case we assume that the true error may well be smaller than the error at simple random sampling, but is not likely to exceed it.

In the Lao case study with a sample of 74 points, the maximum standard error for the estimated land use proportion was 5.8 percent units of the total area. For any class representing between 25 and 75% of the total area the standard error will be between 5.0 and 5.8% with that size of the sample. If the total sample had been e.g. 50 points or 100 points the maximum standard error would have been 7.1% and 5.0 % respectively.

Experiences

The method addresses many of the requirements listed in Table 1. With regard to area size, it has been tested on village level (100 – 200 ha) and for watersheds and communes (5000 - 10 000 ha). In one case, one part of a commune covered by a large block of closed forest (a national park) was surveyed by use of satellite image plots only while other parts with agriculture or significant human influence was surveyed through field plots. In principle, the method works for any size but seems to be more useful for areas small enough to enable the team to walk between plots and the key informant to provide detailed data and explanations.

The whole inventory, including planning and analysis, was completed within one to four weeks in each of the areas. The time depended on size of area, terrain, vegetation and ambition of the survey. The processing of data was usually done on pocket calculator and required less than one day to complete.

The method generated immediate data on e.g. current land use, and a good overview of the historical development, which was verified and complemented by other information sources. Being able to soon return to those people, who provided the data, and to present and discuss the results was an advantage. Having accurate up-dated figures on current land use (and a common reference with the villagers or the commune staff) was a great advantage in the discussion of causes and opportunities. Aerial photos facilitated point identification and data control in the Lao study, but as was shown in Vietnam, much valuable data could be collected with a topographic map only, especially in the smaller areas.

Evaluation of accuracy

In the case study the accuracy of field point sampling data was analysed by comparing data of key informants with data from interpretation of those points on aerial photos of different years (1967, 1982 and 1997).

The general conclusions of the analysis were: 1) The land use reported by the key informant for a specific year in the past was not so accurate, but the trend over a series of years provides important information. 2) The information was more specific (and normally more accurate) if the concerned farmer was present, but it was often impractical and sometimes impossible to arrange. 3) Map reading was difficult for many local officers and inventory staff (although some learned very well). Inexact point identification also induced some degree of bias in the inventory. To improve the accuracy and facilitate recurrent inventory of sampling points a GPS device was recommended.Discussion

"Field point sampling with local key-informants" emphasises simplicity, flexibility, cross-sectoral approaches and integration of techniques from the natural and social sciences. It was developed as a tool for strategic land-use planning but was also found useful for research studies and surveys. An inter-active work process and a research team that involved specialists from different fields were found to be favourable for the outcome.

Discussion

The field point sampling method contains some elements of potential bias. One has to acknowledge and decide how to cope with those elements when using the method.

- When allocating samples on a grid of aerial photos, hills are over-estimated in relation to valleys unless a correction is made based on flight height and altitude. When points are allocated on topographic maps (or satellite image maps) that form of bias is insignificant. On the other hand, the localisation of points, another source of bias, is less accurate when using that method. It requires a well considered procedure (or a GPS) when deciding the exact position of a sampling point in the field.

- The inevitable subjectivity of any key-informant must be compensated by cross checks with data from other sources (e.g. through air-photos, direct observations or questioning of more than one person). It should also be taken into account in the data analysis (by studying the logic in time trends and by presenting and discussing findings with other persons related to the study area).

- Non-available historical data is another problem. One needs to work out how to do in those cases when the key informant simply does not remember and the person who should have the best knowledge has passed away or moved out.

- There is a risk for bias towards activities undertaken by people living in the area in favour of activities carried out by people settled outside the area or passing by. Many land use conflicts concern unauthorised (but often legitimate) activities undertaken by stake-holders who are not settled in the area (migrants, sometimes cattle holders, shifting cultivators, military groups and so on). Business activity such as commercial logging is another example. Complementary methods may be needed to address those issues (PRA was used in the study). It is, however, important to identify all the main stake-holder groups and to have the flexibility and time to approach them.

The method was developed as a component in strategic planning. It was tested (with success) in fairly small areas between 100 and 10 000 hectares. For strategic planning on national level the whole country has to be taken into account. It is hardly realistic to cover all land with such an intensive method. Some form of multi stage design will be needed. One option would be to consider each small area of study as a primary sampling unit and select those samples subjectively or randomly in such a way that they represent different regions or other types of strata.

The case study in Botswana

In the Paje/Mabeleapudi case study we would have used a similar approach as the one in Vietnam. By distributing sampling points evenly along a number of survey lines identified on the available aerial photos, and bringing the village agriculture extension officer along with us, (possibly contacting concerned villagers to obtain some additional information when needed) we should have been able to cover the village area in a week or so. Sometimes the borders of the village cannot be exactly identified in a discussion over a map. The survey line approach is suitable as you simply walk the line until the key informant says, that you cross the border. It also gives you the opportunity to control the estimate of the village area.

Some elementary needs-to know when considering use of aerial or satellite remote sensing in natural resource management

Mats Sandewall

This is a short review of some (few) good-to-know items. The author is not a remote sensing specialist, but has worked with tropical RS applications in practice from time to time. Those interested in details are recommended to go to the reference literature or consult specialists.

Remote sensing has been defined as "the science and art of obtaining information about an object, area or phenomenon through the analysis of data acquired by a device that is not in contact with the object area or phenomenon under investigation" (Lillesand & Kiefer, 1994).

The most commonly used data sources are aerial photos or satellite imagery. There are also several other techniques, such as e.g. radar and lidar.

Aerial photography:

History: The earliest existing aerial photography taken by a balloon over Boston in 1860. Air photography from aircrafts taken for reconnaissance purpose during World War 1. Civil air photos available occasionally from around 1930 and more commonly from around 1950. It means that you have a decent chance to find photos of "your" area from the 1950s and onwards.

Films qualities: Black and white photos are usually made with *panchromatic (standard) film* or *infrared-sensitive* film. The latter can detect certain parts of the spectre that the former cannot. It may e.g. be used to distinguish deciduous and coniferous trees. Use of *color* film and especially *colour infrared* film may also be used to better distinguish certain features on the photo.

Scales: Literature defines *small-scale* aerial photos (1:50 000>, *medium scale* aerial photos (1-12 000 – 1:50 000) and *large scale* photos (1:12 000<). Medium-scale photos are the most commonly used for many purposes including forestry and land resource management, mapping etc.

Costs: Include materials-film processing, photography flights and interpretation/analysis. (Loetsch & Haller, 1973). It varies a lot depending on needs and situation. Flight costs are significant and can be calculated in advance. More flights (denser flight lines, lower flight height, further from air field etc. requires higher costs). Time of photography is important to achieve good conditions for photography and good timing with interpretation and needs of the photos. In all, very careful planning is necessary.

Satellite data

History: First satellite data were obtained in the early 1960s for military purposes (some of those data are now released for civil use). Data for civil purposes available since the mid 1970s (ERTS followed by Landsat in the 1980s).

Types: Landsat (US) and SPOT (French-Swedish) are two common types of satellite data named after the satellite name. Weather satellites (NOAAH) is another types generating data in smaller scale, very frequently and at lower cost. Nowadays there are a quite large number of satellites launched by quite many different countries.

Products: Data could be obtained in *digital form* or as *paper prints* (photography copies). The form to buy depends on how they are to be used (for advanced digital analysis or as an alternative to aerial photos to be interpreted by local interpreters and used in the field. Image maps is a special form of paper prints which has been "precision corrected", adjusted to a certain scale and ready made to be used as a kind of map.

Scales: From about 1:50 000 – 1:500 000 are common scales. More important than the scale is maybe the resolution or "pixel size". It describes the minimum object size that can be detected on a certain image. 10*10 m – 30*30 meters are common pixel sizes for civil satellite images eexisting today. Military satellites have a better resolution.

Costs: SPOT data are known to be quite expensive. The cost of a scene with new data was around 2500 USD a few years ago. Digital data are in the same magnitude. Landsat data was somewhat cheaper but still quite expensive. The expectation is that costs will go done in the future.

Clouds: A special practical problem in all kinds of aerial and satellite photography are clouds and dizzy weather. In some areas, e.g. mountainous tropical moist forest areas, there may be very few days with clear sky. It restricts air flights increases costs because of waiting time and makes many of the satellite photos to be of little use.

Using remote sensing in research and land management

In my own experience from research and tropical forest inventories, remote sensing is a useful *complementary* tool for verification of data and information from field sampling and PRA. It also provides a geographical overview of the entire area and generates "indisputable" data (a photo or image has a good memory). It could be very useful for planning and stratification purposes. Another important opportunity is "exact" change monitoring by comparison of photos of different dates or years.

Access to remote sensing data in the initial part of a project is an asset. On the other hand, obtaining *new* data is expensive and often takes time, especially in combination with a bureaucratic process, so it requires good planning.

When it is the only means of providing land use information it has its limitations. In the ideal situation, one can detect vegetation, trees and some crops, but certainly not people's use of those features or the purpose of the production.

Some useful reference literature

Lillesand, T.M. and Kiefer, R.W., 1994. Remote sensing and Image Interpretation. Third Edition.John Wiley and Sons Inc.

Loetsch,F. and Haller, K.E. 1973. Forest Inventory. Volume 1. Second Edition. BLV Verlagsgesellschaft.

2001-12-15 / MS

REMOTE SENSING – A PRACTITIONERS BRIEF

	Aerial Photography	Satellite data	Other data
Types	Various companies and enterprises produce	Landsat SPOT NOAAH Military Other --- Paper prints Digital data --- Scenes Image maps	Radar Laser etc.
Qualities	Black-and-white Colour IR		
Common Scales	1:10 000 – 1:50 000	1:50 000 – 1: 500 000 (1: Millions for weather satellite photo)	
Time	From about 1950	From about 1980 (military from 1960s)	
Cost	some 50 000 USD for a fairly small area (high flight cost, copies of available photos cheap)	SPOT in magnitude 2500 USD/scene LANDSAT cheaper Could be cheap buy old images when available Check Internet	
Use	Inventory Mapping etc.	Thematic mapping, Stratification Change detection Sampling inventory	
Problems		Clouds	
Terms	Resolution, Pixel size, Rectification		

SECTION C

Case studies, exercises and other documents

SEROWE/PALAPYE APM STUDY - GROUP 1

❑ GROUP MEMBERS

- N. MANYOTHWANE
–M. PILOTO
–K. KEMOREILE
–D. KWESHA

❑ WORK TASK

Develop land use scenario for Serowe/Palapye Sub-district over the period 2001-2031 based on available documents and assumptions on future changes and conditions

PROFILE OF STUDY AREA

- DISTRICT: SEROWE/PALAPYE SUB-DISTRICT
- COUNTRY: BOTSWANA
- LAND AREA: 3,090,400Ha
- PERIOD OF STUDY: 2001 - 2031

DEFINITION & PRIORITISATION OF LAND TRANSFER

LAND USE	PRIORITY LAND TRANSFER CLASS (APM)	PRIORITY RATE
COMMUNAL GRAZING, BLDC & TGLP RANCHES, ARTIFICIAL INSERMINATION	OTHER LAND, POTENTIAL AGRICULTURAL LAND	1
COMMUNITY WOODLOT	FARM FOREST	4
COAL MINING	OTHER LAND, POTENTIAL FOREST LAND	5
INDIGENOUS WOODLANDS	NATURAL ENVIRONMENTAL FOREST, INDUSTRIAL FORESTLAND	2
BOTSWANA DEFENCE FORCE CAMP	NATURAL ENVIRONMENTAL FOREST, INACCESSIBLE	7
SOIL CONSERVATION PROJECTS	NATURAL ENVIRONMENTAL FOREST, PROTECTION AREAS	3
KHAMA RHINO SANCTUARY & RECREATION AREA	NATURAL ENVIRONMENTAL FOREST, NATIONAL PARK/RSERVES	6

DEFINITION OF GROWTH FACTORS

GROWTH FACTORS	BASELINE VALUES - 2001	2002 - 2006	2007- 2011	2012- 2016	2017- 2021	2022- 2026	2027 - 2031
TOTAL POPULATION	148,471	1.4	1.4	1.4	1.4	1.4	1.4
RURAL POPULATION	148,471	1.4	1.4	1.4	1.4	1.4	1.4
GROSS DOMESTIC PRODUCT	2,199	2	2	2	2	2	2
PRODUCTION SUBSISTENCE FOOD	1,000	0.5	0.5	0.5	0.5	0.5	0.5
PRODUCTION MARKETED FOOD	100	1	1	1	1	1	1
PRODUCTION CASH CROP	0	0	0	0	0	0	0
RURAL BIOMASS ENERGY DEMAND	0.65	-3	-3	-3	-3	-3	-3
URBAN BIOMASS ENERGY DEMAND	0	0	0	0	0	0	0

ASSUMPTIONS ON GROWTH FACTORS

- NO URBAN POPULATION
- 1991 CENSUS RESULTS CONVERTED TO 2001 USING 1.4% RATE
- NO CASH CROPS (SUBSISTENCE FARMING ONLY)
- BIOMASS ENERGY DEMAND DECREASING (RURAL ELECTRIFICATION)
- SUBSISTENCE PRODUCTION = 20 X 50KG BAGS/Ha
- 10% OF SUBSISTENCE PRODUCE IS MARKETED FOOD

– **CONCERN:**

  - LIVESTOCK PRODUCTION NOT PART OF GROWTH FACTORS

AGRICULTURAL DATA

	AREA (Ha)	VOLUME/ Ha	AUTOPROD. OF WOOD	RESIDUE YIELD	% USED AS FUELWOOD
AGRICULTURAL LAND					
SUBSISTENCE	826,700	2	0	0	0
MARKETED	91,800	2	0	0	0
CASH CROP	0	0	0	0	0
OTHER LAND					
POTENTIAL AGRIC. LAND	1,982,400	1	10		
POTENTIAL FOREST LAND	0	0	0		
UNPRODUCTIVE	0	0	0		

ASSUMPTIONS ON AGRICULTURAL DATA

- AGRICULTURAL LAND IS PURELY ARABLE
- POTENTIAL AGRICULTURAL LAND IS ASSUMED TO BE UNDER PASTORAL PRODUCTION
- PASTORAL PRODUCTION IS CONCENTRATED IN ARABLE AND FOREST LAND.

FOREST DATA

	AREA (HA)	MAI	AFR	STANDING STOCK(M^3Ha	TOTAL VOL. (M^3)
TOTAL FOREST AREA	189,500				
UNAVAILABLE FOR TIMBER PRODUCTION					
NP & RESERVES	450	0.5		10	
PROTECTION	2	0.5		10	
INACCESSIBLE	1,000	0.5		10	
EXISTING PLANTATIONS	0	0			
AVAILABLE FOR TIMBER PRODUCTION					
INDUSTRIAL	0				
EXISTING PLANTATION	0				
FARM FORESTS	188,041	0.5		10	1,880,410
EXISTING PLANTATIONS	7	0.5			

ASSUMPTIONS ON FOREST DATA

- STANDING STOCK IS $10m^3$/HA
- TOTAL VOLUME FOR FARM FOREST
  - $1,880,400m^3$ (AREA X STANDING STOCK)

Proposed Land Classification

Priority

Communal grazing 1
BLDC Ranches
TGLP Ranches
Artificial Insemination

(Other Land, Potential Agricultural land)

Community woodlot 4

(Farm forest)

Coal mining 5

(Other land, potential forest land)

Indigenous woodland 2

(Industrial forest land
Natural forest)

BDF 7

(Natural environ. Inaccessible)

Soil conservation projects 3

(Natural Environ. Forest protection Areas)

Khama Rhino Sanctuary and Recreation areas 6

(Natural Environ. Forest reserve and NPs)

CHECKLIST: HOUSEHOLD SURVEY

VILLAGE:…….. *Date:……*

Profile

- Name of respondent
- Education
- Gender
- Age
- Household size
- Employment

- **Total population** **Growth factors**
  1. Rural
  2. Urban
  3. Household size

- **GDP** **Growth factors**
  1. Livestock sales
  2. Marketed crops
  3. Cash crops
  4. Remittances
  5. Beer sales
  6. Crafts
  7. Subsistence
  8. Fuelwood sales

- **Landuse**
  1. **Cropping/arable**
     - Size
  2. **Forest**
     - Plantation
     - Natural
     - Protected areas
  3. **Inaccessible forest area**
  4. **Cattle post**
  5. **Settlement**
  6. **Other land**
     - Potential agriculture etc
     - Forest land

- **Production** **Growth factors**
  1. **Arable size**
     - **Allocated**
     - **Utilised**
  2. **Crop type**
  3. **Yield**
     - Grain
     - Stover
     - Variability
  4. **Retentions**
     - Livestock feed
     - Consumption
     - Beer brewing
  5. **Marketed/sales of crops**
  6. **Livestock types**
     - Numbers
     - Sales
     - Gifts
     - Slaughters
     - Kgotla fines
     - Mortality

- **Biomass** **Growth factors**
  1. **Head loads (source)**
  2. **Scotchcarts (source)**
  3. **Alternative sources**
     - Gas
     - Solar panels

- **Other data**
  1. **Production**
     - Fertilisers
     - Vet medicines
     - Improved varieties (e.g. hybrids)
     - Crop rotation
     - Area under grazing
     - Livestock breeds

- Current stocking rate vis a vis "carrying capacity"
- Rangeland condition

2. Energy

- Solar panels
- Biogas
- Electrification

3. General info

- Health (mortality)
- Rural development policy
- Wildlife management/utilisation
- Constraints (for each of the major subheadings)

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4. General Comments

Developing the APM further - some comments and explanations

By Nils-Erik Nilsson

Explanations, Classifications and Definitions
Explanations below are in the order of appearance in the model. It is my intention to follow the original model set up in main aspects but also to open up some development options. My vision is that users of the APM who are familiar with Excel should get the possibility themselves to look for new model solutions or adaptations that may be applicable under their conditions.

However, please remember that the model only is a grey theory but that the nature is green! It is only with the help of your mind and with your understanding of the realities that the model can provide answers to the questions you pose.

Area production
Primary area production is defined as a process within an area unit, which creates. commodities and services that may be beneficial for man and could be utilised by him. It may be past, actual or potential, natural or influenced by man.

The Area Production Model (APM)
The Area Production Model (APM), originally developed in the 1980s is a land-use-planning tool. It describes the development over time of production and consumption in agriculture and forestry within a defined geographical area under different assumptions on management, land use and socio-economical and macro economic changes.

Main components of the APM
The model can be divided into the following parts:

- Part 1 Land-use changes due to development of agriculture.
- Part 2 Biomass energy balances
- Part 3 Utilisation of existing forests
- New part under development

Land-use changes due to development of agriculture.
The thinking behind this part can be described as follows. A growing population needs more base food too maintain the per head nutrition level. If agriculture productivity is increasing at a rate that matches growth of population, the demand for more subsistence food can be met, without increasing the agriculture area. Otherwise, land may need to be converted from other land uses. Changes between agriculture and other land use classes are simulated as effects of

- population growth
- growth in agriculture productivity (yield/ha)
- growth in GDP (Gross Domestic Product)

In essence, this part deals with deforestation, caused by demand for agriculture produce. APM aims at simulating possible future developments of land use and primary area production. It describes the development over time of the production and consumption sub-systems within a defined geographical area under different assumptions on management, land use and priority rules. If possible, an APM run should be based on a close analysis of current and past land use. It is of specific importance that scenarios that are going to be used are calibrated so that energy balances, fodder balances and wood balances are close to zero. That is why it is important to know the actual level of harvesting (wood, energy and fodder consumption) is

well known. As a matter of fact one of the algorithms that we can rely upon is that *present consumption is equal to present production* after adjustment for export, import and possible changes in stock.

The simulation model approach:

Generally speaking, a (mathematical) model:

- Is a representation of a process or problem in mathematical form
- Usually enables a range of alternative actions to be simulated
- Should include only those features of the problem which are important
- Is a simplification of reality
- Is a tool for making a complicated problem manageable

District or area
The original idea was that the model should be applicable on the level of civil district or the smallest area unit for which statistical data are available or can be made available. The studies of Mats Sandewall suggest that in most cases also existing data need to be validated by fieldwork and interviews. This suggests that the model also may be applied on smaller units such as villages. However, the smaller unit the more difficult it is to neglect influences from outside.

Scenarios
The idea with a simulating model is to run the model with varied assumptions with respect to the main deciding parameters. Thus each run is based on a certain scenario. It is recommended not to change several parameters at the same time, since then it is difficult to figure out what are the reasons for the changed output. Put names on the different scenario assumptions and, if necessary, arrange them in a matrix. Save each scenario with a name that relates to its main characteristics.

Dataset
Each scenario defines a basic data set that includes population, land classes and production specifications. In addition to a worksheet named "Data set" basic data are also required in a sheet called "Growth", in a sheet called "Fordata" and in a sheet called “Fpl” that describes all parameters related to the plantation programme, except for the plantation types that are defined in the “Moni!” sheet. Additionally, in the end there is a sheet called "Moni" that contains data that you usually do not need to change. These monitoring data decide the shape of the relative production function, define the forest types both in natural forests and in existing and new plantations.

Total land area
It is important to use a correct estimate of the total land area. Measurement unit is hectares.

Land classes
There are four main land classes: agriculture land, agriculture/forestry land, forestry land and other land. Originally there was no mixed class. It seemed important to make a distinction between agriculture land and forestry land. This distinction was often part of legislation and that there might also have been little of co-operation between the sectors. In some countries of today where forestland is defined by law it can well be that the major part of forest production comes from agriculture land or other land.

Cash crops
It refers to crops grown for marketing on the international or national market. Typical crops of this kind are cotton, groundnuts, coffee, etc. Production of cash crops is also linked to the growth of total GDP = "per capita GDP" multiplied by total population (Not in the FAO-version). In the FAO manual it is suggested that husbandry ("beef-growing") may be regarded a cash crop. Practically, this can be achieved by assigning a "symbolic area" to cash crops and to include the annual yield in some kind of weighted average. In this Excel-version under development husbandry is considered to be an overlapping activity and yield from husbandry.

Agriculture land transfers
The demand for the crops and consequently for land growing them, is steered as follows:

Subsistence food
Subsistence food production is steered by the increase (change) of rural population. It is assumed that the per capita consumption is constant per head over time. As long as the relative increase of rural population is bigger than the increase of productivity per hectare, more land would be needed for subsistence food production. If there is land available for transfer from other land classes, such transfer will occur in the model without delay. Transfers are executed according to indicated priority.

Marketed food
Demand is steered by total GDP. Increasing GDP is assumed to stimulate the production of marketed food. The total marketed food demand is steered by total GDP. However, GDP calculated on the national level is not always a relevant estimator of change on the local level. There are all possibilities for the user to calculate a local GDP that he or she assumes to be more valid. Actually all steering indices (drivers) can be manipulated to better fit the local conditions.

Cash crops
Demand is steered by GDP as in the case of marketed food. The better economy people get the more cash crops they consume (or produce for export). Of course, the same opportunities of local modifications as in the case of marketed food exist.

Change in agriculture productivity
Agriculture crop yield normally increases over time. A higher production per hectare means a reduced pressure on the remaining forests. Increased productivity can be achieved for instance by improved technology, seed and storage, by a higher input of labour per ha, by fertilisation and irrigation etc. Thus there are many considerations needed to assess likely future change.

Reliable time series that show past trends facilitate calibration and it is recommended that the model be run on historic data as part of the calibration process.

"Devpop" Table **3 Development of Population and GDP**

Corresponds towards the same table in previous versions (table 2)

"Agrpro" Table 4 Development of Agriculture Production and annual area transfers

Corresponds towards the same table in previous versions (table 3)

Trans 1 Table 5 Area Transfers

Corresponds towards the same table in previous versions (table 4)

Lanus 1 Table 6 Land use before executing plantation programs

Corresponds towards the same table in previous versions (table 5) Lanus1 gives the land use before planting.

Plantation Programmes

Handling new plantations has been the big headache in previous versions. Now, there is a possibility to chose plantation programs more freely. In addition to "fordata" there is another worksheet "FPL" that defines plantation programmes. The procedure for filling in that worksheet is described in detail below. It is not necessary to plant the same area every year as in earlier versions, but within a specific plantation unit only one plantation type is allowed. In the sheet "FP" area transfers due to plantations are calculated and on that basis a final land use table "Lanus" is developed. This table is the key to including a number of new elements in the model. These elements we have discussed frequently at many past occasions. Now it seems relatively easy to include these elements in the model. This is thanks to a high degree of symmetry in the model, meaning that many tables can be produced on the basis of the same platform, namely the "Lanus" table.

General about plantations and growth

It is assumed that the growth of any natural forest can be simulated with help of the relative production function. There are options for 9 types of growth that are defined in the "Moni" work sheet. In order to define a natural forest type you need to have some idea of the volume per ha and growth of the forest in question. Is it an old climax forest that can be assumed to have a long rotation and slowly decreasing growth or is it a secondary forest of low age and reasonably high growth? What is the volume per ha in open woodland and what is the growth? Is there a biological balance where grazing and growth is balanced? Is the biomass volume increasing or decreasing?

(Those who are not familiar with the relative production function may study the Excel workbook "RPF3" that is available in the APM catalogue of "Literature 2001".)

Forest types 11-19 are reserved for existing plantations and forest types 20-29 are reserved for new plantations. In the "Moni" worksheet there are also "thinning rules" that can be altered within certain relevant limits.

All plantation developments are determined by the forest type; i.e. growth, thinnings and final cuts. A more flexible handling of plantations belong to a future version that concentrates on wood balances steered by consumption requirements.

However, auto removal of fuel wood can take place and is taken into account by adjustment of thinning volumes in all plantation types.

There are three categories of plantations: environmental, farm forestry and industrial. There are no principal differences between these three categories. The distinction just mirrors the idea that the purpose with a plantation should be quite clear at the planning stage.

Existing plantations

There is room for three categories of existing plantations. However, if there are several different plantations they need to be grouped in two classes that are described in best possible way. In an area dominated by plantations it is advisable to adapt the model to these conditions. This is not difficult for someone who has found out the basic structure of the programming.

New plantations (worksheet "Fpl")
There is room for three individual plantation programs within each of the three categories of forests, namely: Environmental forests (land class 14), farm forests (land class 17) and industrial forests (land class 22). Each plantation programme has duration of ten consecutive years. The plantation area of each year can be determined individually including the option of 0 hectare of plantations during certain years. If the plantation program should not be started during the first year, this is achieved by giving the plantation a negative age (the age "– 9 years" will create a plantation during year 10 since new plantations are given the age of 1 year).

The worksheet "Fpl" consists of a left part that steers the decrease of area in the land classes in which plantations should be established. The left part consists of 22 columns, one for each land class. The numbers of land classes that are open for plantations are marked with bold figures. Land classes that are not available are filled with a red colour. Each plantation covers ten consecutive years, starting at any age. Thus, in ten consecutive cells within the appropriate column the annual plantation area should be indicated. On the row below the land class numbers the number of the plantation should be put. (14,1; 14,2 and 14,3 for the three plantation programs that are available for reporting of average volumes and sums under land class 14; similarly 17,1; 17,2 and 17,3 and 22,1; 22,2 and 22,3; respectively for reporting of averages and sums under land class 17 and 22.

The right part of worksheet "Fpl" (columns AB –AJ) is used to steer the development of the plantations together with steering data from "Moni". There are nine columns corresponding towards the possible nine plantation programs (of maximum 10 years); these are 14,1; 14,2; 14,3; 17,1; 17,2; 17,3; 22,1; 22,2 and 22,3. In each column type on row 2 the plantation type, on row 3 the plantation name is pre-printed, on row four type age and then the areas according to specifications in the right part of the worksheet.

Forestry data
One of the disadvantages with the current model is that it is difficult to follow how the forestry production develops. One advantage with the Excel model (there are also a number of disadvantages) is that it is possible to show all calculations. This does not necessarily mean that all calculations need to be followed up in detail as soon as it has been possible to remove bugs that may occur. Anyhow, each land class has got its own worksheet where forest growth and other parameters are calculated. Since there are 22 land classes this means 22 worksheets. However, in most cases it is possible to work with a less number of classes and that will reduce the number of relevant sheets.

The worksheets are named with the same short names that appear in column C of "Dataset". It is possible to change name on any of the land classes but in such case the names of the worksheets must be changed exactly to conform to the new names.
In each of the worksheets it is possible to follow the development over time of volume, growth and other parameters. The growing stock per ha in each land class is reported in the worksheet "Volperha" that delivers **Table 9 Primary forest production, volume m3/ha on land with forest cover.** Next worksheet is named "Growing stock" and delivers **Table 9.b Primary forest production, growing stock 1000 m3.** Then there are three worksheets called "HW1"; "HW2" and "HtrW". These sheets deliver respectively:

Table 9c Wood harvesting, Wood 1 1000m3; Table 9d Wood harvesting, Wood 2 1000m3, Table 9e Wood harvesting, TrfWood , 1000 m3. Finally there is one sheet called "Woodbalance". This worksheet delivers **Table 9 f. Wood demand and wood balance, 1000 m3.** This worksheet reports a balance between wood "demand" and harvests.

New elements as compared with the FAO version:

Animal husbandry and hunting - overlapping land uses.
These segment aims at calculating a fodder balance for cattle and such game that may compete with the cattle for fodder. Reduction of the number of cattle killed by animals should be taken into account when indicating the change of the population over time. In the bottom of "Dataset" the population and corresponding fodder requirements are indicated. Fodder production is indicated in "Dataset" in the case of the four agriculture land classes and in "Fordata" for the other land classes. Fodder production is calculated in the worksheet "Fodprod" that delivers **Table 10a. Husbandry and game fodder production, 1000 tons per year** and the worksheet "Fodder balance" that delivers **Table 10b. Husbandry and game fodder consumption and balance, 1000 tons per year.** (There will be some completion work done on experiences won by me during the workshop. (Including value production of husbandry that is milk and meat).

"Money"
The aim is to calculate the "money" involved in the area production during a year and its development over time according to the scenario. It does not give any complete indication of the size of the economy since there is no calculation of inputs to the sector nor any indication of secondary effects from service activities and similar (no multiplication effect is included). (There will be some completion work done on experiences won by me during the workshop. (Including value production of husbandry that is milk and meat).

However, the calculation will indicate the gross value of the production of one year (as far as it is possible to put the values (market prices) that are needed). Value estimates of residues and wood should be indicated in the "Moni" worksheet (middle of the sheet in connection with the conversion factors). Value estimates of agriculture crops are asked for in "Growth1" and values of minor forest produce in "Dataset". The worksheet "Money" delivers **Table 11. Value production, unit 1000 currency units**

Labour input
This segment aims at calculating the total input of labour in agriculture and forestry as influenced by the development of a certain scenario. All data on labour input are delivered in the worksheet "Growth1". The worksheet "Money" delivers the table **Table 8. Labour input 1000 workdays.**

This is the present stage on Saturday 15 December 2001.

Nils-Erik Nilsson

Attached: A few worksheets for illustration purpose

Data set:	Serowe1	From	2001	To	2021
Country:	Noland	GDP/cap:		500	
District or area:	Tura Sanit				

Scenario name:	1
Rural population	14000
Urban population	0
Total population	14000
Total land area	30000

Land class		Ld	Nr	Area	Cover	AgriPr Kg/ha or %	AgriRes	Energy ratio	Fodder ratio or kg/ha year	AgriValue /kg	Minor forest Produce Kind	Minor forest Produce units /ha	Value /unit
Agriculture land	Subsistence food 1	Sub1	1	1800	0,9	300	150	0,1	0,5	3	0	0	0
	Subsistence food 2	Sub2	2	200	0,9	3000	1500	0,1	0,5	3	0	0	0
	Marketed food	Ma	3	100	0,9	300	150	0,1	0,5	4	0	0	0
	Cash crops (plantations)	Cash	4	100	0,9	6000	3000	0,1	0,5	10	0	0	0
Agri/forestry land	Grazing/(Wood)	GraW	5	800					1000		0	0	0
	Unnamed	Aucl	6	0					100		0	0	0
	Potential agriculture land	PotA	7	10000					1000		0	0	0
	Potential forestry land	PotF	8	17000					1000		0	0	0
Other land	Other land	Oth	9	0					100		0	0	0
	Unclassified	Oucl	10	0					100		0	0	0
For/Environmental	National P & R	Natp	11	0					100		0	0	0
	Protected forests	Prot	12	0					100		0	0	0
	Existing plantations 1	Eepl1	13,1	0					100		0	0	0
	Existing plantations 2	Eepl2	13,2	0					100		0	0	0
	New env. plantations	Enpl	14	0					100		0	0	0
For/Farm	Natural forests	Fnat	15	0					100		0	0	0
	Existing plantations 1	Fepl1	16,1	0					100		0	0	0
	Existing plantations 2	Fepl2	16,2	0					100		0	0	0
	New forest plantations	Fnpl	17	0					100		0	0	0
	Unclassified	Fucl	18	0					100		0	0	0
For/Industrial	Natural forests (acc.)	Inac	19	0					100		0	0	0
	Natural forests (inacc.)	Inin	20	0					100		0	0	0
	Existing plantations 1	Iepl1	21,1	0					100		0	0	0
	Existing plantations 2	Iepl2	21,2	0					100		0	0	0
	New plantations	Inpl	22	0					100		0	0	0
Total land area				30000									
	Area check:			OK									

Land use transfer rules:

Priority	1	2	3	4
Land class number	7	8	15	20
Land class	PotA	PotF	Fnat	Inin

Husbandry and hunting an overlapping land use

Kind	Number of	Weight	Milk/egg production kg/year	Fodder consumption MJ/capita per year	Fodder A Subs consumption kg/ year	Fodder A Prod consumption kg/ year	Fodder B Prod consum kg/year	Recovery rate
Horses (donkeys)	100	400	0		1000		300	0,7
High cattle 1 (beef)	10000	500	0		2000		500	0,7
High cattle 2 (milk)	1000	400	3000		4000		1000	0,7
Sheep and goat	10000	80	0		1000			0,7
Pig	1000	100	0		500			0,7
Poutry	10000	1	20		5			0,7
Game 1	500	100	0		500			0,0
Game 2	100	100	0		500			0,0
Game Other	10	100	0		500			0,0

Table 2. Development of Population and GDP

Year	P	Population								
		Total Men	Total Women	Total All	Rural Men	Rural Women	Rural All	Urban Men	Urban Women	Urban All
1991	1	1000000	1083000	2083000	800000	801000	1601000	200000	282000	482000
1992	1	1025000	1110075	2135075	815200	816219	1631419	209800	293856	503656
1993	1	1050625	1137827	2188452	830689	831727	1662416	219936	306100	526036
1994	1	1076891	1166273	2243163	846472	847530	1694002	230419	318743	549161
1995	1	1103813	1195429	2299242	862555	863633	1726188	241258	331796	573054
1996	2	1131408	1225315	2356723	878943	880042	1758985	252465	345273	597738
1997	2	1158562	1254723	2413285	894764	895883	1790647	263798	358840	622637
1998	2	1186367	1284836	2471203	910870	912009	1822879	275497	372827	648325
1999	2	1214840	1315672	2530512	927266	928425	1855691	287575	387247	674822
2000	2	1243996	1347248	2591245	943957	945137	1889093	300040	402112	702152
2001	3	1273852	1379582	2653435	960948	962149	1923097	312905	417433	730338
2002	3	1303151	1411313	2714464	977284	978506	1955789	325867	432807	758674
2003	3	1333123	1443773	2776896	993898	995140	1989038	339226	448633	787858
2004	3	1363785	1476980	2840765	1010794	1012057	2022851	352991	464922	817913
2005	3	1395152	1510950	2906102	1027977	1029262	2057240	367175	481688	848862
2006	4	1427241	1545702	2972943	1045453	1046760	2092213	381788	498942	880730
2007	4	1460067	1581253	3041320	1063226	1064555	2127781	396842	516698	913540
2008	4	1493649	1617622	3111271	1081301	1082652	2163953	412348	534970	947318
2009	4	1528003	1654827	3182830	1099683	1101057	2200740	428320	553770	982090
2010	4	1563147	1692888	3256035	1118377	1119775	2238153	444770	573113	1017882
2011	5	1599099	1731825	3330924	1137390	1138812	2276201	461710	593013	1054723
2012	5	1635879	1771657	3407535	1156725	1158171	2314897	479153	613485	1092638
2013	5	1673504	1812405	3485909	1176390	1177860	2354250	497114	634544	1131659
2014	5	1711994	1854090	3566084	1196388	1197884	2394272	515606	656206	1171812
2015	5	1751370	1896734	3648104	1216727	1218248	2434975	534643	678486	1213129
2016	6	1791652	1940359	3732011	1237411	1238958	2476369	554240	701401	1255641
2017	6	1831068	1983047	3814115	1257210	1258781	2515991	573858	724265	1298124
2018	6	1871352	2026674	3898026	1277325	1278922	2556247	594026	747752	1341778
2019	6	1912521	2071261	3983782	1297762	1299385	2597147	614759	771876	1386635
2020	6	1954597	2116828	4071425	1318527	1320175	2638702	636070	796654	1432724
2021										

SECTION D

The final seminars

MABELEAPUDI COMMUNITY SEMINAR

by Jeremiah Freeman Ramontsho and Ms R. Kajsa Sandewall

Based on participartory approach, the findings of field exercises in Mabeleapudi and Paje Villages would be presented for the local authorities and those concerned in the two villages. A seminar in each village was thus scheduled on December 14, 2002, at 9.00 a.m.

Unfortunately, on that day most of the concerned persons in Paje Village were occupied with other significant activities resulting in a cancellation of the seminar. Therefore, all workshop-participants were present at the seminar in Mabeleapudi Village. When arriving at Mabeleapudi Village, most of those concerned were occupied with unexpected activities, but they confirmed to be able to attend the seminar.

About two hours after the schedule, the seminar could finally start. It took place in the meeting room of the Village. Both male and female members of the Village (mostly of senior age), including the village leadership and local authorities took part in the seminar. Totally about 50 people were present, including all workshop participants and facilitators.

A traditional prayer was led by the Village Chief prior to the opening of the seminar. After he had opened the meeting, all participants introduced themselves by their names and their occupations.

The findings (see A below) were then presented in Setswana, the local language, by Mr Ramontsho, and were translated simultaneously into English by Mr Kemoreile. After the presentation, the members of the Village made their comments to the findings and raised some additional questions. Those questions were answered or commented upon by the workshop participants (B and C).

A. Presentation to community

1. Landuse types of Mabeleapudi

• Total Area of Mabeleapudi	29 300 ha
• Residential area	257 ha
• Total Arable	6 411 ha
Utilized	1 961 ha
Unutilized	4 450 ha
• Plantation	25 ha
• woodlots (grazing)	2 264 ha
• Inaccessible(sacred hill)	5 ha

2. Arable Production (Kg/Ha)

Planning period	2001	2006	2011	2016
Subsistence	111	116	121	127
Marketed food	105	108	110	113
Cash crop	5	5	6	6

- An emphasis was made that while arable farmers have large area allocated for arable production, the area utilized and also production per hectare remain low. Some instances were:

- projections of the production remain at 2 bags (of 50kg) per hectare for next 15 years (planning period);
- out of 6411ha of allocated arable land, only 1961 ha is utilized

B. Community reaction to the Presentation

- Woodlots – currently the appreciation (by the community) of the benefits accruing from establishing woodlots is low.
- Arable production- community members confirmed that arable production is low and decreasing.

Reasons for low arable production are:

- farmers are mainly the elderly, so they are no longer able to cultivate effectively:
- younger generations prefer other economic activities other than arable production;
- lack of fencing materials;
- inadequate markets outlets (producing at Pl70/ha, only to sell a 50-kg-bag of sorghum at P20);
- inadequate draft power (e.g. only one tractor in Mabeleapudi for hire);
- inadequate extension support (two villages sharing one extension agent);
- Mophane worm collection competes with arable production for labor (arable production end up losing out as Mophane worm is a "cash crop").

C. General comments

- Community members (Paje and Mabeleapudi) wanted to know how the workshop will benefit them.
- It was emphasized that in the short-term, there won't be any tangible products (cash/assistance) accruing to the community.
- In the long term, the findings of the study could contribute to policy formulation, economic coping strategies etc. especially that a seminar was held for policy makers in Gaborone on 17th December 2001.

- **Food For Thought**: one farmer indicated that although he is old, he still undertakes arable production, and that he is still able to obtain noticeable harvest e.g. 1999/2000 he got 20 bags of sorghum from four (4) hectares.

The meeting was concluded with some remarks by the facilitators, who expressed their appreciation of the villagers' interest and their useful comments and input. Mr Kwerepe rounded up by some final conclusions. The Village Chief closed the seminar.

THE FINAL SEMINAR IN GABORONE – SHORT SUMMARY

The final workshop seminar took place at the President Hotel in Central Gaborone on December 17 (attachment 1). The workshop was attended by 17 workshop participants from the three countries, 4 Swedish facilitators and 20 invited representatives of various authorities and organisations concerned with land use issues in Botswana, plus a representatives from DWAF in South Africa. Unfortunately, difficulties with flight arrangements prevented the representative from Zimbabwe to take part.

The seminar was opened by Mr Raymond Kwerepe, who welcomed the participants and summarised the objectives and programme of the workshop. He explained that it had been a *process-oriented workshop,* where the participants had tested a planning approach in a "real life-situation" and considered its suitability for the Region. At this seminar, they were prepared to share their experiences with the broader group of decision makers and stakeholders being present. He expressed his hope that, by the end of the seminar, everyone had developed his/her opinion about the applicability of the APM concept (or similar techniques and approaches) as a tool for natural resource management in Southern Africa, and could propose a way ahead for developing the resource management.

Mr Muduwa Piloto summarised the content of the workshop and the lessons learnt by the participants. Among other things they had *recognized the need for cross-sector and holistic land-use planning* and recognised the need to use real life ground data describing the current situation as the basis for planning, instead of data according to current official plans (attachment 2).

Mats Sandewall and Prof. Nils-Erik Nilsson summarised the Area Production Model and Concept (attachment 3). Mats reviewed the APM structure, i.a. definitions, driving mechanisms, requirements for using it and outputs. He mentioned that this was the first occasion when the Model is used in the region, therefore current versions may not reflect the land use in Southern Africa to a sufficient extent but needs modifications. Nils-Erik told about his experiences since developing the first APM version 20 years ago based on experiences from India through more recent experiences from Southeast Asia and Southern Africa (in this workshop) and how the additional feedback is now being integrated in the new Excel version of the APM that was introduced during the last week of the workshop (Annex C3).

Mr Kemoreille Kealeboga presented the case study from Serowe and the considerations behind the work. He explained how the team had dealt with the real situation in the area, e.g. stratification of the population based on livestock ownership, population, interpreting the land-use pattern into APM standards, how to classify economic activities and various forms of energy consumption. He also presented an APM-scenario including input data and land use development (attachment 4).

The presentation was followed by a lively discussion (attachment 5). Many of the questions brought up had a conceptual character and were raised by the new representatives in the seminar, while replies, explanations and additional issues were made/brought up by the workshop participants.

In the afternoon, the participants were divided into three multi-sectoral groups for a discussion on the following topic:

- What should be an appropriate way ahead for the development of the APM concept into a useful tool for national and regional integrated land use planning in Southern Africa?

The findings of the group work were presented by Ms Nicki Mitchell, Mr Piloto Muduwa and Ms Sebueng Kelatwang (Attachment 6).

The seminar was closed by Mr Raymond Kwerepe. On behalf of the Department of Crop Production and Forestry, he thanked everyone involved and expressed his pleasure with the outcome.

2001-12-16 *Attachment 21*

Interactive and Dynamic Approaches on Forest and Landuse Planning in Southern Africa

Programme for Concluding Seminar at President Hotel, Gaborone on December 17, 2001

Background:

During December 3-17, a regional workshop with the above name has been carried out in Botswana. The participating countries have been Botswana, South Africa, Zimbabwe and Sweden. At this concluding seminar, the findings of the workshop are presented and discussed with an extended group of participants representing different organisations of the three African countries.

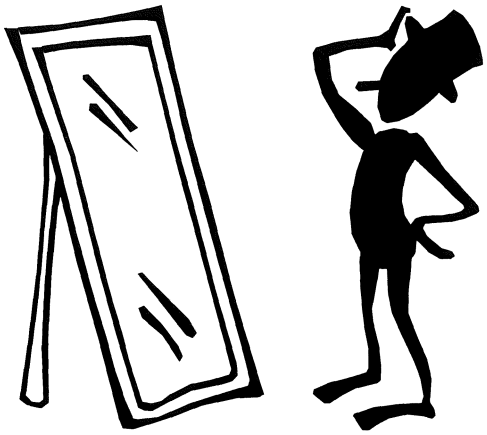
Programme:

9.00-9.15:	Opening of seminar. Summary of workshop objectives and programme.
9.15-9.30:	Lessons learned.
9.30-10.30:	The Area Production Model and Concept.
	COFFEE/TEA
11.00-12.00:	How the APM works in practice - the Paje-Mabeleapudi case study.
12.00-12.15:	Comments and short discussion.
	LUNCH
13.30-15.00:	Potential applicability of the APM to Southern Africa
	COFFEE/TEA
15.30-16.30:	Group discussion - Appraisal of the APM as a tool in Natural Resource Management and decision support for the countries in Southern Africa.
16.30-17.15:	Presentation of group discussions.
17.15-17.50:	Final conclusions on way ahead.
17.50-18.00:	Closing of seminar.
19.00	RECEPTION

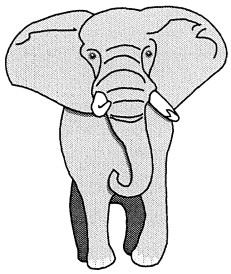
LESSONS LEARNT DURING THE APM WORKSHOP

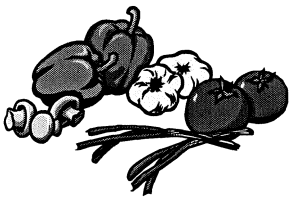
by Muduwa Piloto and team

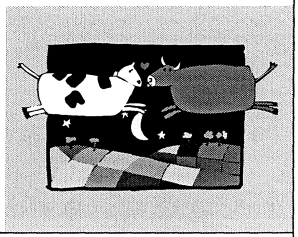
What we have learned or been able to do during this workshop



We recognized the need for <u>cross-sectoral /holistic/balanced strategic land use planning</u>;
- avoids sector competition
- avoids having different policies on the same piece of land.





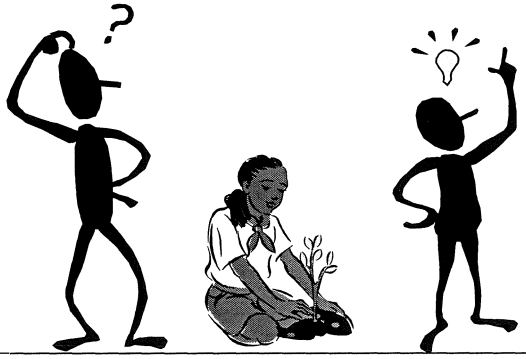


We recognized the need for a <u>multidisciplinary approach</u>

….in fact we capitalized on our different perspectives, professions *(foresters, ecologists, agronomists, economists, & sociologist),* experiences *(academics & practitioners: country-specific)*, & working levels *(village, district, province, national)* to understand issues.

Despite all these differences, we had a lot of consensus.

We collected data from various stakeholders especially the ones directly impacted by the natural resource. Farmers, for example, could provide reliable historical data, current data, in addition to telling us about their future plans.

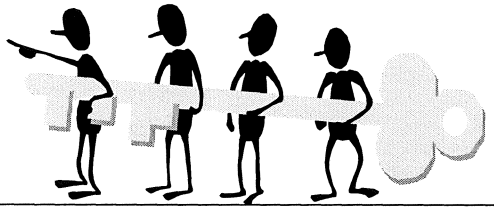


We organised semi-structured interviews (Participatory Rural Appraisals) to obtain data and information.

We applied the "Walk-Talk-Touch" principle.

We became aware of the need to reduce the gap between "top-down" & "bottom-up" approaches in planning.

We appreciated the need for <u>field work on point sampling based on local key informants,</u> that gives an assessment of the Land Use now and in the past.



We were able to describe Land Use conflicts, problems and opportunities in Paje/Mabeleapudi

We recognised the need to use real life/current/ground data as the basis for planning instead of data according to current official plans.

We tried/tested/(tinkered with) the Area Production Model (APM) in strategic Land Use planning.
We also started to generate scenarios that depict both the historical Land Use, development problems, and development opportunities.

INTER-ACTIVE AND DYNAMIC APPROACHES ON FOREST AND LAND USE PLANNING IN SOUTHERN AFRICA – THE AREA PRODUCTION MODEL AND CONCEPT. PRESENTATION AT CONCLUDING SEMINAR 18/12 (A SLIGHTLY REVISED VERSION WAS PRESENTED AT THE WORKSHOP START ON 3/12)

by Mats Sandewall

Dear workshop participants

1. During this workshop we have worked with the Area Production Model. It is a simulation model aimed to be used as a tool for strategic land use planning. The APM was developed by Professor Nils-Erik Nilsson who is here today. During a period of five years, I have had the pleasure of working together with Nils-Erik in testing the APM and developing a concept for its use in some tropical countries. We will together try to explain what the Model is about and how it works.

   Before going ahead in this presentation I need to make a few clarifications about the assumptions underpinning the APM. They may also help to illustrate the objective and title of this workshop.

2. It is understood that "land use" consists of two parts, production and consumption. It could be goods (e.g. timber, agriculture crops, animals) or services (such as recreation, a rich wild-life, clean water and soil protection). In other words, people are not only users but also producers (OH 1)

3. In line with international policies and agreements (e.g. from UNCED), forestry and agriculture are seen as integrated parts of a land-use system consisting of environment and society (individuals, stakeholders, market etc).

4. Governments do have an important role by providing the framework for the resource management, but only as long as it works together (interacts) with the society-people. I am sure that you have also experienced examples of that from time to time (OH2).

5. Land use planning concerns how government and society jointly manages the natural resources (natural resource management). Although plans are often made for defined time periods, changes usually do not occur in predictable steps but gradually in a dynamic process. Today's situation and ongoing changes depend on historical factors, and what you plan to do may have long-term implications.

6. This workshop concerns "strategic planning of land use". It is a type of planning which aims at creating conditions for desired changes to take place rather than stating what shall happen. It requires clear objectives and an accurate description of the current situation. (i.a. To decide what to do, you need to know the starting point and the (desired) end (OH3).

7. The APM is based on scenario technique, which enables analysis of the outcome of various optional strategies before decision-making (OH4).

8. When using the APM you need accurate data. You also need to define what data you need because data collection is expensive. When analysing the APM scenarios you need to understand your data. When presenting and implementing the findings you need appropriate practices so that people understand (and possibly agree to) what you suggest. It requires

techniques and practices for collecting and analysing data and presenting/discussing findings. We have named the whole package "the APM (land management) concept" (OH5).

9. APM requires various cross-sectoral input data in relation to land use. That includes agriculture, forestry, environment, socio-economic, demographic, macro-economic data and awareness of policies and other change mechanisms (OH 6).

10. The future changes are generated by the "growth factors". Those factors (e.g. re. future population growth) might represent expected changes but could also represent certain considered policies or strategies to be analysed (e.g regarding family planning, or infra structure development). (OH7).

11. The driving mechanisms for landuse changes in the APM are also traced in the growth parameters. It is primarily 1) peoples need for food, and 2) peoples capabilities and opportunities to generate income 3) technical development and investment in productivity.

12. The output of an APM simulation, "the scenario" is illustrated by a number of tables describing how population, income level, agriculture and forest production, energy balance and so on change over time under given assumptions for a period of up to 50 years.

13. The APM was developed by Professor Nilsson based on his experiences from India. It has later been extensively tested in Southeast Asia and in several case studies over the tropical world (OH 8). For example, it is now being applied in a research project in Burkina Faso. To my knowledge, it has until this workshop not been tested in Southern Africa. Therefore you may find that some forms of land-use relevant here (e.g. livestock holding and wildlife management) are not well reflected in the current APM version. Models are however made to be modified and adapted to the needs. Professor Nilsson will elaborate further on this matter.

Thank you!

The Area Production Model and concept

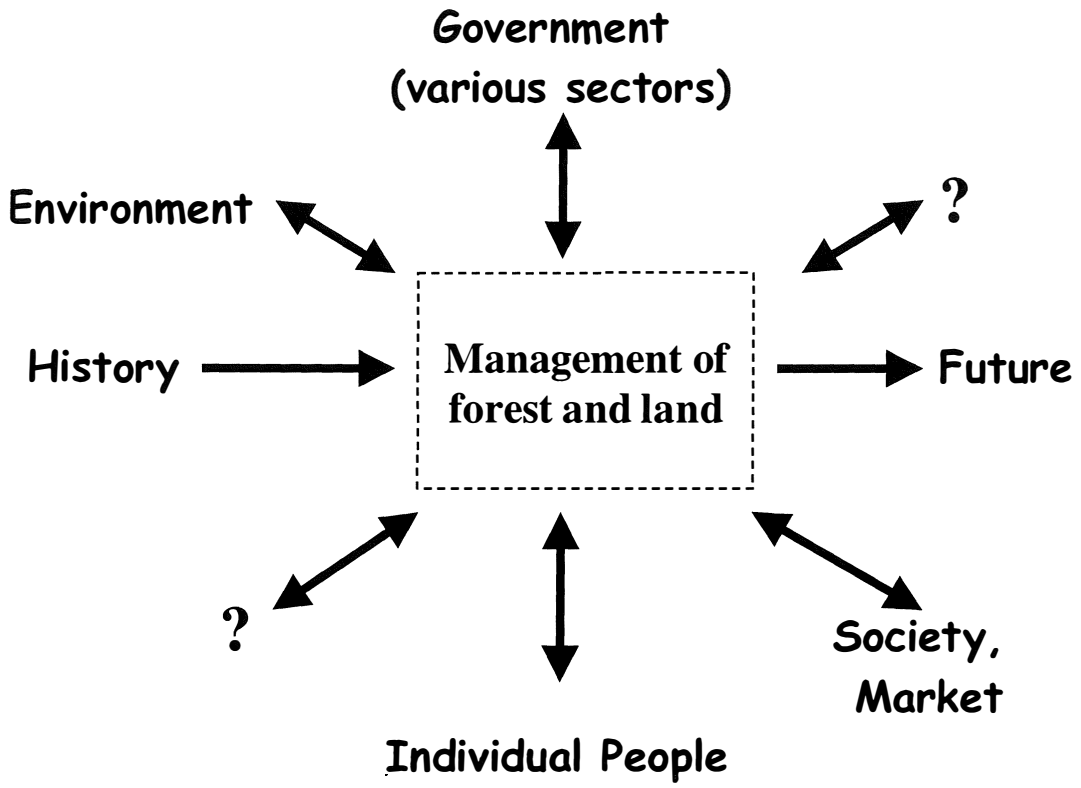
- a brief presentation

OH 1

Land use consists of two parts - production and consumption

OH 2

Different perspectives of forest and land management



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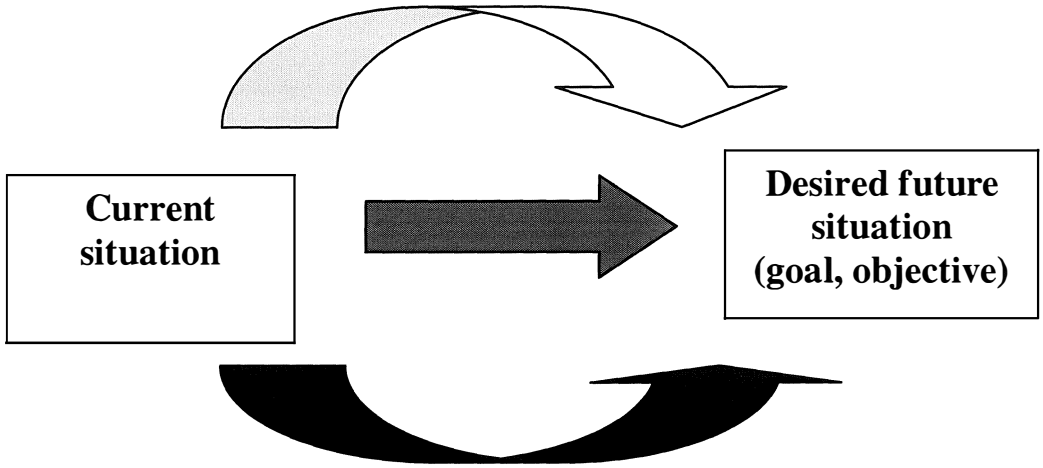
OH 3

STRATEGIC PLANNING OF LAND USE

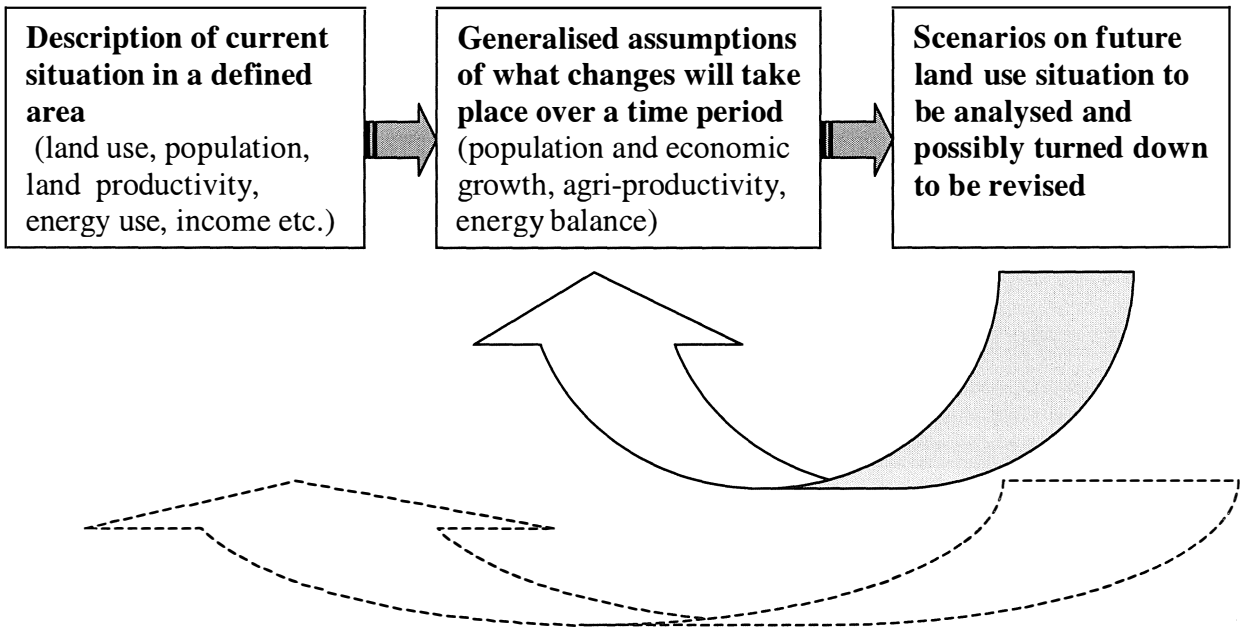
Strategies that create a conducive environment for desired changes to occur

Requires accurate description of the current situation and clear objectives



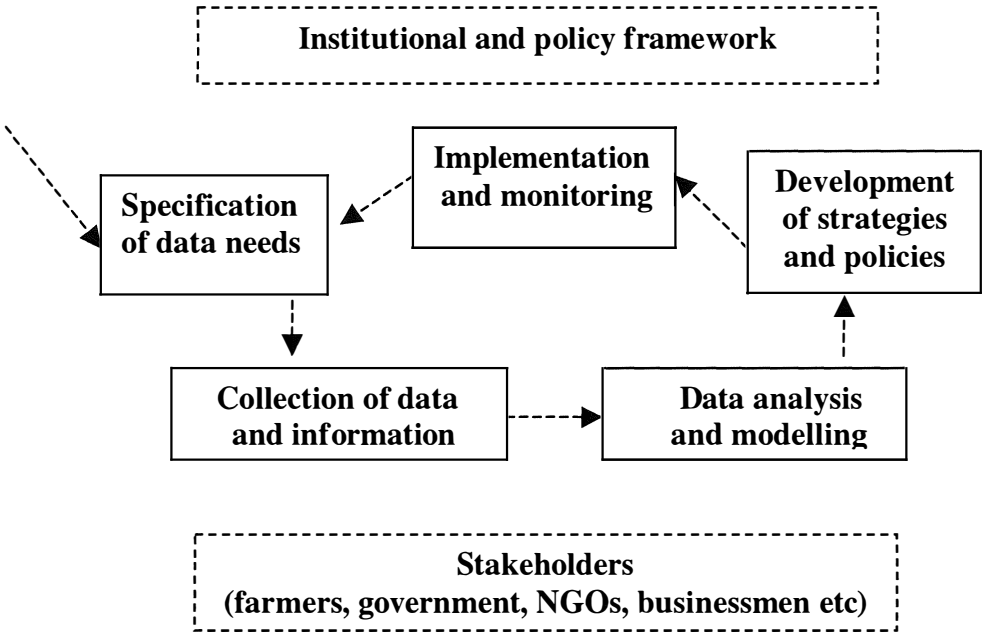
OH 4

Simplified illustration of APM simulation



OH 5

The APM land management concept



OH 6

Some important input data in the APM

Current population (actual number and rate of change)

Income per capita (actual amount and rate of change)

Land productivity, **subsistence agriculture** (actual level, rate of change)

Land productivity, market food and cash crops (actual level, rate of change)

Biomass energy demand, rural and urban (actual level, rate of change)

Total land area on different categories of current land use
(agriculture, forestry, other etc)

Growing stock of trees on forest and non-forest land
Increment and removal of wood from forest and non-forest land

Yield and use of agriculture residues

OH 7

The APM growth/change factors could reflect two things:

- **Expected changes**
- **Strategies to be tested**

The primary mechanisms in the model which "drive" land use changes are:

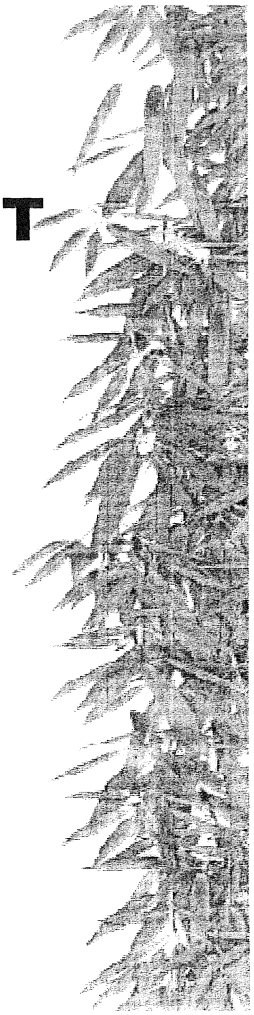
- **Peoples' need for food**
- **Peoples' opportunities and capabilities to generate income**
- **Technical development and investment in productivity**

OH 8

Some studies and projects where APM has been used

India	1984, 1995
Thailand	1986, 1995
Indonesia	1986, 1993
Peru	1988
Laos	1997-2001
Vietnam	1997-2000
Uganda	1998
Burkina Faso	2001

APPLICATION OF APM AT SEROWE/PALAPYE SUBDISTRICT



– CASE STUDY PAJE & MABELEAPODI VILLAGES

Data set

Description: Mabeleapudi

District	Serowe/Palapye	
Country	Botswana	
Land area	28600	
Years	1999	2019

1 ton agriculture residue to Giga Calories (GCal)	4,0
1 cubic meter solid wood to Giga Calories (GCal)	2,6
1 cubic meter solid wood to 1 forest cubic meter	1,0

Land use transfer priorities

Other land, potential agriculture land	1
Farm forest land, natural forests	3
Other land, potential forest land	2
Industrial forest land, natural forests	4
Nat. environmental forest, in-accessible	5
Nat. environmental forest, protection areas	6
Nat. environmental forest, rerserves and NP	7

Growth factors, start value and period growth in %.

Total population	3 400	1,00	1,00	1,00	-1,00
Rural population	800	8,00	8,00	7,00	7,00
Gross Domestic Product	5 667	1,00	1,00	1,50	1,50
Production subsistence food	170	0,50	1,00	1,00	-1,00
Production marketed food	34	0,50	1,00	1,00	0,50
Production cash crop		0,00	0,00	0,00	0,00
Rur. biomass energy demand	3	-1,00	-1,00	-2,00	-3,00
Urb. biomass energy demand	3	-1,00	-1,00	-2,00	-3,00

Agriculture data

Agriculture land	Area (hectares)	Volume wood per hectare	Autoproduction of wood m^3 / hectare and year	Yield of residues kg per hectare	Amount of residues used as fuelwood (%)
Subsistence food	680	2	0,5	170	0
Marketed food	136	2	0,5	34	0
Cash Crop		0	0		0

Other land

Potential agricultural	26 964	5	2
Potential forest	700	5	2
Unproductive		0	0

Forest data

I Unavailable for production	Area (hectares)	MAI m^3	Ann fuel wood removal m^3	Ann. Logging m^3 / hectare	Total volume in m^3 per ha	Total volume in m^3 altogether	Commercial volume in m^3 per ha	Commercial volume in m^3 altogether
NP and reserves								
Protection								
Inaccessible areas	40	0,5						
Existing plantations	25							
II Available for production								
Industrial								
Existing plantations								
Farm forest	55	0,5	0,5		0	0		
Existing plantations								

Population & GDP

Year	Population			Gross Domestic Product	
	Rural	Urban	Total	Total (in millions)	Per capita
1999	800	2 600	3 400	19	5 667
2000	864	2 570	3 434	20	5 724
2001	933	2 535	3 468	20	5 781
2002	1 008	2 495	3 503	20	5 839
2003	1 088	2 450	3 538	21	5 897
2004	1 175	2 398	3 573	21	5 956
2005	1 269	2 340	3 609	22	6 016
2006	1 371	2 274	3 645	22	6 076
2007	1 481	2 201	3 682	23	6 137
2008	1 599	2 119	3 719	23	6 198
2009	1 727	2 029	3 756	24	6 260
2010	1 848	1 945	3 793	24	6 354
2011	1 977	1 854	3 831	25	6 449
2012	2 116	1 754	3 870	25	6 546
2013	2 264	1 644	3 908	26	6 644
2014	2 422	1 525	3 947	27	6 744
2015	2 592	1 316	3 908	27	6 845
2016	2 773	1 095	3 869	27	6 948
2017	2 968	863	3 830	27	7 052
2018	3 175	616	3 792	27	7 157
2019	3 398	356	3 754	27	7 265

Land use transfers

1 = Other land, potential agriculture land
2 = Other land, potential forest land
3 = Farm forest land, natural forests
4 = Industrial forest land, natural forests
5 = Nat. environmental forest, in-accessible
6 = Nat. environmental forest, protection areas
7 = Nat. environmental forest, rerserves and NP

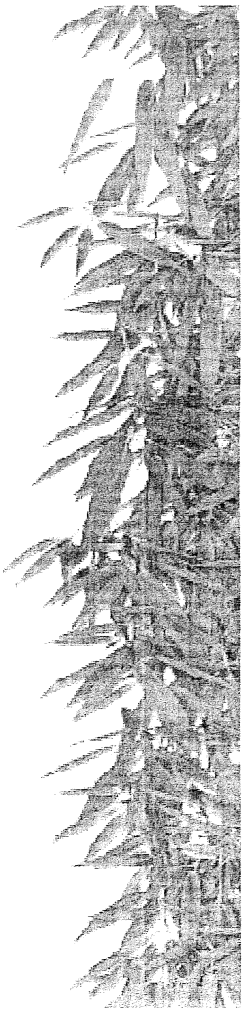
Year	Accumulated transfer	Remaining area after land transfer, classes as listed above.						
		1	2	3	4	5	6	7
1999	0	26 964	700	55	0	40	0	0
2000	52	26 912	700	55	0	40	0	0
2001	106	26 858	700	55	0	40	0	0
2002	166	26 798	700	55	0	40	0	0
2003	230	26 734	700	55	0	40	0	0
2004	298	26 666	700	55	0	40	0	0
2005	365	26 599	700	55	0	40	0	0
2006	437	26 527	700	55	0	40	0	0
2007	515	26 449	700	55	0	40	0	0
2008	597	26 367	700	55	0	40	0	0
2009	685	26 279	700	55	0	40	0	0
2010	767	26 197	700	55	0	40	0	0
2011	854	26 110	700	55	0	40	0	0
2012	945	26 019	700	55	0	40	0	0
2013	1 042	25 922	700	55	0	40	0	0
2014	1 145	25 819	700	55	0	40	0	0
2015	1 293	25 671	700	55	0	40	0	0
2016	1 454	25 510	700	55	0	40	0	0
2017	1 626	25 338	700	55	0	40	0	0
2018	1 814	25 150	700	55	0	40	0	0
2019	2 015	24 949	700	55	0	40	0	0

Agriculture development

Year	Subsistence food		Marketed Food		Cash Crop		Accumulated transfer
	Area	Production/Ha	Area	Production/Ha	Area	Production/Ha	
1999	680	170	136	34	0	0	0
2000	731	171	137	34	0	0	52
2001	785	172	137	34	0	0	106
2002	844	173	138	35	0	0	166
2003	907	173	139	35	0	0	230
2004	975	174	139	35	0	0	298
2005	1 042	176	139	35	0	0	365
2006	1 114	178	139	36	0	0	437
2007	1 192	180	139	36	0	0	515
2008	1 274	181	139	36	0	0	597
2009	1 362	183	139	37	0	0	685
2010	1 443	185	140	37	0	0	767
2011	1 529	187	141	37	0	0	854
2012	1 620	189	141	38	0	0	945
2013	1 716	191	142	38	0	0	1 042
2014	1 818	193	143	39	0	0	1 145
2015	1 965	191	144	39	0	0	1 293
2016	2 124	189	146	39	0	0	1 454
2017	2 295	187	147	39	0	0	1 626
2018	2 481	185	149	39	0	0	1 814
2019	2 681	183	150	39	0	0	2 015

STRATIFICATION OF STUDY AREA

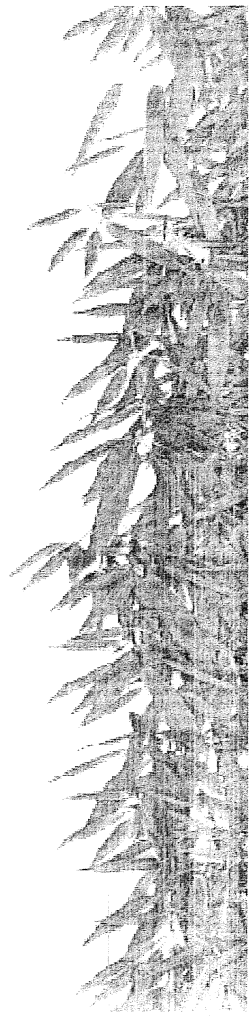
- **BASED ON LIVESTOCK OWNERSHIP**
  - CATEGORY 1: 0 – 40 CATTLE (Low Income)
  - CATEGORY 2: 40 – 60 CATTLE (Medium Low Income)
  - CATEGORY 3: 60 –100 CATTLE (Medium High Income)
  - CATEGORY 4: > 100 CATTLE (High Income)



IDENTIFICATION OF DATA COLLECTION PARAMETERS

- **DEMOGRAPHY**
  - TOTAL POPULATION
  - TOTAL HOUSEHOLDS
  - AVERAGE INDIVIDUALS/HOUSEHOLD
  - AVERAGE POPULATION GROWTH
  - NO. OF FEMALE HEADED HOUSEHOLDS
  - NO. OF MALE HEADED HOUSEHOLDS

* **CURRENT LAND USE PATTERN**
  - EXTENSION AREA SIZE
  - VILLAGE/SETTLEMENT SIZE
  - TOTAL ALLOCATED ARABLE LAND
  - TOTAL CULTIVATED ARABLE LAND
  - GRAZING/FOREST LAND
  - PLANTATION/WOODLANDS AREA
  - INACCESSIBLE LAND
  - PROTECTED AREA SIZE
* **GROSS DOMESTIC PRODUCT**



* **ECONOMIC ACTIVITIES**
  - (a) FARMING ACTIVITIES
    - LIVESTOCK PRODUCTION
      - (AVE. OFFTAKE, AVE. INCOME & TOTAL INCOME)
    - CROP PRODUCTION
      - SUBSISTANCE FOOD PRODUCTION
      - MARKETED FOOD PRODUCTION
      - CASH CROPS PRODUCTION
    - NON-WOODY FOREST PRODUCTS
      - E.g. wild fruits, thatching grass etc.
  - (b) NON-FARMING ACTIVITIES
    - REMITTANCES
    - SOCIAL SECURITY
    - TRADITIONAL BEER PRODUCTION
    - OTHER EMPLOYMENT OPPORTUNITIES

* **ENERGY REQUIREMENTS**

  - FUELWOOD
  - GAS UTILISATION
  - ELECTRICITY CONSUMPTION
  - PARAFFIN USE

  - ALL ABOVE ASSESSED FOR THE FOLLOWING:

    * AVE. COMSUMPTION PER HOUSEHOLD
    * TOTAL CONSUMPTION AT VILLAGE LEVEL
    * ENERGY CONSUMPTION PER CAPITA (GigaCalories)

METHOD OF DATA COLLECTION

* **CHECKLIST FOR ABOVE PARAMETERS**

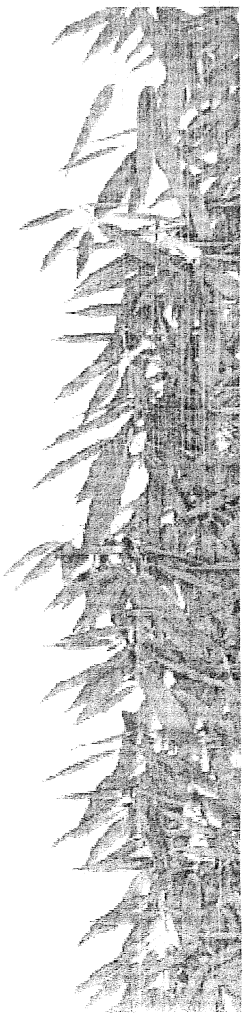
* **SOURCES OF INFORMATION:**

  - OFFICIAL DOCUMENTATION
  - SEMI-STRUCTURED INTERVIEWS

    * HOUSEHOLDS
      - VILLAGE LEVEL
      - LANDS AREAS

    * KEY INFORMANTS
      - TECHNICAL ASSISTANT (CROP PRODUCTION)
      - VETERINARY ASSISTANT (ANIMAL PRODUCTION)
      - SOCIAL WELFARE OFFICERS

PRIORITIZING LANDUSE TRANSFER CLASSES



* **Other Land, Potential Agricultural land**
  - Communal grazing 1
  - BLDC Ranches
  - TGLP Ranches
  - Artificial Insemination

* **Farm forest**
  - Community woodlot 4

* **Other land, potential forest land**
  - Coal mining 5

* **Natural ENVIRONMENT, Industrial Forest land**
  - Indigenous woodland 2

* **Natural ENVIRONMENT, Inaccessible**
  - BDF 7

* **Natural ENVIRONMENT, Forest Protection Area**
  - Soil conservation projects 3

* **Natural Environment, Forest reserve and NPs**
  - Khama Rhino Sanctuary and Recreation areas 6

QUESTIONS RAISED AND OUTCOME OF GROUP DISCUSSION

Major questions raised during seminar:

The discussion during the seminar has been compiled and summarised hereafter. Some of the issues were brought up several times. In the following, they are gathered into main issues, without any notion of the order in which they were discussed.

- *Where will the Model take us?*

  - The question concerned the general concept. What comes out, who and how to work with it and how can it be of any use for decision support. Some representatives questioned the use of a model for decision support if there are so many uncertainties. In this context the usefulness and accuracy of existing official data and the need to capture new data and complementary information for scenarios and strategic planning analyses was also discussed.

  - It was concluded that, although official data often have shortcomings, they do provide significant information. Therefore, it is better to use the data and information we have (in a critical way), than just guessing. In the end, it was apparent that the scenario concept had not been fully understood by everybody, but many seminar guests mixed it up with predictions.

  - Some of the participants did their best to explain to the new arrivals about the idea of scenarios as working tools for discussion and further analyses, although it is not easy to grasp the whole concept in a few hours. Anyhow, it was concluded, that it had been better for the understanding of the concept to try to present at least two scenarios.

- *Climatic factors*

  - The question came up several times and concerned to what extent the APM can reflect short term and long term climatic changes and trends, global warming, erratic rainfall etc. As it is now, the model describes the mean expected changes in land productivity over time (in 5 year periods). It includes climate and site factors as well as expected input in terms of e.g. fertilisers, genetic improvement and agriculture intensity.

  - Some participants and representatives pointed out that for rainfall (erratic rainfall is a serious constraint for the farmers in e.g. Botswana and Zimbabwe), there are a lot of historical data available that could be used to simulate the irregularity in rainfall. One representative also emphasised the strong trends in precipitation related to "El Nino years".

- *Food security versus cropping*

  - The issue of subsistence agriculture or production for the market was discussed. Is it possible to reflect a change over time from subsistence-dominated agriculture towards increasingly market driven production of cash crops, livestock and other goods and services?

  - Several participants expressed the opinion that the increased market-economy and the situation where more and more incomes of the villagers are connected with activities taking place outside the defined area, needs better attention in the Model.

  - One participant suggested that the study area in Serowe is rather unique as seen in a regional context and that the current version of the APM is much better suited to the situation in e.g. Zimbabwe than in the study area.

- *How to reasonably estimate the change in land productivity?*

  - In the Serowe scenario, the growth in agriculture productivity was set at 0.01 tonnes/ha, year. Some representatives argued that the figure was unrealistic and meant that the potential is far higher.

  - Other participants argued that the case is a scenario for a particular village, not a prediction, and reflects the special situation in that village. If there are no incentives or resources to increase productivity, there is not any reason to believe it will increase by itself.

  - Another aspect brought up was that it is easy to raise productivity, if there are funds for investment. As had been shown in the case study, however, many small holders do not have any such funds. It was concluded that there is a need to differentiate agricultural intensity in the Model.

- *The livestock issue*

  - The case study had shown that much of the income was derived from livestock production (much more than from crop production). Many persons argued that the value of the Model is questionable as long as livestock production is not included.

  - Another mentioned problem with the livestock production is that it is linked to the people living in the area but usually takes place outside the area. It was suggested that livestock could be modelled by treating it as a form of "cash crop" in the Botswana situation.

  - However, in many other countries in Africa, including Zimbabwe, livestock is also used for cultural and other purposes. Those forms of use are more difficult to deal with in a model.

- *How sophisticated should this type of Model be?*

  - One participant acknowledged, that there are a lot of improvements that could be made. At the same time it will be more and more complicated to use.

  - The possibility of letting different countries or individual develop different parts of the Model was discussed. Another opportunity would be to develop an "open-ended model" that could integrate or be linked to other existing Models by users.

Outcome of group discussion:

The task of the discussion was to "Propose the appropriate way-forward for the development of the APM concept into a useful tool for national and regional integrated land use planning".

Conclusions of Group 1-presented by Sebueng Kelatwang:

- The APM has a number of technical shortcomings, which need to be addressed:
  - The Model does not reflect trans-boundary movement and trade.
  - While the idea of the APM emphasises multiple land use, the present version of the model does not cater for non-consumptive goods and services.
  - Labour and non-timber forest products are not integrated in the Model.
  - The Model does not cater for food security.
  - It is not possible to alter the parameters for various land use types.
  - The land use changes are focused/revolve around on arable land.
- The future work should be objective oriented.
- It is also proposed that the Model should be linked to spatial data.
- It is the respective countries' responsibility to;
  - harmonise data,
  - establish a one-stop information system (directing the user to the database),
  - establish an analysis-function (organisational unit responsible for to organising and analysing data)

Conclusions of Group 2 – presented by Nicky Mitchell:

- Identify homes for the Model in each country. The homes can be institutions, NGOs, other service providers. They must be multi-sectoral and have the capacity and expertise.
- Test the model further under various conditions and establish different scenarios.
- Future work must aim at making the Model adaptable to different needs, identifying information gaps and make it compatible with PRA and other participatory approaches and policies.

Conclusions of Group 3- presented by Piloto Muduwa:

- Agrees on the strategies proposed by previous groups.
- Issues that should be included in the APM to reflect the potential land use options for the Region.
  - Crop production.
  - Livestock
  - Timber
  - National Parks
  - Non Timber Forest Products
  - Mining
  - Eco-tourism
  - Aquatic systems (e.g. the Okavango delta)

Some final comment by the participants:

- Keep it simple, think about who should be "the pilot"!
- Different "homes" could possibly host different parts (ref. Botswana)
- Make use of possibilities to link APM with other models (instead of trying to develop a too big and sophisticated model).

SECTION E

Concluding paper

THE AREA PRODUCTION MODEL – LESSONS LEARNT FROM THE WORKSHOP IN SOUTHERN AFRICA

by Nils-Erik Nilsson

1. Background

This paper is aimed at as a contribution to the proceedings of the workshop "Interactive and Dynamic Approaches on Forest and Land Use Planning in Southern Africa". During the recent years the interest in the APM model has been increasing, not least as a result of the development of a modern Windows version created by Magnus Grylle at the FAO. Since my first version was presented in 1982 there have been versions developed in many programme languages. Although the first version was presented as a demonstration model only, there has been no change since then in basic substance. Many weaknesses have been identified over the years. In a joint paper by Mats Sandewall and me " The Area Production Model: A tool and concept for sustainable land use and forest - resource management", published in Journal of Environmental Management last year we can read the folowing:

> *"The experience of recent exercises in Laos and Vietnam (Anon 1999) indicates that although the APM has some technical inconsistencies as a model, it has also significant advantages as a planning tool. Instead of 'answers and solutions' it provides decision-makers with a better insight in matter of data quality and data needs. It brings surveyors closer to strategic issues as it requires them to collect and analyse multi-sectored data. It provides a frame for what data to collect and to analyse, and (when used with care), it indicates what methods to use, who should be involved and what could be the process. There is, however, a need to develop the APM. Some general components, as those mentioned here, would benefit from joint development efforts. For other parts, however, it is the end user themselves who should find ways of adapting it to their own environment."*

Based on the idea that the APM model would require development and adaptation to local needs and on the basis of experiences from the Vietnam and Laos workshops in 1999, I started work to develop an Excel version of the APM. The justification for using Excel is that many people can handle Excel so this would open a possibility for local development work. Still, I believe that more permanent solutions would require the APM be developed in a database environment to facilitate integration with existing databases such as on general statistics, spatial and climatic data.

These efforts were intensified in the end of last year, as a preparation for the Serowe workshop. I brought with me to the workshop a first trial version of the APM - Excel. This version contained quite satisfactory solutions to simulating the development of forest crops and plantations excepting the fact that our knowledge of site-species-climate relationships is quite unsatisfactory. The model also contained first approaches to including most of the identified missing pieces into the model. However, the quite primitive assumptions with respect to the development of subsistence agriculture were unchanged. Back home from Botswana and with the experiences from the concluding meeting with villagers in Serowe and the seminar in Gaborone, I started to reconsider the idea that the planning unit should be considered as a closed, self-sufficient area. What I heard ringing in my ears was the statement from one of the village chairmen, who said, "hunger is our biggest problem" and the

equivalent statement by Sebueng Kelatwang representing discussion group 1: "The Model does not cater for food security". In addition, I had been greatly worried by the reported low per hectare harvest of subsistence food. This also made me go back to the case study of Adilabad district of Andhra Pradesh in India, that is included as an example of input data in the Windows version of the model. Ever since I took part of that case study I have had some worries about the relevance of some basic assumptions in the model. Still, during this mental process, I also had in mind an over-riding worry that too complex a model would be difficult to handle.

On this basis I started a learning process on the issue of food security or rather food insecurity based on the FAO report "The state of food insecurity in the 2000 world". This report can be downloaded from Internet. It defines food insecurity like this: "When people live with hunger and fear starvation". In technical terms, FAO considers that a food supply corresponding to a body mass index of 18 is the lower limit for sufficiency. Depending of activity level men would need around 2300 - 3200 Kcal/day and women around 1800 -2200 Kcal/day.

I was also able to download good statistical information on Botswana, Zimbabwe and South Africa from Internet. On this basis, I started to redefine some of the basic assumptions in a process that is now on-going. Since this paper needs to be finished now for inclusion in the proceedings from the workshop I have to describe the present work in a quite brief manner. Distribution of the present version to participants might serve the purpose of facilitating the understanding of this presentation. Of course, I have not forgotten my promises to those who got my first trial version on a compact disc to send them a more developed version in the beginning of this year.

The changes now underway also open for the option of using the model on a national level. I will make some efforts in this direction under the continued validation work. The question also arises whether there are other models doing the same job as the version underway. Then, there is the fear that the model may become too complicated. However, there are always easy ways for eliminating elements that are considered of little relevance in a certain case.

2. Work in progress

Allow me now, on the basis of the above considerations, to present a brief list of efforts that are being included in the new APM –Excel version.

2.1 Food production and consumption balance.

Based on the FAO report referred to above I have introduced a possibility to choose a minimum food requirement based on "body mass index" and activity level for men and women in the rural and urban population. This requires input population data for both men and women. (The approach is still quite approximate since it does not take the age distribution into account). In addition, there is an option for steering towards a certain level of self-sufficiency; for indicating the ratio of basic food consumption and for filling some of the food requirements by import.

2.2 Food production

- Livestock, poultry and game are included. This production is steered by numbers, fertility rate and ratio of taxing and deaths to fertility rate. Input data on weight,

weight development, traction, milk and egg production is amongst those needed. Basic needs are expressed in joules, although Kcal is sometimes used for better recognition.

- Additional food production, requiring little or no additional area is included. It covers roots and tubers, pulses, other vegetables, fruit, fish and minor forest produces. Input data on a per capita and year basis is required.
- It is possible to steer food production towards a certain level of self-sufficiency after ten years and at the end of the studied period (up or down).

2.3 Fodder production and consumption balance

- The fodder production and consumption balance is steered by food requirements that are also expressed in joules. Part of subsistence food can be used for filling the requirements of craft fodder. As in several other cases more permanent data and parameters are provided in the worksheet named "Moni".

2.4 Energy production and consumption balance

- There are no basic changes. Measurement unit is changed from calories to joules.
- The previous complication that wood is measured in m3 solid volume and that does not reflect the fact that much fuel-wood comes from brush, lops and tops has been taken into account by introducing a biomass factor (>1) that can be altered on the basis of local conditions.

2.5 Forest production and consumption balance

- The trial version of 2001 includes a fairly complete balance but with an incomplete steering mechanism as a consequence of little feedback
- More work is needed on the concept of environmental forestry and the options for the inclusion of some kind of production - consumption balance. A worksheet called APM matrix has been included in order to keep some aspects of this problem open.
- The forest production and consumption system can in a broad way also cater for minor forest produce (or Non Wood Forest Products).

2.6 Labour input

- There is a worksheet for labour input but no work done on that item since the first trial version in December 2001.
- Development towards a more general "input" table needs to be considered.

2.7 Money (Value production)

- There is work ongoing with the aim of calculating some kind of "gross agriculture product", "GAP", comparable with GDP and to be used for steering the production of marketed food and cash crops.
- In this part there is a future option for including calculation of gross capital values based on a chosen rate of discount. Whether or not this would be of any interest is questionable.

Future options proposed by the Botswana workshop

3.1 Water (Aquatic systems)

- This is an item that is very essential. However, I do not have (at least at present) the competence to identify any realistic approaches. Including a land class "water" introduces no problems and it can be done, meaning it should be done. It is more difficult when it comes to handling soil water balances that are of relevance for estimating the length of the growing season and for developing productivity indices. For those interested in this problem there are references in the literature package that was included in the compact disc that was distributed to some of the participants during the seminar. I will also keep in contact with Crispen Marunda from Zimbabwe, whose doctor thesis work relates to this problem area.

3.2 Mining

- Mining can easily be included, as soon someone will consider the input needs.

3.3 Eco-tourism

- Can be handled in the present version as "a minor forest produce"

3.4 Climatic fluctuations

- I see small opportunities for including climatic fluctuations in simulation of future scenarios, except for the option of including extreme scenarios in the study. Historical data of course may take these variations into account, in so far that they really mirror this variation. The biggest problems relate to making use of historical data on plantation growth. This problem has been dealt with in several of my papers included in the literature package.

4. Existing version of APM- Excel

I am at present using a set of data for Adilabad district of Andhra Pradesh when developing the model. These data are contained in a report by Antonio Marzoli of December 1995. (Databases for forestry planning in Andhra Pradesh; FAO: UTF/INDIA/158/IND). Until a few days back I used some compiled data from Serowe. I now consider the possibility of making an effort to apply the model on the entire Botswana, considering the fact that the available general statistics appear to be quite adequate. I would welcome any feedback from the participants of the seminar that could be helpful for my future work. Of course my big vision is that interested persons would engage themselves in development work according to their own visions and aspirations. The name of the present version as saved today is APMAdilabad0208.

Krylbo 2002-02-08

Nils-Erik Nilsson

SECTION F

Annexes

2001-09-07 / MS

Inter-active and dynamic approaches on forest and land use planning – terms of reference for training workshop in Southern Africa

1. Background

Deforestation is an issue of major concern in Southern Africa. The levels and rates of deforestation vary from place to place due to land use practices, land tenure classification, human and livestock/wildlife populations, and the status of the resource prior to pressures being applied. Despite the levels and rates in deforestation, undesirable consequences, which include fuel-wood shortages, soil loss, loss of bio-diversity, and desertification, are common to countries in Southern Africa. Efforts are in place to address deforestation through forestry projects and the results show localised successes but also failures. Some of the failures are due to the fact that some of the forestry projects have been planned and implemented with little regard to other activities impacting on forestry, such as agriculture or livestock production. Other projects have also failed because they focussed only on commodity production.

Today, it is acknowledged that forestry planning must be holistic and be formulated in such a way to cover, amongst others, the following broad agendas:

- Inter-sectoral and macro-economic issues
- Environmental issues
- Social and community issues
- Enterprise issues
- Sustainability issues.

Mindful of (a) UNCED's Agenda 21 and "Forest Principles" emphasis on "the need to protect the environment and to promote people's participation to achieve sustainable development and (b) the fact that the principle question is always "Trees and forests for whom and for what?"; the need for a participatory approach to planning is indeed necessary.

As a follow-up programme to the "*International Training Programmes in Sweden – Development of National Forest Policies and Strategies",* Botswana, South Africa, and Zimbabwe have agreed to expose some of their professionals to a scenario modeling approach on land-use and forest planning referred to as the "Area Production Model (APM)". The APM aims at simulating possible future developments of land use and primary area production. The model describes the production and consumption of sub-systems within a defined geographical area under different assumptions on management decisions, land use, and priority rules over time. Thus, it is a useful tool of foreseeing the consequences of various land-use policies and strategies.

2. Outline of the training workshop

2.1 Objective:

By exposing the participants to new approaches on land use planning, including forestry, and strategy development, the workshop would provide

- an input to considerations of how the planning system could be improved.
- the platform for the participating countries to initiate cross-sectoral landuse planning efforts.

2.2 Content, time and location:

- Preparatory course and planning talks for contact persons and co-ordinators in Umeå during February 20 - March 4, 2000.

- A two weeks regional workshop, including case studies and a concluding seminar. The workshop would take place in Botswana (Serowe area, 300 km North of Gaborone) with participants from South Africa, Zimbabwe and Botswana, during December 3-18, 2001.

2.3 Main issues to be covered in the workshop:

- What kinds of data and information are needed in planning and decision making? Official data, quantitative and qualitative data. Objective and subjective methods for data collection (e.g. methods based on field sampling, remote sensing and participatory rural appraisal). Complete and incomplete data. Importance of correctly describing the current situation and estimating ongoing changes. Analysis of data. What to do when plans do not match reality?

- How could a simulation model, such as the APM, be helpful as a planning and decision making tool in a Southern African context? Scenarios on land use, wood energy balance and forest resource development, including socio-economic and environmental aspects.

- How to narrow the gap between "top-down" and "bottom-up" oriented planning? Inter-action and communication between government staff and rural people. Roles of men and women in the land use planning process.

- Planning as a tool for integration of social economic and environmental considerations.

    - The relation to international and national policy processes (the macro perspective).

    - How could "planning" e.g. stimulate local people to plant trees or develop their agriculture (the micro perspective).

2.4 Outline and general content:

The training workshop would be divided into three (3) main parts

1. Opening key note speech and initial presentations, lectures and demonstration exercises (1 week)
2. Case studies including capture of planning data in the field with subsequent analysis of data and scenario modelling (1 week)
3. Concluding seminar including summary of concept, presentation of course works and discussion (1.5 days)

Part 1 will cover policies, strategies and planning issues, land use in the region, institutional aspects including the role of communities and other stakeholders, methods for data capture, the APM concept and applications, presentation of some previous case studies, assignment and introduction to course works.

Part 2 will be carried out in small "research groups" through interviews, inventory work, capture of statistics, photo interpretation, analysis of available data and scenario modelling by hands-on use of the APM.

In order to respond to an expected diverse group of participants, the program (part 1 and 2) will aim at having a "dynamic" design including a combination of lectures, exercises and discussions.

Part 3 will cover seminar presentations by each group and joint discussions of findings. A broader group of stakeholders and decision-makers will participate.

2.5 Proceedings report:

The workshop will be documented as proceedings and distributed to participants and others concerned.

2.6 Target group (participants):

Some main categories would be addressed

- Persons concerned with forest and land use planning at national and sub-national level.
- Central government staff concerned with planning, policy development, data analysis and data capture in relation to the use and management of forest and other land.
- Researchers (institutes and universities)
- Non-Governmental Organisations

For the purpose of the workshop, the multi-disciplinary and gender-balanced composition of each country team is important. For practical reasons the total number of workshop participants (excl. the co-ordinators) should not exceed 20 (Botswana 8,

Zimbabwe 6 and South Africa 6. The number of participants in the concluding seminar would include an additional 20-30 people, most of them from the host country but also including invited officials from each of Zimbabwe and South Africa.

3 Organisation and resource persons

3.1 Organisation:

The workshop will be funded by Sida through the CCB Programme at the National Board of Forestry. A team of facilitators under the Department of Forest Resource Management and Geomatics, Swedish University of Agricultural Sciences (SLU) has been assigned to arrange the workshop in co-operation with government organisations from Zimbabwe, Botswana and the Republic of South Africa.

3.2 Contact persons and workshop co-ordinators/resource persons

Mr Motserenganyi Sekgopo and Ms Ntjidzi Manyothwane (Botswana)
Mrs Sebueng Kelatwang (Republic of South Africa)
Mr Mudiva Piloto and Mrs Sibongile Baker (Zimbabwe)

On the Swedish side Dr Mats Sandewall, SLU, Dept of Forest Resource Management and Geomatics will be the team leader. In addition, about 4 persons will be involved.

3.3 Preparatory training for resource persons:

The appointed co-ordinators and resource persons from Zimbabwe, Botswana and South Africa participated in a two weeks course in Umeå, Sweden during February 20 – March 3, 2000. That course, named "Forest management planning at the national level", focused on developing countries and covered policy issues, land use planning and scenario modelling including APM. It is seen as part of the workshop preparation.

List of participants in the regional workshop

South Africa:

Ms Sebueng Kelatwang, Assistant Director, Information
Ms Nicky Mitchell, Deputy Director, Indigenous Forest Management,

Zimbabwe:

Ms Sibongile Baker, Deputy General Manager, Conservation and Extension, Forestry Commission,
Mr Edson Chidziya, Deputy Director, Department of National Parks and Wildlife Management
Mr James Gambiza, Rangeland and Plant Ecologist, University of Zimbabwe
Mr Dominick Kwesha, Mapping and Inventory Officer, Forestry Commission
Mr Godfrey Nehanda, Chief Irrigation Officer, Agritex
Mr Muduwa Piloto, Corporate Planning Manager, Forestry Commission

Botswana:

Mr Lawrence Akanyang, Forestry Association of Botswana, Serowe
Mr Sedi Mosegofatsi Bose, Forester, Southern Region, Kanye
Mr James M Ellard, Regional Forest Officer, Central District, Serowe
Mr Kealeboga S Kemoreile, Forester, Northwest Region, Maun
Ms Ntjidzi Manyothwane, Senior Agricultural Economist, Ministry of Agriculture, Gaborone
Ms Naledi Moshele, Senior Technical Officer (Lands), Palapye Sub-Land Board, Palapye
Mr Ephraim Mosimanyana, Forester, Gaborone Region, Gaborone
Mr Jeremiah F Ramontsho, Rangeland Ecologist, Gaborone
Mr Motserenganyi Sekgopo, Forest Officer, Ministry of Agriculture, Gaborone
Mr Moagi Mark Sinombe, Agricultural Land Use Planner, Central Region, Serowe

Participants in the final seminar on December 17, 2001

Name	Organization	Address (Botswana unless specified)
Lawrence Akanyana	Forestry Association of Botswana	P.O.Box 31113 Serowe
Sibongile Baker	Forestry Commission	Box HG 139, Harare, ZIMBABWE
Moagi Balesewg	Land officer	mobalesewg@gov.bw
Montlenyane Barobi	MoA, Crop Production&Forestry	P/Bag 003, Gaborone
S. Baruti	MFDP - RDCD	P/Bag 008, Gaborone
S.D. Bok	EAD	sbok@gov.bw
Sedi M. Bose	Ministry of Agriculture	P/Bag 032 Kanye
Pauline O. Dube	University of Botswana	dubeop@mopipi.ub.bw
James Ellard	Ministry of Agriculture	P.O.Box 143, Serowe
James Gambiza	University of Zimbabwe	Jgambiza@science.uz.ac.zw, ZIMB
Karl Gustafsson	National Board of Forestry	Karl.Gustafsson@svo.se, SWEDEN
K Keitshokile	MoA, Crop Production&Forestry	P/Bag 003, Gaborone
Sebueng Kelatwang	Forest Policy, RSA	lAe@dwaf.pwv.gov.za, RSA
K.S.Kemoreile	Ministry of Agriculture	Box 16, Maun
M. Kolaatama	MoA, Crop Production&Forestry	P/Bag 003, Gaborone
Raymond M. Kwerepe	Ministry of Agriculture	P/Bag 003 Gaborone
Dominick Kwesha	Forestry Commission	Box HG 595, Harare, ZIMBABWE
Nicky Mitchell	Indigenous Forest Mgmt, RSA	micheln@dwaf.pwv.gov.za, RSA
M. Modise	Plant Protection Division	P/Bag 0091 Gaborone
B.E. Moji	DCPF	P/Bag 32, Kanye
C.B. Montsho	DCPF	P.O. Box 10002, Gaborone
G Moremedi	MoA, Crop Production&Forestry	P/Bag 003, Gaborone
N.G. Mosele	Ngwato Land Board	Box 868, Palapye
E. Mosimanyana	Ministry of Agriculture	P.O. Box 10002, Gaborone
Linda Mossop	DWAF-RSA	P/Bag x93 Pretoria 0001, RSA
B. Motlhetlhi	MoA, Crop Production&Forestry	P/Bag 003, Gaborone
Godfrey Nehanda	Agritex	Box cy 639, Harare, ZIMBABWE
G.I. Nilsson	Sanitas	Box 606, Gaborone
Nils-Erik Nilsson	Planalys Konsult	Bäsinge, SE-775 96, Krylbo, SWEDEN
M. Piloto	Forestry Commission	Box HG 139, Harare, ZIMBABWE
J. F. Ramontsho	MoA, Range Ecology	Jramontsho@gov.bw
Kajsa Sandewall	SLU, Dept of Forest Ecology	SE-901 83 Umeå, SWEDEN
Mats Sandewall	SLU, Forest Resource Mngement	Mats.Sandewall@resgeom.slu.se, SWE
N. Sebapalu	Department of Wildlife	Box 131, Gaborone
S. Sedetso	MoA, Crop Production&Forestry	P/Bag 003, Gaborone
M. Sekgopo,	MoA, Crop Production&Forestry	P/Bag 003, Gaborone
M.M. Sinombe	Ministry of Agriculture	Box 143, Serowe
Edson Nyalani Wotho	MoA, Crop Production&Forestry	P/Bag 003, Gaborone

Interactive and dynamic approaches on forest and land-use planning in Southern Africa
- Regional workshop in Botswana, December 3 - 18, 2001

Frame programme:

Nov 26-Dec 1:	Preparation team (MS and KS) arrive, discussions and work in Gaborone and Serowe together with the resource persons from Botswana
Dec 2:	Participants arrive to Gaborone and travel to Palapye, check-in at hotel
Dec 3-7:	Seminar week in Palapye (see attached programme)
Dec 8:	Check-out Palapye, travel to Serowe (change of hotel)
Dec 9:	Recreation day (e.g. wildlife reserve), Serowe
Dec 10-15	Case study week in Serowe
Dec 16:	Check-out Serowe and travel to Gaborone (change of hotel), special guests arrive
Dec 17:	Final seminar, day 1, cocktail dinner
Dec 18:	Completion of seminar (a.m.), evaluation, departure

Contact persons and workshop co-ordinators/resource persons

From the participating countries:

Mr Raymond Kwerepe (RK) (Botswana)
Mr Motserenganyi Sekgopo (Mse) (Botswana)
Ms Ntjidzi Manyothwane (NM) (Botswana)

Mrs Sebueng Kelatwang (SK) (Republic of South Africa)

Mr Piloto Mudiva (PM) (Zimbabwe)
Mrs Sibongile Baker (SB) (Zimbabwe)

From Sweden:

Dr Mats Sandewall (MS), SLU, Department of Forest Resource Management and Geomatics, Umeå, forester, (land management, forest inventory and planning, interdisciplinary approaches). Team leader.

Mr Karl Gustafsson (KG), Swedish Board of Forestry, forester, (resource data analysis, scenario modelling).

Professor Nils-Erik Nilsson (NEN), Planalys AB, Senior forester, formerly SLU and Swedish Board of Forestry, (forest resource management, site quality issues, data analysis, originator of the APM).

Mr Bo Ohlsson (BO), SLU, Department of Forest Resource Management and Geomatics, sociologist, (land use policy, socio-economic aspects on forestry in a local, national and global context)

Ms R Kajsa Sandewall (KS), Swedish Board of Forestry and SLU, agronomist, (participatory approaches, stakeholder interaction, aspects of culture and tradition in research and land management)

The week of final preparations (Monday 26/11- Saturday 1/12):

Nov 26-27: Arrival MS and KS (by SA1765 at 14.05). Discussions and arrangements, Gaborone.
Nov 28: Travel to Palapye-Serowe, discuss and check hotel arrangements during seminar.
Nov 29: In Serowe, Discuss with authorities,.hotels, banks etc. in Serowe. Back to Palapye.
Nov 30: Return to Gaborone. Discussions and preparations.
Dec 1-2 a.m: Discussions and preparations in Gaborone.

Programme for the Seminar week in Palapye (Sunday 2/12- Saturday 8/12):

Sunday December 2: Participants (plus BO and KG) arrive to Gaborone, travel by bus to Palapye and and check-in at Botsalo Hotel, dinner upon arrival (around 20.00). Note: The participants from Zimbabwe will arrive on December 3, and are expected to join the Seminar in Palapye by 16.00.

<table>
<tr><th>Time</th><th>Monday 3</th><th>Tuesday 4</th><th>Wednesday 5</th><th>Thursday 6</th><th>Friday 7</th></tr>
<tr><td>7–8</td><td>Breakfast</td><td>Breakfast</td><td>Breakfast</td><td>Breakfast</td><td>Breakfast</td></tr>
<tr><td>8-9</td><td rowspan="3"></td><td>Morning meeting. Discuss workshop objectives (MS)</td><td>Morning meeting (MS)</td><td>Travel to Serowe (meeting in bus)</td><td>Morning meeting (MS)</td></tr>
<tr><td>9-10</td><td rowspan="3">Introduction (RK)
Practicalities (MS)

Background and ideas of the workshop (MS)

Forest and land use in a regional context (BO)</td><td rowspan="3">Aspects & views on land-use (KS+participants)

Modelling of landuse, the APM concept (MS)</td><td rowspan="3">Data capture:
- Public sources
- PRA
- Sampling
- Remote sensing
(BO,KS,MS,KG)</td><td rowspan="3">Data capture exercises, PRA, point sampling, RS etc. (4 groups rotating between work stations)</td><td rowspan="3">Discussion of the exercise on data capture.

Presentation of scenario exercise (participants)</td></tr>
<tr><td>10-11</td></tr>
<tr><td>11-12</td></tr>
<tr><td>12-13</td><td rowspan="2">Lunch Break</td><td rowspan="2">Lunch Break</td><td rowspan="2">Lunch Break</td><td rowspan="2">Lunch break and switch of activity</td><td rowspan="2">Lunch Break</td></tr>
<tr><td>13-14</td></tr>
<tr><td>14-15</td><td>Agriculture and forestry in Serowe area (Mr Thabone, RAO, Serowe)</td><td rowspan="2">The APM tool, presentation and demonstration exercise (KG)

Start of scenario group exercise – APM</td><td rowspan="2">Data analysis, exercise including sum-up discussion (MS, KG)</td><td rowspan="3">Continuation of the data capture exercises (BO,KS,MS,KG)</td><td rowspan="3">Summing-up and discussion of the planning concept (MS, BO)

Introduction to case studies (MS, KS, KG)</td></tr>
<tr><td>15-16</td><td>Coffee break</td></tr>
<tr><td>16-17</td><td rowspan="3">Issues of landuse, planning, policy in Botswana, South Africa, Zimbabwe (participants)

Discussion (BO)</td><td>Introduction for Thursday field exercise</td></tr>
<tr><td>17-18</td><td rowspan="2">Rest and Dinner</td><td rowspan="2">Rest and Dinner</td><td rowspan="2">Return travel Dinner</td><td rowspan="2">Rest and Dinner</td></tr>
<tr><td>18-19</td></tr>
<tr><td>19-21.30</td><td>Opening session Key note speech Dinner</td><td>Time to work on group exercise</td><td>Social Activity</td><td>Time to finalise scenario exercise</td><td>Social Activity</td></tr>
</table>

Saturday, December 8:

Breakfast, Evaluation of first week, Check-out from the hotel in Palapye, Travel to Serowe and check-in at hotel (Serowe Hotel and Lentwe Lodge respectively), Free time for shopping and other practical matters. (Bo Ohlsson returns to Gaborone and Sweden).

The case study week in Serowe (Sunday 9/12- Saturday 15/12):

General outline: Case study teams (of 4-6 persons) work independently with gathering and analysis of field data and other information. Gathering session for all groups in the conference room at Lentwe Lodge each morning. On Wednesday afternoon and Thursday morning, there will be an intermediate summing-up and discussion session focussed on data analysis and some other issues (led by Professor Nils-Erik Nilsson, who arrives Tuesday evening).

Sunday, December 9:

Recreation visit to wildlife sanctuary including barbeque dinner in the field.

<table>
<tr><th>Time</th><th>Monday 10</th><th>Tuesday 11</th><th>Wednesday 12</th><th>Thursday 13</th><th>Friday 14</th></tr>
<tr><td>7.00–7.45</td><td>Breakfast</td><td>Breakfast</td><td>Breakfast</td><td>Breakfast</td><td>Breakfast</td></tr>
<tr><td>7.45-8.15</td><td>Transport to Lentwe Lodge</td><td>Transport to Lentwe Lodge</td><td>Transport to Lentwe Lodge</td><td>Transport to Lentwe Lodge</td><td>Transport to Lentwe Lodge</td></tr>
<tr><td>8.15 - 9.00</td><td>Morning meeting. Discuss case study objectives (MS)</td><td>Morning meeting (MS)</td><td>Morning meeting (MS)</td><td>Morning meeting (MS)</td><td>Morning meeting (MS)</td></tr>
<tr><td>9-10</td><td rowspan="6">Case studies (detailed planning made by participants)</td><td rowspan="6">Case studies (detailed planning made by participants</td><td rowspan="2">Case studies</td><td rowspan="2">Intermediate seminar on data analysis (NEN)</td><td rowspan="6">Case studies (detailed planning made by participants</td></tr>
<tr><td>10-11</td></tr>
<tr><td>11-12</td><td rowspan="2">Lunch Break</td><td rowspan="2">Lunch Break</td></tr>
<tr><td>12-13</td></tr>
<tr><td>13-14</td><td rowspan="3">Intermediate seminar on data analysis (NEN)</td><td rowspan="3">Case studies</td></tr>
<tr><td>14-15</td></tr>
<tr><td>15-16</td><td rowspan="2">Return to hotel Dinner</td><td rowspan="2">Return to hotel Dinner</td><td rowspan="2">Return to hotel Dinner</td><td rowspan="2">Return to hotel Dinner</td><td rowspan="2">Return to hotel Dinner</td></tr>
<tr><td>16-17</td></tr>
<tr><td>17-18</td><td rowspan="2">Return to hotel Dinner</td><td rowspan="2">Return to hotel Dinner</td><td rowspan="2">Return to hotel Dinner</td><td rowspan="2">Return to hotel Dinner</td><td rowspan="2">Return to hotel Dinner</td></tr>
<tr><td>18-19</td></tr>
<tr><td>19-21.30</td><td>Time at disposal</td><td>Time at disposal (Arrival of NEN)</td><td>Social activity</td><td>Time at disposal</td><td>Time at disposal</td></tr>
</table>

Saturday, December 15:

Time and facilities available for completion of the case studies. Evaluation of 2nd week.

The concluding seminar at President Hotel in Gaborone (Sunday 16/12- Tuesday 18/12):

General outline: The participants of the workshop will be given the opportunity to present their findings of the seminar and their case studies to a broader group of stakeholders and decision makers. Following the presentations, all the participants in the seminar will discuss (in group sessions and jointly) the issue, the approach and how to go ahead.

Sunday, December 16:

Check-out from hotels in Serowe and travel to Gaborone (a.m.). Check-in at President hotel.

Monday, December 17:

8.30-9.30	Opening of seminar. Presentation of participants and background to seminar
9.30-10.00	Coffee/Tea
10.00-12.00	Presentation of case studies by workshop participants
12.00-13.00	Lunch
13.00-13.30	Review of the APM Model and concept, introduction of group discussion
13.30-15.00	Discussion in small groups of certain defined topics
15.00-15.30	Coffee/Tea
15.30-17.00	Presentation and summary of group discussions
19.30-	Cocktail dinner

Tuesday, December 18:

8.30-11.00	Continuation and completion of seminar Comments by the different stake-holders How to go ahead
11.00-11.30	Evaluation by participants
11.30	Lunch Departure of participants in the afternoon

2001-12-17

WORKSHOP EVALUATION BY PARTICIPANTS: "Inter-active and dynamic approaches on forest and land use planning in Southern Africa, Dec 3-17, 2001.

(1) To what extent are you satisfied with the outcome of the workshop as seen from a professional viewpoint? (Please, give a mark between 1 and 5, where 1 is disappointed, 3 is satisfied and 5 is entirely satisfied)

Mark	1	2	3	4	5
Nos. (persons)	-	1	5	7	4

Comment by MS: There were totally 18 participants in the course (2 from South Africa, 6 from Zimbabwe and 10 from Botswana). However, one person from Zimbabwe had to interrupt the course after 10 days for family reasons and is not included in the evaluation.

(2) The objectives and content of the workshop were formulated as on the following page. Please comment on the objectives and the content with regards to relevance and the way it was fulfilled!

- More in-depth study of the APM was needed and how it could be applied to our respective situations. It would have been useful to have the Excel version from the start.
- I personally feel the objectives of the workshop were fulfilled.
- The model needs to be objective oriented. The content could have been more understood if a regional example was given. Otherwise the concept is very good.
- The objectives of the workshop were highly relevant and fulfilled. It was an eye-opener for planning.
- Objectives partly achieved and the second objective was not achieved.
- Cross-sectoral land-use planning concept was well defined and demonstrated. However, how the model can improve the planning at national level is still questionable.
- I think the objectives were fairly well formulated and feasible for the workshop. The objectives were relevant.
- Objectives were clear. Content OK.
- The objectives do not show that the workshop aimed to exposing the participants to using APM as a planning tool. What is shown as objectives have been achieved to some extent.
- The objectives/content were relevant and the program achieved them. Practical data collection exercise was also relevant. The Excel version of model should have been used instead of old version.
- Objectives generally fulfilled.
- Objectives were fulfilled but the process to fulfilling them was rather tedious and slow.
- The objective was very relevant but the exposure to the model could have been improved by awaiting the Excel version to allow the participants to practice using it in the presence of the Swedish team.
- The objectives were relevant and were fulfilled nicely.
- Everything was fairly OK.
- Objectives: On target as it takes Southern Africa from land-use planning based on-crisis management to that of collecting data and projecting outcomes which is productive. Content: A bit ambitious for 2 weeks.
- Objectives were clear and precise and in relation to the workshop aims.

Comment by MS: Comments are rather well synchronised and fairly positive. Several persons (3) suggest that the new Excel version should have been used from the start. We did actually consider it, but as none of us had tried it before or had any experience from using it, we did not dare to, as we wanted to make sure that complete scenarios could be developed. Waiting with the workshop was not an option after all previous delays.

(3) The workshop was process oriented in the sense that you were supposed to test a concept and elaborate on its applicability in your own environment. It meant that the program, especially during the case study week, was "flexible" and subject to continuous discussions. Please comment on the program design!

- Stronger facilitation was needed to keep up momentum and provide a more fulfilling training session. Demonstrations of the APM:s flexibility would be useful. More than one scenario should have been developed to see the strength of the Model.
- The program design should continue and be made such that it will be useful in all countries and accommodate various parameters.

- The parameters attired were not locally possible. However, by re-defining them we came to a consensus. The checklist we made was very practical and farmers answered with confidence. The flexibility did indeed offer continuous discussion.
- The idea of discussing the program was welcome. It enabled participants to take part and shape it the way it suited them.
- Program design was OK but the experts were failing to explain it and assist participants to apply it on practice.
- The program lost focus.
- This actually formed the pillar of the workshop. I feel that by doing, participants were given the opportunity to add more questions and assess the model more realistically.
- The programme is rigid in that it does not take into account livestock production, an important activity in many semi-arid countries.
- Due to its flexibility, a lot of time was wasted during some sessions when the group had to decide what should be done next. The workshop coordinators allowed it to be too participatory instead of effectively guiding the proceedings.
- The program was OK and discussions resulted in avoiding shortcomings. However, more time should have been available for data collection and analysis/methods.
- Program was OK and participatory.
- The flexibility in cases was missing. Personally, I am more comfortable with something more predictable.
- While flexibility is good, it would have needed more guidance from the facilitators to avoid too much discussion.
- Program design was OK.
- Although it has its limitations, we were in fact able to test its applicability to the real situation and make adjustments in the process.
- Flexibility encourages active participation, but the program could have been better if some more time management had been brought in.
- Its done the model was flexible and could give the participants a chance to test different scenarios. The program also was able to make the participants meet and actually see the farmers and their activities.

Comment by MS: To make it short, some people appreciated this way of working, others did not. With the experience of the outcome, I would probably have tried to come to the point a little bit earlier, but basically the answers reflect the different background and expectations of the participants.

(4) The composition of participants was supposed to be multi-disciplinary. Did you miss any category of people among the participants and, if so, what category(ies) was missing?

- Yes, agriculture/land-use planning/community forestry from S.A.
- Statisticians
- The district land use officers. They are more of environmentalists and land administrators than any of us. They could have balanced information given by others.
- It was indeed multi-disciplinary. Should have invited town/regional planners for the two weeks.
- Sociologists (3 persons).
- No (2 persons)
- Researchers were missing.
- Agronomists/livestock specialists were not represented in proportion to natural resource managers.
- In our case (Zim) the representation was adequate.
- Participants' mix was good. Almost all categories were there. I can't think of any that were missing. It was well represented (3 persons)
- Livestock professionals, other NGOs.
- The group was diverse, but NGOs were not well represented (only one person).

Comment by MS: Three people missed sociologists, two people asked for more NGOs.

(5) How do you consider the various parts of the workshop with regards to relevance and usefulness (5 is very relevant/useful, 1 is not relevant/useful).

Part	Relevance	Usefulness
Seminar week	55555 54444 44433 33	55555 55444 33332 --
Case study week	55555 55544 44444 3-	55555 55444 44433 3-
Concluding seminar	55555 55555 44442 1-	55555 54444 43321 1-

Comments:

- The first seminar week could have been shortened. The PRA training exercise the 1st week could have been combined with the case study week.
- The concluding seminar could have been useful if structured differently. It should have been focused on policy issues and how policy makers could benefit from this. Instead it was a technical brain-storming event.
- Participants at the concluding seminar could have been given some materials (notes) on the model and calculations used for the case study in order for them to effectively appreciate it's usefulness and concept.
- Allocate more time for data collection and analysis methods and make arrangements well in advance.

Comment by MS: The most remarkable is how differently the participants viewed the value of the concluding seminar.

(6a) Has the workshop changed your ideas on land use planning (and if so how)?

- I think now I have a wide mind and have realised the importance of consulting with all concerned stakeholders who have common interest and use the same resources.
- Land-use planning should be multi-disciplinary and dynamic.
- Yes (2 persons)
- When planning for the use of land, you should not only think of what you want to do, but also for other use.
- No (2 persons)
- Yes, a lot of our work is sector oriented rather than multi-sectoral and we always downplay the latter. This workshop has showed that it has serious practical implications.
- Yes. The need for a multi-sectoral approach.
- Yes concrete data from the field can enhance the bottom-up approach and the fact that it incorporates land-uses makes it excellent for planning.
- Yes, analysis of future implications for different land use options is important.
- Yes, the need to integrate (different land uses in planning).
- I have been reminded of the "ongoing" nature of planning – one never arrives! It is an iterative process.

Comment by MS: The need for multi-sectoral ways of working was obviously acknowledged by many participants.

(6b) Do you foresee that it will influence you in your work in any way (and if so how)?

- Definitely this will influence the way I work with others and the stakeholders to harmonise all land-use systems prevailing in the (extension) area**.**
- I will try to apply the APM concept in areas where there is a significant problem of land transfer, e.g. peri-urban areas around Gaborone.
- I think it will to some extent, in that it shows that it is important not to plan in isolation.
- The multidisciplinary nature of (?). using the APM is useful. What might change is perhaps the possible improved co-ordination with organisations represented at the workshop.
- No, but the appropriate land-use planners may benefit.
- It will help me in deciding on what should be considered most sufficient, relevant and sustainable when dealing with land use issues.
- It will, I will always insist on incorporating others (from our sectors).
- Yes, it has influenced me to advocate for cross-sectoral co-operation and linkage in planning and information exchange.
- No.
- The APM has a place, but not as it stands now. It will be good if the Excel version could be programmed in such a way that it is driven by need/objective.
- To me, the idea of simulation into the future was an addition that should improve my own approach.
- Yes. It allows me to expose students to a "new" modelling concept/program.

- Yes, I will use it to determine how the forest resources can be managed by collecting data and running different scenarios into the future.
- I will be more receptive to the way subsistence agriculture influences other land uses.
- Increased consultation of stake-holders.

Comment by MS: The aspect of advocating for participation and consultation of stake-holders

(7) Considering feasibility for the task, costs involved (a given total budget) and other alternatives, To what extent do you think the accommodation and conference arrangements was appropriate? If inappropriate, please suggest alternatives.

Part	Too high level	Sufficient	Inappropriate
Seminar week	2	15	0
Case study week	2	9	6
Concluding seminar	4	13	0

Comment by MS:

There were quite diverging opinions on the accomodation at Serowe hotel during the case study week. I herewith present two comments, that could well represent all comments given.

- Accomodation in Serowe hotel was not conducive for a heavy and tight work schedule.
- Being a local I believe that the best accomodation possible was chosen, and for that I am thankful.

I am really sorry the hotel was not convenient to everybody. I have concluded that the differences could partly be related to different expectations and partly to some differences in room standard within the hotel. During the preparation week just before the workshop, I stayed at that hotel together with the resource person from Botswana. We asked the hotel to try and speed up the breakfast service but did not comment on the rooms as we really thought they were quite OK, but we only stayed in two of the rooms and did not survey the other.

(8) Please give any other comments and suggestions that you wish to forward. Concrete suggestions, on how you think we should make further use of the results of the workshop, are appreciated!

- A new model should be formulated to suite local conditions. Alternatively support should be given to participating countries in order to let them develop their country specific derivates of the model.
- Preparatory meetings and reflections with all resource persons on a daily basis would have been appropriate.
- Very little feed-back from organisers for specific requests.
- Program should be distributed to academic (local) institutions for improvements.
- I am personally not happy with the results (of the concluding seminar). However, if we can use the outcome of the group discussions as guideline we will be able to achieve something.
- Results should be used as a suggested "way forward".
- If budget permits, it would be good to facilitate similar workshops on country level.
- Sida to facilitate national workshops, with Nils-Erik invited for at least 10 days, next year before we forget.
- I have the feeling that further training on the use of the model and collection of data should be taken on board.
- I believe comments made on the way forward by groups sufficiently answer the above.
- James Ellard was extremely helpful to visitors and was a key member leading to success of the workshop. Way forward – country co-ordinators should organise meetings in their own countries.

Comment by MS:

With the exception of question 7, all comments and remarks have been presented herewith. Thanks for taking your time to providing sincere and very useful comments.

Extract from the Terms of Reference for the workshop:

2.1 Objective:

By exposing the participants to new approaches on land use planning, including forestry, and strategy development, the workshop would provide

- an input to considerations of how the planning system could be improved.
- the platform for the participating countries to initiate cross-sectoral land-use planning efforts.

2.3 Main issues to be covered in the workshop:

- What kinds of data and information are needed in planning and decision making? Official data, quantitative and qualitative data. Objective and subjective methods for data collection (e.g. methods based on field sampling, remote sensing and participatory rural appraisal). Complete and incomplete data. Importance of correctly describing the current situation and estimating ongoing changes. Analysis of data. What to do when plans do not match reality?

- How could a simulation model, such as the APM, be helpful as a planning and decision making tool in a Southern African context? Scenarios on land use, wood energy balance and forest resource development, including socio-economic and environmental aspects.

- How to narrow the gap between "top-down" and "bottom-up" oriented planning? Inter-action and communication between government staff and rural people. Roles of men and women in the land use planning process.

- Planning as a tool for integration of social economic and environmental considerations.

  - The relation to international and national policy processes (the macro perspective).
  - How could "planning" e.g. stimulate local people to plant trees or develop their agriculture (the micro perspective).

2.4 Outline and general content:

The training workshop would be divided into three (3) main parts

1. Opening key note speech and initial presentations, lectures and demonstration exercises (1 week)
2. Case-studies incl.capture of planning data with subsequent analysis of data and scenario modelling (1 week)
3. Concluding seminar including summary of concept, presentation of course works and discussion (1.5 days)

Part 1 will cover policies, strategies and planning issues, land use in the region, institutional aspects including the role of communities and other stakeholders, methods for data capture, the APM concept and applications, presentation of some previous case studies, assignment and introduction to course works. Part 2 will be carried out in small "research groups" through interviews, inventory work, capture of statistics, photo interpretation, analysis of available data and scenario modelling by hands-on use of the APM. In order to respond to an expected diverse group of participants, the program (part 1 and 2) will aim at having a "dynamic" design including a combination of lectures, exercises and discussions. Part 3 will cover seminar presentations by each group and joint discussions of findings. A broader group of stakeholders and decision-makers will participate.

List of reference documents for the workshop:

Grylle, M, 1997. Users Guide to the Area Production Model, APM. Version 2.0 for Windows. Final Draft. FAO/FRA (+ software).

Lindgren, O., 1986. Simulation of Forest Resources Development – an introduction to the Area Production Model (APM). GCP/RAS/106/JPN, Field Document 11, April 1986. FAO Regional Office for Asia and the Pacific.

Nilsson, N-E. (1982). Outline to an area production model for long term forestry and land use planning (Retyped from original. First outline of the model dated 1982-02-21).

Ohlsson, B, 2001. Lecture note on forest and forest land use issues in Southern Africa Sub-region at workshop on Interactive and Dynamic Approaches on Forest and Forest Land Use Planning in Southern Africa, 3rd - 17th of December 2001

Sandewall, M and Nilsson, N-E, 2001. The Area Production Model - a tool and concept for sustainable land use and forest resource management. *Journal of Environmental Management* ***62***, 415-427

Sandewall, M., Ohlsson, B. and Sawathvong, S. 2001. Assessment of historical land use changes for purposes of strategic planning - a case study in Laos. *Ambio* ***30,*** 55-61.

Sandewall, M., Ohlsson, B. and Sandewall, K. 2001. Balancing the goals of society and the needs of local people in forest land use - interdisciplinary research in focus. *Currents 25/26,* 9-13.

Serien Arbetsrapporter utges i första hand för institutionens eget behov av viss dokumentation. Rapporterna är indelade i följande grupper: Riksskogstaxeringen, Planering och inventering, Biometri, Fjärranalys, Kompendier och undervisningsmaterial, Examensarbeten samt internationellt. Författarna svarar själva för rapporternas vetenskapliga innehåll.

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Riksskogstaxeringen: (*The Swedish National Forest Inventory)*

1995 1 Kempe, G. Hjälpmedel för bestämning av slutenhet i plant- och ungskog. ISRN SLU-SRG-AR--1--SE

2 Riksskogstaxeringen och Ståndortskarteringen vid regional miljöövervakning. - metoder för att förbättra upplösningen vid inventering i skogliga avrinningsområden. ISRN SLU-SRG-AR--2--SE.

1997 23 Lundström, A., Nilsson, P. & Ståhl, G. Certifieringens konsekvenser för möjliga uttag av industri- och energived. - En pilotstudie. ISRN SLU-SRG-AR--23--SE.

24 Fridman, J. & Walheim, M. Död ved i Sverige. - Statistik från Riksskogstaxeringen. ISRN SLU-SRG-AR--24--SE.

1998 30 Fridman, J. & Kihlblom, D. & Söderberg, U. Förslag till miljöindexsystem för naturtypen skog. ISRN SLU-SRG-AR--30--SE.

34 Löfgren, P. Skogsmark, samt träd- och buskmark inom fjällområdet. En skattning av arealer enligt internationella ägoslagsdefinitioner. ISRN SLU-SRG-AR--34--SE.

37 Odell, G. & Ståhl, G. Vegetationsförändringar i svensk skogsmark mellan 1980- och 90-talet. -En studie grundad på Ståndortskarteringen. ISRN SLU-SRG-AR--37--SE.

38 Lind, T. Quantifying the area of edge zones in Swedish forest to assess the impact of nature conservation on timber yields. ISRN SLU-SRG-AR--38--SE.

1999 50 Ståhl, G., Walheim, M. & Löfgren, P. Fjällinventering. - En utredning av innehåll och design. ISRN SLU-SRG--AR--50--SE.

52 Riksskogstaxeringen inför 2000-talet. - Utredningar avseende innehåll och omfattning i en framtida Riksskogstaxering. Redaktörer: Jonas Fridman & Göran Ståhl. ISRN SLU-SRG-AR--52--SE.

54 Fridman, J. m.fl. Sveriges skogsmarksarealer enligt internationella ägoslagsdefinitioner. ISRN SLU-SRG-AR--54--SE.

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