Afforestation and woodland management in South Africa

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EDRC 1994

EXECUTIVE SUMMARY

Introduction

Fuelwood is the staple energy for the rural poor. It provides four-fifths of the total domestic energy to this sector. Even if there is an accelerated programme of rural electrification, the primacy of fuelwood is projected to continue.

In some areas there is evidence of declining or degrading woodland. While fuelwood gathering may be a factor, it is probably not the main cause. This paper suggests that there is much evidence that fuelwood shortages do exist in many rural areas, that we cannot wait for the problem to go away – decisive remedial action is required. On the other hand, fears of imminent environmental destruction wrought by fuelwood collecting are unfounded.

It argues for a rational well-planned three-pronged approach to the question of fuelwood supplies:

- to enlarge the available fuelwood resource by promoting the redistribution of surpluses;
- strategies for the sustainable utilisation of natural woodland which currently supplies most of the fuelwood;
- a fully integrated national programme to promote social forestry in all its forms.

Fuelwood consumption (Chapter 2)

The database on fuelwood consumption is adequate for obtaining a reasonable aggregated estimate fuelwood consumption on a national or broad regional scale. The total annual consumption of fuelwood by low income households in South Africa is about 11 million tons, of which about 6.6 million tons is used in rural areas in the homelands, about 3.5 million by farmworkers, only 0.7 million tons in urban areas, and a smaller amount by other rural communities outside of the homelands. More work is needed to provide finer details on the dynamics and determinants of rural energy consumption patterns.

Fuelwood resources (Chapter 3)

There is no data on the proportion of fuelwood coming from different sources. Such information as there is suggests that it is plausible that two-thirds comes from indigenous woodland, particularly savanna. A sizeable portion of the remainder comes from the commercial agricultural and forestry sector. Self-seeded exotics are important in certain areas. Woodlots, however, which cover an estimated 62 000 hectares in the homelands, provide relatively little fuelwood.

Three estimates of wood production in savanna types of woodland have been published recently: 40 million tons per year in all South Africa (derived from Millington et al 1991); 11.6 million tons per year, homelands only (Aron et al 1989); 8.4 million tons per year (fuelwood only) in all South Africa (Kruger et al 1993). Although the studies are not directly comparable, there are clearly discrepancies between them. Current research on wood biomass needs to be fully supported and coordinated to obtain a detailed and reliable inventory of wood resources. While it seems that the total potential fuelwood resource in South Africa is adequate to meet the needs, there are fuelwood deficits in at least five homelands (KaNgwane, KwaNdebele, KwaZulu, Lebowa, QwaQwa and Transkei).

There is no recent data on the amount of plantation residues generated in commercial plantations, but it is probably between 2.5 and 4 million tons per year. Much of this is transported to the homelands along with wood derived from bush clearing and wattle eradication on commercial farmland.

Commercial forestry sector (Chapter 4)

The commercial forestry sector is reviewed. Elsewhere, this paper advocates the principle of 'convergence' – the bringing together of commercial forestry and social forestry in a single policy and institutional framework, in contrast to the 'dual economy' paradigms of the past. The extent of commercial plantation in South Africa is 1.37 million ha. The industry employs 122 000 people, roughly half in plantation forestry and half in primary processing.

The area of afforestation has been growing at an average of 4% per year for the last decade, compared to 7% per year for the expansion of cultivated land and pasture in the same period. A significant feature has been the emergence of timber small-growers, presently confined to KwaZulu.

The involvement of the Forestry Branch has been recently reduced: its research functions have gone to FORESTEK, much of its conservation responsibilities have passed to provincial conservation bodies, its plantations have nearly all been taken over by SAFCOL, and its extension support to commercial growers has been terminated. On the other hand, it has repositioned itself to play a significant role in social forestry.

Basic principles for biomass policy (Chapter 5)

Major shifts have been taking place in the analysis of the so-called 'firewood crisis', both here and internationally. This was originally perceived as a straightforward resource issue: the demand for firewood exceeded the sustainable yield, resulting in deforestation. Shortages were projected to worsen as populations grew and wood resources dwindled, resulting in accelerating degradation. The mood was alarmist. Simple supply-and-demand solutions were proposed: woodlots to increase supply, and demand mitigation through efficient stoves, paraffin subsidies, or whatever. These views have recently come under close scrutiny and found to be flawed in many respects. It is now widely acknowledged that agricultural practices and land clearing are the main causes of deforestation, rather than fuelwood collection. The resilience and regenerative capacity of woodland had not been considered. Furthermore, the responses of rural people themselves to issue were not adequately considered. These responses are coping strategies which are shaped by a whole set of rural conditions and constraints. The concept of 'regional political ecology' is described in the paper as a framework for understanding the complexity of the relationship people hold to land and resources.

The contemporary analysis has redefined the fuelwood problem in a more holistic way, acknowledging the social dimension, the context of poverty, and linking the environment to development. In practical terms this means:

- a shift away from narrow interventions focused only on fuelwood, instead of on the full potential role of trees in the rural economy and environment;
- due recognition to the value of woodland and woodland products to rural communities, and the importance of including sustainable management of woodland in wider rural development strategies;
- people-driven development, building on local practices as far as possible;
- linking the fuelwood issue to other aspects of development and the alleviation of poverty.

Management of natural woodland (Chapter 6)

There is a growing appreciation of the value of natural woodland resources in communal areas. The paper describes these resources, the value of which may be equivalent to several hundred rands per household per year. There are numerous practices which have the effect of regulating the utilisation of indigenous common

resources. Some may have a deliberate conservation intention, others may inadvertently regulate utilisation. Some of these, and the institutions which apply them, are described. In a changing society, both the institutions and the management systems are being challenged, and are having to adapt to new circumstances. The management of common property resources is a political issue which reflects local power relations. The critical issue is the strength of the community institutions which enforce the rules. The development of local institutions for resource management cannot be separated from institution building for development.

Management strategies which require radical changes to established patterns of resource utilisation are almost certainly doomed to failure. It is very important to be aware of and to understand customary practices of resource use and to build on these. In relation to fuelwood, in particular, four broad categories of regulation of tree harvesting in communal woodland have been reported in South Africa and could provide the basis of a management strategy:

- regulation of the area of woodland which may be harvested;
- regulation of the time of wood harvesting (in Transkei, for example, the headman has the prerogative to halt harvesting in certain areas for a period);
- regulation of material harvested – this applies particularly to live wood but might also apply to species;
- regulation of access – such as restriction of access to a specific group. The subject is very under-researched here, and information is scattered and anecdotal.

Resource Management Areas (RMAs) are special cases of communal area management. The main attribute of RMAs is that these are proclaimed as areas for sustainable resource use and are managed as such for the benefit of the whole community. Access to the area may be restricted, but access to the benefits should be equitable. Community control is an essential part of RMA projects, so the question of appropriate local institutions arises again.

In parts of South Africa (notably in Bophuthatswana and KaNgwane) RMAs are starting to contribute to people's resource needs as well as providing economic and employment opportunities where hunting, tourism or other commercialisation takes place.

It is not recommended that detailed policy guidelines on the management of indigenous woodland should be formulated at this stage. Instead, innovative initiatives for the sustainable and equitable use of the resources should be actively encouraged and supported. This should happen within broad rural development programmes.

Protected areas controlled by conservation agencies are potential sources of fuelwood. In only a small proportion of the conservation areas in South Africa is wood harvesting actually permitted. In some quarters, attitudes are changing towards a more people-orientated approach to conservation, but new management paradigms are still being sought to translate the new concepts into practice.

Natural woodland on commercial farmland is a major potential source of fuelwood. A small proportion of this wood is used as fuelwood for farmworker families and some is transported to areas where it is needed. Wood harvesting can be incorporated into a management strategy to control bush encroachment and invasive species, and some farmers are indeed doing this. Strategies to facilitate such transfers could benefit commercial farmers and rural communities.

Distribution and commercialisation of fuelwood (Chapter 7)

Promoting the redistribution of fuelwood from areas of abundance to areas of shortage could potentially increase the available supply of fuelwood greatly at relatively little public cost. A number of surveys have indicated that the purchasing of fuelwood is a widespread phenomenon in rural areas. The proportion of households doing so varies from almost zero to well over half, depending on local circumstances. We do not yet have enough data to say how much of the fuelwood in South Africa is actually purchased. Nor is enough known about the informal sector activities in the distribution and sale of fuelwood in order to identify the best points of intervention. Information on these networks is anecdotal and limited, but indicates that the operations may vary from area to area. Transporting of fuelwood over distances in excess of 100 km has been noted, and the theoretical maximum distance over which it can be transported economically is about 160 km, depending on local prices. Such distances bring large areas of commercial farmland and most of the commercial plantations within the range of some homeland area.

In South Africa there is not the same massive transfer of woodfuel (as firewood or charcoal) into the cities that occurs in many other parts of Africa.

Strategies for afforestation and social forestry (Chapter 8)

Looking at experience and progress to date, the paper reviews the past experience of woodlot and tree-planting programmes which began 100 years ago with the planting of the first woodlot to provide poles and firewood for rural communities. Most of the activity since has focused on woodlots. These were generally established by an administrative authority (a department of forestry or a municipality). The management of many of these woodlots was transferred to the local traditional (or so-called tribal) authority. The condition of the woodlots is often poor. They are almost without exception eucalyptus woodlots. Sizes of TA woodlots are generally between 20 and 50 hectares in Transkei and Ciskei, but are smaller elsewhere (2 – 8 ha). Departmental woodlots are mostly larger: 30 – 300 ha.

There have been very few genuine community woodlots (that is, those established and managed by communities themselves). Evidence suggests that community woodlot programmes are not cost effective if fieldworker and extension costs are included. Some families have established their own small homesite woodlots, and these may be quite common in certain areas (for example, Pondoland).

There are presently some 7 000 small-growers of timber or wattle bark. This is a burgeoning sector, although at present confined to KwaZulu. Most timber growers are supported by and contracted to a timber company, while bark producers register with the KwaZulu Department of Forestry which administers the production quotas. Wattle bark production may generate large quantities of fuelwood as a by-product. Timber growers are mostly contracted to sell their crop, but may produce fuelwood as well. About a quarter of the timber growers also have non-commercial woodlots for fuelwood.

The total areas of the different types of woodlot have been estimated:

	Hectares
Traditional authority	16 036
Institutional (eg dept or municipal)	17 450
Private non-commercial	5 295
Small-grower	10 927
Community 66 other & unclassified	12 513
TOTAL	62 287

There has been widespread disillusionment with a number of aspects of woodlots, and woodlot programmes have virtually come to a complete halt with the notable exception of small-grower schemes. Interest has shifted to broader programmes of social forestry (SF) which can be defined as the planting and/or management of trees in populated environments by local individuals, communities or groups to meet local needs whether economic, subsistence, or environmental. In South Africa, there was very little action in SF or agroforestry prior to 1990. There was a small amount of isolated and inconclusive research, and a few local SF initiatives undertaken by development NGOs. Since 1990, there has been a notable increase in SF initiatives, both in the government and NGO sectors, though the scale of the projects is still small compared to some other countries in Africa. In government, the main initiatives originated in the Energy Branch of the Department of Mineral and Energy Affairs, and the Forestry Branch of the Department of Water Affairs and Forestry. The Biomass Initiative was established by Cabinet in 1992 under an interdepartmental Steering Committee to promote SF research and pilot projects.

Current projects are varied but most are centred on a small nursery supplying trees to the neighbouring community. It is too early to evaluate these. However, there are some important points that have emerged about SF in South Africa:

- the transition from conventional forestry and woodlots to SF involves fundamental changes in approaches to rural development, extension and working with communities;
- facilities for training in SF are virtually non-existent;
- SF projects face serious constraints in the area of extension and fieldwork;
- SF projects often lack the necessary in-house technical expertise in agroforestry systems, species selection etc.

Options for the future

SF encompasses a very wide range of options for afforestation and tree dissemination, and it is recommended that these be supported and co-ordinated within a national programme for social forestry. The options described include: agroforestry (use of trees in association with crops and/or livestock), homesite tree-planting including micro-woodlots; a tree delivery system based on a network of village nurseries; village greening (such as school tree projects); and reclamation forestry (using trees in soil rehabilitation and conservation).

Woodlots should not be forgotten. The emphasis should be placed on larger managed woodlots under a trained forester, the rehabilitation of existing woodlots, and the expansion of small-growers. There are a number of issues which need attention, such as changing the afforestation permit system to accommodate mini-plantations, revising the wattle bark quota system, linking timber to other development options so that rational landuse decisions can be made, and the present isolation of small-growers from the commercial forestry sector.

Aspects of SF, particularly agroforestry and small-scale timber production, are very compatible with the small farm units which are likely to form the basis of land redistribution policies in South Africa, so an important role is seen for SF in a rural restructuring programme.

Auxiliary functions and services for SF (Chapter 9)

A national programme of SF would have to address extension and other support services for projects, training, and research. The paper makes a number of recommendations in this regard.

The whole field of rural extension should be reviewed. There is a need for new and participatory approaches to extension within a coordinated (or unified) broad-

based extension service. There will still be a need for specialists from the different sectors. Forestry should aim for a slim, well-qualified, well-paid and motivated extension service which complements, but does not compete with, other agencies.

Rural communities need support from service organisations in their tree-planting projects (such as a supply of plants, advice, access to inputs). The service organisations themselves (often small NGOs) require support too (icluding, for example, information networks, data bank, technical services, basic infrastructure, a ready supply of materials). Resources for training in SF at all levels, from village to tertiary, and for retraining existing field-staff, must be developed. The current focus at tertiary and technicon level is almost exclusively on commercial forestry. It is recommended that a body for the development and co-ordination of SF training be constituted. This might comprise three units:

- a Training Unit which would be concerned with providing a wide spectrum of training to a range of target groups;
- a Media Unit which would co-ordinate and develop media materials for training and public awareness;
- a Curriculum Development Unit which would engage with educational institutions to bring about the necessary changes to curricula.

A southern African network for training in SF would help to rationalise facilities on a regional scale, and permit exchange programmes for trainees and students.

Research also needs to be planned and coordinated in three key areas: policy research, technical research (systems, species, silviculture), and community-based and participatory research.

Economic and investment implications (Chapters 10 and 11)

Chapter 10 reviews the rather sparse information on costs of woodlot and SF projects in South Africa. The conclusions are that departmental woodlots are more expensive to establish than the norm for commercial forestry; that community woodlots may have low direct costs but very high extension costs and project overheads; and that small-grower woodlots are the most cost effective in terms of project costs per hectare planted.

Local SF programmes are too young to evaluate, but examples elsewhere in Africa indicate whole-programme costs of reasonably successful SF projects are of the order of US$1 per tree distributed. A theoretical costing suggests that similar costs might be expected here. However, some of development's horror stories are to be found in the sphere of SF, with costs of up to $580 per surviving tree having been incurred. This underlines the importance of programme management.

Chapter 11 presents a financial projection based on a scenario for a national programme for SF and fuelwood supplies. The programme would include small-grower schemes, some large woodlots, tree dissemination from a network of village nurseries, support for the redistribution of local fuelwood surpluses by the informal sector, and promoting the management of communal woodland.

The start-up and establishment costs would be R430 million, spread over a five to ten-year period, with additional annual running costs of R40 to R50 million (1993 rands). The impact on fuelwood supplies is difficult to predict, but it might conservatively be expected to increase by 1 to 1.5 million tons per year. This benefit would be relatively minor compared to the stream of other economic and environmental benefits the programme could bring.

Pricing of fuelwood (Chapter 12)

As described earlier, fuelwood in South Africa originates from a wide variety of sources. Each of these feeds into what is, in effect, a discrete energy system with its own distribution system and economics. This greatly complicates the issue of pricing. The chapter reviews some criteria for pricing policies: financial, social, and environmental. These may be in conflict, and the way in which they are reconciled will depend on broad development goals. A price may be attached to fuelwood in various ways. For example, there may be a direct selling price, or a collecting permit fee, or a stumpage fee. The conclusion is that it is not appropriate to have a pricing policy for fuelwood in South Africa, except where it is sold from government plantations and woodlots. It is suggested that the price might be based on recovery of recurrent and re-establishment costs, but not initial establishment costs. In certain situations an 'environmental subsidy' might be placed on fuelwood.

An institutional framework (Chapter 13)

New policy directions for forestry have profound implications for the future role of the state in forestry, and for institutional status and location of the sector within government. An institutional framework is required for the planning, coordination and implementation of SF which straddles so many different sectors. An institutional structure needs a clear point of entry for funds and effective mechanisms for delivering the funds to where they are needed. An institutional capacity is required at three broad levels:

- at the national level for policy, overall coordination, international linkages (esp within southern Africa);
- SF programmes would be operationalised at the regional level and integrated into rural development programmes, integrated energy plans, etc;
- the development of institutional and organisational capacity at local level is needed for project implementation which requires the accessing coordination and timing of a range of inputs and support services. This is a crucial component of SF projects, particularly those concerned with the management of common resources. Devolution of control of resources to a local level is the cornerstone of contemporary strategies.

For the present, it is suggested the Forestry Branch is best positioned to provide an institutional base for a national programme of SF.

NGOs can play a vital role in project implementation and in developing innovative approaches to SF. The resources and support should be available to NGOs to enable them to operate effectively in the roles to which they are best suited. It is recommended that, as a starting point, a national advisory and coordinating forum for SF be convened, composed of people from the various disciplines and sectors connected to SF, and have both government and non-government representation. The forum might eventually be constituted as a statutory council.

Summary of recommendations (Chapter 14)

The reader is referred to Chapter 14 for a brief summary of all the recommendations made in the report. Of fundamental importance is the establishment of an national programme for social forestry with the necessary institutional framework and funding base for planning, coordination and implementation. While SF could be located within the forestry sector and be part of a national forestry policy, it must also be truly multi-sectoral. It cannot be isolated from integrated rural development strategies, from conservation strategies or from integrated energy planning.

Contents

CHAPTER ONE

Introduction

This paper forms part of the Energy Policy Research and Training (EPRET) project carried out at the Energy for Development Research Centre (EDRC) at the University of Cape Town. EPRET was a two-year programme to develop policy options for widening access to basic energy services for the urban and rural poor. The focus of this paper is on policy options in the area of fuelwood supply.

Fuelwood is the staple energy of the rural poor. It provides about four-fifths of the total domestic energy to this sector. It is used for cooking and space heating in nearly all rural homes, often in combination with other fuels. The primacy of wood in the rural energy economy is expected to continue, in the medium term at least, even if there is a vigorous programme of rural electrification and access to transitional fuels is improved.

In another of the EPRET papers (Trollip 1993), it has been projected that existing energy policies and electrification initiatives (that is, with no new interventions) will result in electrification of 20% of rural homes by 2010. Another (best case) scenario based on a range of interventions in integrated energy planning, is expected to result in 80% of all homes being electrified – but only 47% of rural homes (Trollip 1993).

However, in the electrified homes high rates of wood use may still persist. If there were to be widespread rural electrification, various low-cost options would have to be considered, including limited wattage, which would be insufficient for most cooking and heating requirements. Even in rural homes with a 60 amp supply, other fuels (particularly wood) are still commonly used for cooking, and electricity is hardly ever used for space heating. We are evidently not on the threshold of a spectacular decline in fuelwood demand.

In some areas there is evidence of declining and degrading woodland. Some surveys have highlighted the difficulties rural households may face in meeting their fuelwood needs and the long hours spent collecting wood. There is plenty of evidence that fuelwood shortages do exist, and that remedial action is necessary.

Fuelwood is a conditionally renewable resource: the extent to which it is renewable depends on the extent to which it is exploited. The balance between the actual offtake and the sustainable yield is critical. As a starting point for rational planning, this paper reviews the existing data on fuelwood consumption in South Africa, and on the extent and productivity of the resource base.

It must be emphasised that this is only a starting point. The 'fuelwood problem' is not simply a problem of supply and demand. It is inseparably tied to a host of other factors which include the diverse pressures on rural environments, people-resource interactions, general issues of poverty, alternative energy options and rural development directions.

The aims of this paper are:

- to try to understand the nature, extent and context of the fuelwood problem;
- to make recommendations on broad strategies to meet fuelwood needs; and
- to suggest guidelines for a policy and institutional framework within which these strategies can be funded, coordinated and implemented.

CHAPTER TWO

Fuelwood consumption

2.1 The database

2.1.1 Quantitative surveys

When le Roux (1979) made the first published estimate of the consumption of fuelwood by rural populations in South Africa, there was not one shred of local consumption data available, and he had to rely entirely on the results of surveys conducted outside South Africa. Best (1979) was the first to attempt to quantify fuelwood consumption by a rural community in South Africa. The database has gradually been enlarged as subsequent surveys have been conducted. Of these, only one research project (Eberhard 1986) aimed at forming a national picture of energy consumption patterns in rural and peri-urban areas, and selected the study areas accordingly. Despite the haphazard nature of research on rural energy consumption in South Africa, there is a reasonable spread of data points covering different regions, settlements and bio-climatic types. There is, however, a predominance of data from KwaZulu, Transkei, Gazankulu and Bophuthatswana. There is no published data at all from Venda, KaNgwane or KwaNdebele.

Area	*Annual fuelwood consumption*		*Source*
	kg/capita	*kg/household*	
RURAL:			
Bophuthatswana (Bodibe)	237	1387	(Eberhard & Dickson 1987)
KwaZulu (Ezingolweni)	251 *	1 205	(May et al 1993)
Transkei (Jozanna's Nek)	270	1 700	(Best 1979)
Bophuthatswana (Ganyesa)	297	1 223	(Eberhard & Dickson 1987)
Bophuthatswana (Madutle)	302	2 124	(Eberhard & Dickson 1987)
KwaZulu (Hlanganani)	371 *	2 040	(May et al 1993)
Bophuthatswana (Dinokana)	375	2 530	
KwaZulu (Emzumbe)	394 *	2 522	(May et al 1993)
KwaZulu (Ingwavumu-1)	409	3 033	(May et al 1992)
Transkei (Clarkebury)	484	2 753	(Eberhard 1986)
Bophuthatswana (Deerward)	485	2 792	(Eberhard & Dickson 1987)
Transkei (Nkanga)	498	3 777	(Eberhard 1986)
Gazankulu (refugees/Mhala)	500	4 146	(Griffin et al 1992)
Gazankulu (Athol)	505	3 674	(Griffin et al 1992)
KwaZulu (Nquthu)	506 *	3 390	(May et al 1993)
Gazankulu (Xanthia)	540	3 939	(Griffin et al 1992)
Gazankulu (Welverdiend)	560	4 751	(Griffin et al 1992)
Gazankulu (Cottondale)	572	3 580	(Eberhard 1986)
KwaZulu (Mahlabatini-1)	620	4 712	(Gandar 1988)
KwaZulu (Mabibi)	610	5 444	(James 1992)
KwaZulu (Ongoye)	615 *	3 259	(May et al 1993)
KwaZulu (Makaza)	640	6 400	(Cleminson 1993)

Transkei (Manzimahle)	650	2 845	(Eberhard 1986)
Lebowa (Mokumuru)	655	3 358	(Eberhard 1986)
KwaZulu (Mahlabatini-2)	740	5 624	(Gandar 1988)
KwaZulu (Nkandla)	756 *	5 065	(May et al 1993)
Gazankulu (Giyani dist)	760		(Liengme 1983)
Ciskei (Lujiko)	766	3 402	(Eberhard 1986)
Bophuthatswana (Loopeng)	772	3 978	(Eberhard & Dickson 1987)
KwaZulu (Ingwavuma-2)	806	6 884	(May et al 1992)
KwaZulu (Hlabisa)	879 *	7 559	(May et al 1993)
KwaZulu (Mashunka)	1 120	4 820	(Best 1979)
Namaqualand (Richtersveld)		1 634	(Borchers et al 1990)
Namaqualand (Leliefontein)		2 743	(Borchers et al 1990)
Natal (Scheepersdal)		4 429	(Gandar 1990a)
KwaZulu (KwaBiyela)		5 074	(Gandar 1990a)
SEMI-RURAL/PERI-URBAN:			
Bophuthatswana (Amatelang)	26	263	(Eberhard 1986)
QwaQwa (7 villages)	40	343	(Eberhard 1986)
Boph (Mmabatho/Mafikeng)	134	908	(Eberhard & Dickson 1987)
KwaZulu (Dukuza Village)	173 *	1 211	(May et al 1993)
W Cape (Crossroads)	213	1 527	(Eberhard 1986)
Gazankulu (Okkerneutboom)	376	2 892	(Griffin et al 1992)
Gazankulu (Rolle)	450	3 516	(Griffin et al 1992)
E Cape (New Bethesda)	648	3 042	(Eberhard 1986)
KwaZulu (Vulindlela)	742	5 213	(Eberhard 1986)
Namaqualand (Steinkopf)		1 156	(Borchers et al 1990)
Namaqualand (Komaggas)		1 279	(Borchers et al 1990)
Namaqualand (Concordia)		1 372	(Borchers et al 1990)
Namaqualand (Pella)		4 100	(Borchers et al 1990)
FARMWORKERS:			
E Transvaal 792		3960	(Gandar 1992)
Natal	818	4950	(Gandar 1992)
W Transvaal	934	5734	(Gandar 1992)

Note: Entries marked with an asterisk were calculated for wood-using households only. May et al (1993) state that the proportion of wood users in the whole sample is 79% (52) and 80-90% (84).

TABLE 2.1 Summary of fuelwood consumption estimates from surveys in non-urban communities in South Africa

The distinction made in Table 2.1 between 'rural', 'semi-rural' and 'peri-urban' is unclear and somewhat arbitrary. In some studies, survey areas have not been described in sufficient detail to locate them accurately on the urban-rural continuum. In broad terms, 'rural' refers to scattered homesteads and to small isolated closer settlements. The semi-rural/peri-urban category refers to larger closer set-

tlements with relatively high employment and lying adjacent to major transport routes, and to settlements close to metropolitan areas or towns.

2.1.2 Reliability of data

Attention has sometimes been drawn to the unreliability of fuelwood estimates in the international literature (Foley 1988; Eberhard 1992). The main methodological tool in estimating fuelwood consumption is a questionnaire survey which is recognised as being a blunt instrument for research. Nevertheless, when Griffin et al (1992) used actual measurement to crosscheck questionnaire survey results in Gazankulu, the surveys were found to be remarkably accurate. On the other hand, Kennedy (quoted by Griffin et al 1992) working in the same area found that users' estimates of wood consumption generally exceeded measured consumption.

There are numerous methodological difficulties with fuelwood consumption measurements, particularly the variability of numerous factors. Firstly, changes in consumption with season and weather are difficult to account for except by continuous monitoring over the period of a whole year. Secondly, variability between households and areas poses sampling problems. Also, household sizes vary greatly from area to area. It is notable that the order of entries in Table 2.1, which are ranked according to fuelwood consumption per capita, would be very different if entries were ranked according to consumption per household. Thirdly, working in remote areas poses problems with regard to the supervision of enumerators and quality control of the data.

Most of the data in South Africa is derived from questionnaire surveys. Generally the sample sizes and procedures have been statistically adequate, although there are some data points which have been based on small samples. This is particularly true of the data on farmworkers, which has come from a single study which was limited in scope. Two other data points (Gandar 1990a in Table 2.1) are based on a mere four or five households in which fuelwood was weighed regularly over the period of a whole year.

In fuelwood consumption studies, the moisture content of the wood is very seldom measured. Data is generally assumed to refer to the weight of wood as it is used. Gandar (1988) found this to have an average moisture content of 17%, compared to air-dried wood with a content of 10-12%, or freshly cut wood with a moisture content of 30-60% depending on the species.

2.1.3 Work in progress

A national wood and fuelwood survey is currently being undertaken by Planning and Energy Research as part of the Assessment Component of the Biomass Initiative Programme. This will add a further 84 data points to the information base on fuelwood consumption in South Africa, and give a much clearer picture of regional patterns of fuelwood consumption. The existing data points are presently being fed into a geographic information system at the Institute of Natural Resources. This will allow interrogation of the data to identify some of the factors responsible for the variability of fuelwood consumption. Some 45 studies contain rural energy data from 99 rural places (S Ward, personal communication).

2.2 Variability of fuelwood consumption

The data on fuelwood consumption in rural communities shows considerable variability from 26 to 1 120 kg/cap/year. It is an ironic coincidence that the highest mean consumption of fuelwood per household ever recorded in South Africa (7 559 kg/year) was in a newly electrified rural community near Hlabisa (May et al 1993).

Viljoen (1989) describes a domestic energy transition process in which domestic

energy moves from biomass through transitional fuels to modern fuels as part of a modernisation/urbanisation process. The paradigm is useful in explaining changing energy consumption patterns particularly in peri-urban situations where fuel-switching is most common. The driving forces might include access, amenity, affordability and aspirations or quality of life. Sometimes the precise driving force is not clear and Viljoen suggests there is also a stochastic component involved.

In rural areas where modernisation influences are not strong and where fuelwood is still the main source of energy, much of the variability can be explained by differences in local availability. This has been demonstrated by some surveys which included different communities in the same district:

Ingwavuma, KwaZulu, well-wooded plains:	806 kg/cap/yr
Ingwavuma, KwaZulu, sparsely wooded foothills:	409 kg/cap/yr
Mahlabatini, KwaZulu, valley lowveld:	740 kg/cap/yr
Mahlabatini, KwaZulu, high grassland:	620 kg/cap/yr

(May et al 1992, Gandar 1988).

On the other hand, fuelwood consumption in four communities in relatively uniform Terminalia-Acacia-Combretum bushveld in the Mhala District (Gazankulu) were clustered in the narrow range of 500 to 560 kg/cap/year (Griffin et al 1992).

Little has been published on the determinants of fuelwood consumption at a household scale. There is evidence, albeit inconsistent, that wood consumption is related to income. May et al (1993) found that people who used wood were the poorest. However, no correlation between income and wood consumption could be found in the Vulindlela data set of Eberhard (1986) which was analysed by Bromberger and Gandar (unpublished). In some, but not all, of the communities covered by the Namaqualand household energy survey, there was an evident trend of decreasing wood use with increasing income (Borchers et al 1990).

Some unexpected factors have been found to have a bearing on rural energy consumption, and serve to highlight the fact that energy consumption is a product of a complexity of influences:

- In a KwaZulu survey it was found that per capita fuelwood consumption was higher in households in which a male head of household resided permanently at home (Gandar 1988).
- The presence of school-going children in the family is a principle factor shaping the energy profile of the household (May et al 1992).
- The type and structure of a homestead (whether it is a single structure or multistructured homestead) not only affects whether a household adopts a new fuel or appliance, but also the extent to which this fuel is used (May et al 1993).

2.3 Domestic fuelwood consumption on a national scale

2.3.1 Rural areas in the homelands

The most thorough attempt to produce an estimate of the total consumption of fuelwood was that of Aron et al (1989), but it concentrated only on the homeland areas. The authors estimated total fuelwood consumption in the homelands in 1980 and the projected consumption in the year 2000 as follows:

1980: 5.5 million tons per year
2000: 8.3 million tons per year.

The main obstacle to deriving a good estimate of total fuelwood consumption is the problem of disaggregating the data. This applies to both consumption and demo-

graphic data. When the new data, which will soon emerge from the work in progress mentioned above, are added to the existing database, much more accurate projections of fuelwood production will be possible. However, the lack of detailed and reliable information about rural demography and settlement patterns will remain a constraint.

	Area km²	*Population*		*No of rural households*	
		total 000s	*density per km²*	*official 000s*	*functional 000s*
Boph'tswana	41 526	1 921	48	275	98
Ciskei	8 231	803	98	76	18
Gazankulu	7 484	717	96	116	90
KaNgwane	3 917	600	153	81	30
KwaNdebele	2 208	425	192	56	21
KwaZulu	36 074	4 979	138	605	438
Lebowa	22 137	2 659	120	361	255
QwaQwa	1 040	293	282	42	18
Transkei	4 365	3 104	71	451	421
Venda	6 807	525	71	79	68
TOTAL	173 078	16 026	93	2 142	1 457

Note: The official number of rural households is based on government census statistics. The functional number of rural households is based on DBSA criteria whereby peri-urban areas from which people commute to urban areas for work and shopping, and semi-urban concentrations in excess of 5 000 people, are regarded as being 'functionally urban'. In all instances the official rural count exceeds the functional rural count.

TABLE 2.2 Details of population size and density in the homelands

Since the 1989 estimate of fuelwood consumption in the homelands (Aron et al 1989), the database has been enlarged. To update the estimate, the demographic statistics in Table 2.2 will be used here. From the data summarised in Table 2.1, the annual consumption of firewood per household has been estimated for each homeland. Where there is adequate data from an area, the mean household consumption was calculated, otherwise a discretionary figure was used (Table 2.3).

In each case there is a rural estimate and a semi-rural/peri-urban (sr/pu) estimate of fuelwood consumption. It is assumed that the 'functionally' rural households (Table 2.2) consume fuelwood at the rural rate. Households which are 'officially' rural but not 'functionally' rural are assumed to consume it at the sr/pu rate.

	Annual consumption per household (kg)		Estimate of total annual consumption (000 tons)	
	rural	*sr/pu*	*EPRET*	*EDRC*
Boph'tswana	2 400	1 400	483	678
Ciskei	3 400	2 280	193	266
Gazankulu	4 100	3 200	452	414
KaNgwane	4 000	3 200	283	237
KwaNdebele	2 400	1 400	98	102
KwaZulu	3 910	2 890	2 193	1 102
Lebowa	3 800	2 850	1 271	1 054
QwaQwa	1 000	340	26	12
Transkei	2 950	2 300	1 311	1 332
Venda	4 200	3 280	315	291
TOTAL			6 625	5 488

Note: The estimate derived as described in the text is referred to as the EPRET estimate. It is based on the putative consumption by rural and sr/pu households as listed. The EDRC estimate comes from unpublished work in progress at the Energy for Development Research Centre, University of Cape Town.

TABLE 2.3 Estimates of fuelwood consumption by rural communities in the homelands

The estimates of fuelwood consumption derived for this paper (EPRET estimates) are compared to those which have come from work in progress at EDRC. The fact that there are some large discrepancies between the two sets of estimates (which have been derived from more or less the same database) highlights the inadequacy of the existing database. The main discrepancies are in:

i) KwaZulu: the reason for the discrepancy is unclear, but it does have a very large impact on the estimate of total wood consumption.

ii) QwaQwa: there is very limited data from QwaQwa, and its unique situation and exceptionally high population density make it risky to extrapolate from other areas.

iii) Ciskei: on DBSA criteria, only 15% of the population is classed as 'functionally rural' (see Table 2.2). This probably underrates the rural character of Ciskei and results in the EPRET estimate being on the low side.

iv) Bophuthatswana: similar discrepancy and similar explanation as for Ciskei, above.

2.3.2 Farmworkers

There has been very little quantitative research on fuelwood consumption by farmworkers. On the basis of a restricted sample it was estimated that the total annual consumption by farmworkers living in Natal and Transvaal is 2 190 000 tons altogether made up as follows:

Natal: 560 000 tons
Transvaal: 1 630 000 tons (Gandar 1992).

There is no data from the other provinces, but it might be expected that fuelwood consumption is slightly lower than in Natal/Transvaal. The total fuelwood consumption by farmworker families on commercial farmland throughout South

Africa is expected to be about 3.5 million tons.

2.3.3 Low-income urban households

Urban energy consumption data has been synthesised by Afrane-Okese (work in progress at EDRC). The consumption of fuelwood was analysed by region and by dwelling type and the results are summarised in Table 2.4. As with the rural energy data set, the urban data also has many gaps which had to be filled with extrapolations and assumptions.

Region	Housing Type					Total
	FE	FnE	PS	US	BS	
A (S Cape)	14	226	284	250	282	1 056
B (N Cape)	3	1 443	687	13	105	2 279
C (OFS)	48	1 738	1 367	493	332	3 978
D (E Cape)	0	632	889	740	270	2 531
E (Natal)	13	2 966	335	657	709	4 680
F (E Tvl)	30	1 272	1 442	409	170	3 323
G (N Tvl)	1	278	6 928	1 134	25	8 366
H (PWV)	3 493	2 177	3 344	1 210	8 25	18 475
J (W Tvl)	134	1 308	2 698	860	356	5 356
TOTAL	3 764	12 040	17 974	5 760	10 500	50 044

Key: *FE: formal electrified*
FnE: formal non-electrified
PS: planned shack (site and service)
US: unplanned shack settlement
BS: backyard shack

TABLE 2.4 Total monthly fuelwood consumption per household in the low-income urban sector in South Africa (EDRC, work in progress)

This gives a total annual fuelwood consumption in the low-income urban sector of 0.60 million tons for all the regions together.

2.3.4 Other domestic fuelwood consumption

There are also poor rural families, other than farmworkers, who live outside of the homelands and who also depend on firewood to meet a large part of their energy needs. These include:

- communities on freehold areas belonging to black landowners, or 'black spots' as these areas were called;
- former labour tenant families which have lived for generations on what were once 'labour farms'; and
- coloured communities in the northern Cape.

The only relevant energy data comes from the Namaqualand survey of Borchers et al (1990) and from monitoring wood consumption by former labour tenant families at Scheepersdal in Natal (Gandar 1990a).

No estimate has been made of the total wood consumption by this miscellaneous group. It is unlikely to exceed 0.5 million tons per year, so it does not significantly affect the aggregate fuelwood consumption in South Africa, though it may be important locally.

Fuelwood is also used in mid-to-high-income households for space heating and barbecues, but this falls outside of the scope of the EPRET project.

2.3.5 Summary of fuelwood consumption

Despite numerous gaps in the available data, we estimate that the total amount of fuelwood used by low-income households in South Africa is a little over 10 million tons per year (see Table 2.5).

	Fuelwood consumption (million tons/year)
Homelands (rural & semi-rural)	6.6
Farmworker families	3.5
Other rural	<0.5
Urban	0.7
TOTAL	11.3

TABLE 2.5 The consumption of fuelwood for domestic energy in low-income households in South Africa.

CHAPTER THREE

Fuelwood resources

3.1 Woodlots

3.1.1 Area of woodlots

In the homelands, there are some 62 000 ha of woodlots, of which 68% are located in Transkei. The type and condition of the woodlots is very variable, as described in detail in Section 8.1. Table 8.2 in Chapter 8 lists seven types of woodlot, which basically fall into three main categories:

i) Some 33 000 ha have been established by formal woodlot programmes. The condition of these is variable, mostly moderate to very poor. The woodlots in better condition tend to produce more building poles than firewood, while some in very poor condition produce only scraps of firewood.

ii) Woodlots belonging to small growers of timber and wattle bark cover 11 000 ha and are only found in KwaZulu. The crop from 60% of this area is sold to timber companies under contract, with firewood available only from harvest residues and coppice reduction. However wattle bark growers might produce more substantial amounts of firewood as a by-product.

iii) There are an estimated 18 000 ha of private non-commercial and unclassified woodlots, but the estimate is very rough. Very little is known about the condition and productivity of these.

3.1.2 Productivity of woodlots

If all existing woodlots were in reasonably good condition and were geared specifically to fuelwood production, they could produce close to one million tons of wood per year. In practice, the productivity and product mix of woodlots is unknown. From the fragments of information, it can be deduced that woodlots supply roughly 2% of the fuelwood consumed in the homelands (or just over 100 000 tons per year).

3.1.3 Farm woodlots

These are woodlots on commercial farms primarily for on-farm requirements, as opposed to producing commercial timber. A survey of farms in Natal and Transvaal revealed that 30% of farms had woodlots (Gandar 1992). The mean area of these woodlots was 11.8 ha, but three-quarters were 10 ha or smaller, and 70% of them provided some fuelwood for farmworkers. Energy for farmworkers is the subject of another EPRET report (Hofmeyr 1993).

3.2 Commercial forestry

The total area under commercial timber in South Africa is 1.37 million ha (refer to Section 4.1 for a detailed overview of the commercial forestry sector). Timber harvesting generates large amounts of residues which have to be disposed of since these interfere with forestry operations and constitute a fire hazard. These plantation residues are a potential source of fuelwood, and indeed are used to an extent.

There has been no recent inventory made of the plantation residues, and there are discrepancies between older estimates (White 1978; Cohen et al 1980). The amount of plantation residues produced annually in South Africa probably ranges from two to four million tons.

The homelands contain 9.6% of the commercial plantations, and the residues from these would be in demand locally. Fuelwood is sometimes transported 100 km, so nearly all of the plantations in Transvaal and Natal (80.6% of the total) would be within range of a potential fuelwood market. It is only some of the Cape plantations (9.8% of the total) which would be inaccessible.

In addition, the wood processing industry produces roughly one million tons of waste per year. This is a less promising fuelwood resource since much of it would have to be reconstituted before it can be used as fuel (for example sawdust and pine bark), and has other competing uses as energy for the mill itself or for non-energy purposes.

3.3 Self-seeded exotics

Self-seeded exotics are an important source of firewood on commercial farmlands. In Natal and Transvaal, fuelwood from these sources provides energy for farmworkers on 33% of farms (Gandar 1992). From postal questionnaire replies from 300 farms in these two provinces, it was tentatively estimated that the sustainable yield from self-seeded exotics is about 40 tons per year per farm (Gandar 1992). There is no comparable data from the other provinces, but exotic vegetation is clearly a potential fuelwood resource, particularly in the winter rainfall regions of the Cape. A yield of 40 tons per year per farm over the whole country would imply a national yield of about 2.5 million tons from self-seeded exotics on commercial farms.

Apart from supplying farmworkers, there are reports of large quantities of fuelwood from invasive wattles on commercial farmland being transported to the homelands (Gandar 1988 and 1992, McClintock 1988).

There is no information on the extent or yield of exotics growing in the homelands, but in a significant proportion of these areas, exotics are an important fuelwood resource.

3.4 Indigenous woodland and forest

3.4.1 Indigenous forest

South Africa has very limited indigenous forest. Official statistics put the total area at 165 000 ha (or 0.14% of the land area) of which, 128 000 ha is under some form of state control (Aron et al 1989). The figure includes high forest and coastal scrub forest. However, Brink and Van der Zel (1980) give a significantly higher figure of 300 000 ha of forest in the areas south of the Limpopo (but still only 0.2% of the land area). A more recent estimate of the area of forest in South Africa (including closed-canopy thicket) is 605 000 ha (Kruger et al 1993). The discrepancies are largely a result of inconsistent classification.

Large amounts of firewood were extracted from forests in the eighteenth and early nineteenth centuries (Muir 1990). Now only the collection of dead fuelwood, if any, is allowed in protected forests. Since much of the dead wood in forests partially decays in the canopy before falling to the ground, very limited suitable firewood is available.

Island patches of forest, often surrounded by grasslands, become foci of exploitation by surrounding populations. Little is known about the potential yield of these. It makes more sense to classify this vegetation type as a grassland/cultivation/forest mosaic rather than include the small forest islands in the forest category.

Research on the sustained yield of indigenous forest has focused on the extraction

of high value timber. Despite the large amount of woody biomass, annual wood production in indigenous forest is low. Growth rates range from 0.5% to 1.6% per year (Van Dalen 1988) which is much lower than those measured in savanna (see below).

Given the small area of indigenous forests, the low productivity, and the restrictions on gathering wood in state forests, these constitute an insignificant fuelwood resource in absolute terms, though forests may be important locally.

3.4.2 Savanna woodland and shrubland

3.4.2.1 Description

In South Africa, the savanna woodlands are the main source of fuelwood and the largest single fuelwood resource. (The term savanna refers to plant communities with both a tree and shrub stratum, and a conspicuous herbaceous layer composed of grasses and forbs.) South African savannas may vary in terms of the density and volume of the woody component, ranging from sparse shrubland to open woodland to dense thicket formations. Climatic and edaphic factors are regarded as the prime determinants of the distribution of savanna woodlands, which generally occupy tropical and sub-tropical regions between the high rainfall canopy forests and semi-arid grasslands.

Two main divisions occur within the savanna woodland biome, namely the more moist, mainly broadleaf savannas generally on less fertile (dystrophic) soils, and the semi-arid microphyllous savannas on more fertile (eutrophic) soils and in which the genus Acacia is well represented (Huntley 1982). In South Africa, this broad division is not always as distinct nor are the woodlands as well developed as in countries to the north (for example Zimbabwe and Zambia) where extensive areas are covered by, for example, tall 'miombo' woodland or Kalahari thornveld. Within South Africa, a mosaic of woodland types is common.

Examples of broadleaf types include Terminalia sericea – Burkea africana woodland, Combretum apiculatum woodland, and the arid Colophospermum mopane woodland north and east of the Soutpansberg range and in the Limpopo River basin. In the north-west of the country, on deep sands, mixed Kalahari thornveld, with Acacia erioloba, predominates. In the south-eastern Transvaal lowveld and Zululand, taller woodlands with species such as Schotia brachypetela, Scleryocarya birrea, Ziziphus mucronata, Trichelia emetica, Albizia adianthifolia, Syzygium cordatum, and well developed riparian woodland occur. In the eastern Cape, a succulent 'valley bushveld' transitional thicket is found in the larger valleys.

3.4.2.2 Summary of biomass studies

Given the diversity of savanna woodland and shrubland types, it is not surprising that the published biomass data cover a whole order of magnitude (Table 3.1). In some instances the published figures have been adjusted to make the measurements consistent (that is air-dry wood mass). The table does not cover the full possible range, and there may be patches of woodland in which the biomass exceeds 25 tons/ha. For example, prime undisturbed mopane woodland with 35-40 twelve-metre tall trees per hectare, has a wood biomass approaching 50 tons/ha, and floodplain Acacia communities of 4-6 metre tall A tortilis with 8-12 metre tall A xanthoploea emergents has a wood biomass of the order of 26 tons/ha (East African Technical Services 1990). Examples of such woodlands can be found in South Africa.

kg/ha (air dry)	Wood biomass site description, comments and source
22 900	Mopane woodland, eastern Transvaal, height about 2.5m, 3 000 stems per ha (Scholes 1988)
21 300	Valley lowveld, Mahlabatini District, KwaZulu. Mixed Acacia and broadleaf rangeland. Mean for the whole area (including arable, abandoned arable and residential areas) was 17 300 kg/ha (Gandar 1988)
20 800	Burkea – Terminalia woodland, northern Namibia (Rutherford 1975)
20 000	Dense Albizia versicolor – Pterocarpus angolensis woodland, with canopy height from 10 to 15 metres, Driekoppies, KaNgwane (Stalmans 1993)
18 900	Terminalia-Acacia-Combretum woodland, eastern Transvaal lowveld, no wood harvesting for at least 25 years (Shackleton 1993a)
18 500	Combretum apiculatum – C zeyheri woodland, Kruger National Park. Only these two dominant species, which comprised 85% of crown cover, were included in the estimate of biomass (Drayton 1978)
17 300	Mopane woodland. Mean of three sites in south-east Zimbabwe with a range of from 8 200 to 28 000 kg/ha. (Kelly & Walker 1976)
17 410	Terminalia-Acacia-Combretum woodland in Mhala District Gazankulu. The site which has been subject to wood harvesting for decades, is adjacent to the unharvested site above (Shackleton 1993a)
16 700	Burkea africana woodland on Nylsvley Nature Reserve, northern Transvaal (Rutherford 1982)
11 500	Combretun apiculatum woodland on ridge granites, eastern Transvaal (Scholes 1988)
5 800 – 11 000	Terminalia – Grewia woodland in the Matsheng area, south-central Botswana (White 1979)
5 560	Very open Acacia nigrescens woodland on bottomlands, eastern Transvaal. About 6 dominant trees per hectare (Scholes 1988)
4 600	Acacia nilotica – A tortilis mixed shrubby woodland on hillsides in a woodland-grassland mosaic, Mahlabatini District, KwaZulu. Heavily utilised and degraded area (Gandar 1988)
3 000	Degraded and shrubby Terminalia woodland, interspersed with from 5 to 10m tall Scleryocarya. Heavily utilised. Driekoppies, KaNgwane (Stalmans 1993)
2 500	Lands and fallow lands in cleared lowveld. Isolated large trees have been spared. Driekoppies, KaNgwane (Stalmans 1993)
2 000	Hydromorphic grassland with scattered Acacia sieberana and Terminalia sericea. Midslope bands along seepage lines subject to intermittent waterlogging. Driekoppies, KaNgwane (Stalmans 1993)

TABLE 3.1 Published data on wood biomass in savanna areas in southern Africa

3.4.2.3 Rate of wood production

As a rule of thumb, the rate of wood production in savanna is, conservatively, about 4% per year of the standing wood biomass, or more than double that in forest (see above). Examination of somewhat disparate information indicates that radial growth is about 3% of wood biomass per year on average (Rutherford 1978) and shoot production is about 1%, though in shrubbier physiognomic forms the latter is higher. The data in Table 3.2 indicate higher rates of growth but the ratio of about 3:1 for radial growth:shoot growth is fairly constant.

Wood production in moderately disturbed savanna woodland is higher than in undisturbed areas. A comparision of average radial growth in utilised valley

lowveld in KwaZulu, and an area in the adjacent Umfolozi Game Reserve, revealed growth rates of 5.65% and 3.5% respectively (Gandar 1988). The percentage increment was higher in young trees than older mature trees, and radial increment in coppice regrowth was found to be 70% higher than in an uncoppiced control sample. This explains the higher of the two production rates (B) in Table 3.2.

	Biomass	*Radial production*		*Shoot production*		*Total production*	
	kg/ha	*kg/ha*	*%*	*kg/ha*	*%*	*kg/h*	*%*
A	16 700	720	4.31	259	1.55	979	5.86
B	17 320	979	6.65	332	1.92	1 311	7.67

A – *Burkea africana woodland, Nylsvley, northern Transvaal (derived from the data of Rutherford 1975)*

B – *Valley lowveld, Mahlabatini District, KwaZulu (Gandar 1988)*

TABLE 3.2 Data from two studies which have specifically measured wood biomass and production in savanna

3.4.2.4 Aggregate wood biomass and production

Two inventories of the biomass and production of indigenous woodland in South Africa have been published (Aron et al 1989, Millington et al, in press). A further estimate has been made of the potential fuelwood production in Savanna woodland in South Africa (Kruger et al 1993). While these are not directly comparable, there appears to be a large discrepancy between them. The total wood biomass in South Africa was estimated to be 1.7 billion tons with an annual sustainable yield of 54 million tons (Millington et al, in press). This includes forestry plantations which are responsible for the bulk of the forest/plantation category in Table 3.1 (that is 8.3% of wood biomass, but 21.9% of sustainable yield). The true savannas are estimated to contain 80.5% of the wood biomass, and produce 60.8% of the sustainable yield (derived from sub-divisions of vegetation not included in Table 3.1). This includes shrub savannas, such as Acacia bushland on Kalahari sands.

The other published inventory only covers indigenous woodland and shrubland in the homelands and only gives estimates of the sustainable yield, not the total wood biomass (Aron et al 1989). The total production in the homelands was estimated to be 11.6 million tons (Table 3.4). We therefore have estimates for the annual production of indigenous woodland of some 40 million tons per year (based on Millington et al, in press) for the whole country, while that in the homelands, which constitute only 13% of the area, is 11.6 million.

Subsequent data indicates that some of the assumptions of Aron et al (1989) probably overestimated woody biomass production. The figure of 11.6 million tons should be regarded as an upper limit. The figure for wood production of Millington et al (in press) might also be an overestimate. By far the largest biomass class in Table 3.1 is broadleaf woodland. The estimated biomass in this class is equivalent to 66 tons/ha, which is way in excess of anything measured in this country (see Table 1). This is partially offset by the low yield (1.4% of biomass per annum) which was assumed for this class. These biomass and production figures might possibly apply to mature miombo woodland in countries to the north, but not to the broadleaf savannas here (for example entry A in Table 3.2).

A more conservative estimate puts the potential production of *firewood* (as opposed to total wood biomass) at 8.4 millions tons per annum from all the savanna woodland in South Africa (Kruger et al 1993). In this projection, the area of woodland is taken to be 422 000 km^2, or 34% of the total area, made up as follows: moist woodland – 55 394 km^2; arid woodland – 366 437 km^2 (shrublands were excluded). The estimate is derived from regressions relating tree basal area and

biomass to mean annual rainfall, and on observations relating mean annual increment in southern African woodlands to standing biomass. The authors do not give the criteria by which potential fuelwood is defined, or what percentage of total wood biomass it constitutes.

In summary, the following estimates have been published for wood production in South African savanna woodland:

- 40 m tons pa (whole country) (Millington et al, in press);
- 11.6 m tons pa (homelands only) (Aron et al 1989);
- 8.4 m tons pa (firewood only) (Kruger et al 1993).

Vegetation type	*Area*	*%*	*Biomass*	*%*	*Yield*	*%*
Desert	79	6.5	0	0.0	0	0.0
Grassland	221	18.1	50	3.0	2.2	4.1
Transit. wooded grassland	173	14.2	11	0.7	1.7	3.2
Shrublands	352	28.9	283	17.0	17.6	32.7
Thickets/bushland	129	10.5	221	13.2	2.7	5.0
Acacia woodland mosaic	142	11.7	317	19.1	9.0	16.6
Broadleaf woodland	96	7.9	634	38.1	8.8	16.3
Cultivation/forest /woodland mosaic	6	0.5	9	0.6	0.1	0.2
Forests and plantations	23	1.9	138	8.3	11.7	21.9
COUNTRY TOTAL	1221	100	1665	100	53.9	100

TABLE 3.3 The total area (in km^2 x 1 000) covered by broad physiognomic categories of vegetation in South Africa together with the total wood biomass and sustainable yield (in millions of tons)
Source: Millington et al (in press)

Area	*Sustainable yield of wood (tons x 1 000)*
Bophuthatswana	1 514
Ciskei	702
Gazankulu	1 739
KaNgwane	356
KwaNdebele	120
KwaZulu	1 300
Lebowa	2 176
QwaQwa	0
Transkei	2 396
Venda	1 301
TOTAL	11.6 million tons

TABLE 3.4 Sustainable supply of indigenous wood from individual homelands
Source: Aron et al 1989

3.4.2.5 The fuelwood resource

Not all of the total productivity of woodland is available as fuelwood. It has been argued that the fuelwood resource is only half of the productivity (Aron et al 1989). The reasons put forward are:

- some wood is not suitable for fuelwood because of oversized or undersized pieces, noxious smoke, or superstition, for example. In one study it was found that of the total annual production of woodland, 40% was very suitable as fuelwood, 30% was usable but not ideal, and 30% was unusable (Gandar 1988);
- offcuts and waste in harvesting which may account for as much as 35% (Gandar 1988);
- unused regional surpluses;
- local constraints on wood gathering such as long distances to sources or time constraints;
- competing demands for wood which may account for from 1 to 11% of indigenous wood taken (Liengme 1983, Gandar 1988); and
- other wood losses to veld fires, woodborers, or termites.

3.5 Firewood resources in relation to consumption

In Table 3.5 it is evident that the primary source of fuelwood, natural woodland, can meet present consumption in only four homelands: Bophuthatswana, Ciskei, Gazankulu and Venda. Even in those four, the situation is probably not as good as the table might suggest. It was suggested above that the estimates of sustainable yield may be optimistic, especially in Gazankulu, and that the consumption in Bophuthatswana and Ciskei may be underestimated. Also, in Venda the aggregated figures mask the apparent shortages which occur in the southern part of the area.

On the other hand, the situation in KwaZulu might not be quite as dire as the enormous projected deficit of 1.5 million tons per year indicates. As mentioned above, there are discrepancies in the estimates of total fuelwood consumption in KwaZulu and the deficit may, in fact, not be quite as great (see Table 2.3). There are also significant transfers of wood into KwaZulu from the commercial agricultural and forestry sector. The deficits are met by the other fuelwood resources described earlier, and by harvesting certain areas of indigenous woodland beyond the sustainable offtake.

Area	*Supply*	*Consumption*	*Surplus/deficit*
Bophuthatswana	757	483	274
Ciskei	351	193	158
Gazankulu	870	452	418
KaNgwane	178	283	(105)
KwaNdebele	60	98	(38)
KwaZulu	650	2 193	(1 543)
Lebowa	1 088	1 271	(183)
QwaQwa	0	26	(26)
Transkei	1 198	1 311	(113)
Venda	651	315	336
TOTAL	5 803	6 625	(882)

TABLE 3.5 The available and sustainable supply of fuelwood from indigenous woodland in the homelands (Aron et al 1989), with estimates of consumption and the surplus (deficit) for each homeland

3.6 A national wood biomass inventory

While the projections of wood biomass and yield presented in this section might give an indication of the overall extent of the resource and of some of the regional differences, these are not adequate for the finer details of planning.

Gaps in the data have necessitated extrapolations which are inevitably guesses. This is particularly true of data on growth rates. Furthermore, a much finer level of disaggregation of data is required to pinpoint and quantify the wood shortages.

There are currently two research programmes which should significantly improve the national wood biomass database. The approaches adopted in these programmes are totally different from one another, but ought to be complementary.

The first approach is to assess wood biomass using remote sensing, aerial photographs and ground-based assessments (ground truthing). The objective is to produce a quantitative and qualitative assessment of current and potential wood resources in selected areas, and to detect changes in wood availability and measure the rates of change. This is currently being undertaken by the Institute of Natural Resources of the University of Natal as part of the Biomass Initiative Programme.

The second approach does not use any remote sensing, but relies on predictive mathematical relationships between bioclimatic and edaphic factors, and wood biomass and growth. Data on biomass and growth rates are being collected at selected sites to validate the equations. The first advantage of this method over the former is that it is quick and inexpensive once the predictive model has been validated. Secondly, it can be used to extrapolate to areas which have not been studied, and thirdly, it can give projections of growth rates which remote sensing cannot. However, it cannot provide the same level of fine detail which aerial photography or satellite imagery can, nor is it able to describe trends in the condition of woodlands due to utilisation. The Division of Forest Science and Technology (FORESTEK) of the Council for Scientific and Industrial Research (CSIR) and the University of Witwatersrand Rural Facility are jointly making use of this method.

Taken together, these two research initiatives could provide the basis of a national wood biomass inventory which could later be enlarged to include all sources of wood biomass, and be refined and made more precise as the need arises. The immediate need is for reliable and disaggregated data on fuelwood resources which can be used for policy and planning in conjunction with data on wood consumption, land-use and demographic patterns.

However, woodland resources are not confined to wood, and Chapter 6 describes some of the others. The ultimate goal should be an holistic strategy for the use and management of natural woodlands based on a full inventory of woodland resources.

CHAPTER 4

Overview of the forestry sector in South Africa

To provide a background, this chapter gives a brief review of the commercial forestry sector and the changing role of the state in forestry in South Africa.

4.1 The commercial forestry sector

The statistics presented in this section have been derived from the Forestry Council (1992) and the Department of Water Affairs and Forestry (1992a).

4.1.1 The size of the industry

In 1991, the total area under commercial timber plantation in South Africa was 1.37 million ha, or 1.1% of the land area. Of this, softwood species (almost entirely pine species) make up 50.4%, Eucalyptus species 40.4%, wattle 8.6% and others 0.6%. The percentage under eucalyptus has increased in the last 10 years as new afforestation has concentrated mainly on these species.

The timber industry employs 122 000 people, 64 000 in plantation forestry, and 58 000 in primary wood processing.

The total production of roundwood from plantations in South Africa is about 16 million cubic metres per year which sold for R912 million in 1991. After primary processing (for example pulping, but not paper manufacture) the value of timber production increased to R5.4 billion. The value of exports of timber products, which had been growing at 21% per year through the 1980s, reached R2 billion in 1990.

	Hectares
Transvaal	635 098
Natal	525 589
Cape	134 844
Transkei	66 844
Ciskei	5 576
Venda	3 482
TOTAL	1 371 433

TABLE 4.1 The area of plantations in different parts of South Africa

4.1.2 Expansion of plantation forestry

The commercial forestry sector in South Africa is currently in an expansionary phase. There has been an accelerating rate of new afforestation in recent years (Table 4.2). Most of the new afforestation (60%) has been concentrated in Natal. Although the area of afforestation has been growing rapidly through the 1980s at 4% per year, this rate is less than the rate of increase of cultivated land and pasture at the expense of natural veld which was 7% per year over the same period.

A significant feature of recent forestry development is the emergence of timber

small-growers. Although the proportion of new afforestation under small-growers is not large, it is an important phenomenon from a rural development perspective which is described fully in Chapter 8.

year	ha of new plantation
1987/88	23 270
1988/89	30 057
1989/90	30 965
1990/91	45 423

TABLE 4.2 The extent of recent new afforestation in South Africa

4.1.3 Structure of the forestry industry

A striking feature of forestry in South Africa is its domination by a few corporate interests (Table 4.3).

At present, the commercial forestry interests of the state are being commercialised. In other words these are being transferred from the Forestry Branch of the Department of Water Affairs and Forestry to a wholly state-owned company, the South African Forestry Company Ltd (Safcol). By April 1993, 264 560 ha of state plantation had been transferred to Safcol.

Vertical integration is a characteristic of the forestry industry in South Africa. The main processing plants and the bulk of the plantations are in the same corporate hands, a situation which does not allow market forces to operate freely in the timber production sector. The result has been a distorted price structure with the profit margins in wood processing outstripping those in timber production. Indeed, the Natal Timber Co-operative, representing private timber growers, finds it more profitable to export roundwood to a Moroccan pulp mill than to sell it locally (Natal Witness, 16 February 1993).

The pricing structure, which favours primary processing at the expense of timber production, is an obstacle to the development of small-grower production. It has also been a major discouragement to the introduction of commercial tree growing within a mixed agricultural system. Farmers have, however, demonstrated a readiness to plant high value timber (for example saw tooth oak, Quercus acutissima), indicating that mixed timber and agricultural production is feasible given the appropriate incentives.

The structure of the forestry industry thus favours the development of large plantations: 82% of afforestation is in plantations of over 1 000 ha in extent, and 98.5% is in plantations of over 100 ha.

Private ownership	*Hectare*	*Percent*
Individuals or partnerships	195 907	15.12
Companies	754 618	58.25
Private institutions	1 885	0.15
TOTAL PRIVATE	952 410	73.52
Public ownership		
State and SGT governments	329 745	25.45
Local authorities	13 376	1.03
TOTAL PUBLIC	343 121	26.48

TABLE 4.3 Ownership of forestry plantations (excluding TBVC) in 1991 prior to commercialisation of state forests

4.2 The changing role of the department of forestry

4.2.1 Divestment of previous functions

The state Department of Forestry (since 1990 the Forestry Branch of the Department of Water Affairs and Forestry, previously the Directorate of Forestry in the Department of Environment Affairs) has divested itself of many of its functions in recent years.

Research

The department has shed its research role. The South African Forestry Research Institute (SAFRI) was under the former Directorate of Forestry in the Department of Environment Affairs. It has now been merged with the National Institute of Timber Research at the CSIR to form FORESTEK, a division within the revamped and partially commercialised CSIR.

Conservation

The department shed some of its responsibilities in conservation in terms of its role in the management of the country's important watersheds. Thus, its control over large parts of the Natal Drakensberg was transferred to the Natal Parks Board along with the staff concerned.

Commercial operations

The state is in the process of commercialising its plantations. As mentioned above, this involves the establishment of a new forestry company, Safcol, with the state as the sole shareholder. Safcol will operate all the commercial forestry plantations and processing plants of the state. There are some issues which still remain unresolved at the end of 1993. These include the exact terms of Safcol's entitlement to the land, the future of patches of indigenous forest within or contiguous to the plantations, the future of homeland governments' commercial plantations after reincorporation, and the future of economically marginal plantations under state control.

Extension

The extension service of the Forestry Branch was originally set up to support the private commercial timber growers. In 1993, this support was withdrawn, and it was left to the South African Timber Growers Association (SATGA) to provide an extension service. However, at the same time the producers' levy on roundwood (which was the main source of SATGA's funds) was abolished, so it has become impossible for them to provide such a service.

4.2.2 Rural Forestry Programme

The shedding of these responsibilities by the Forestry Branch has been balanced by the establishment of a section to deal with social forestry, or rural forestry as it is referred to by the department. The section was started in 1992 with the mission 'to promote, in conjunction with the initiatives of local communities, the conservation of natural ecosystems through the planting of trees to advance sustained meeting of the energy needs and other multi-purpose timber uses in southern Africa' (Department of Water Affairs and Forestry 1992b). The forestry extension service which had previously served the commercial growers is reorientating itself towards social forestry. The Forestry Branch has begun by initiating some village-scale rural nursery projects.

CHAPTER FIVE

Basic principles governing biomass policy interventions

5.1 Understanding the nature of the problem

Trite as it may sound, the key prerequisite to policy intervention is understanding the nature of the problem. Much has been written about the fuelwood question and this literature exhibits a deepening respect for the complexities of the issue. Hoever, a clear grasp of the firewood issue and an understanding of the way in which contingent factors act upon it have proved elusive. Nevertheless, new paradigms for conceptualising the fuelwood problem are facilitating clearer ideas about appropriate strategies.

5.1.1 Defining the problem

The firewood crisis was initially defined as a resource crisis, and up to a point it is. Scarcities of fuelwood do exist and woodland is declining. The early analyses which concentrated on supply, demand and shortages did serve a valuable function in drawing attention to the problem and expressing it in quantitative terms (even if the data available at the time were woefully inadequate).

The line of argument ran as follows. Fuelwood is a conditionally renewable resource: it is renewable as long as utilisation does not exceed the rate at which it grows naturally. Where the demand exceeds the supply of fuelwood, the pressure on the remaining woodland results in its depletion. Thus an ever-widening gap between the demand for fuelwood and the sustainable level of offtake was postulated, leading to an inevitable and accelerating collapse of woodland.

Having defined the firewood crisis as a resource problem, resource solutions were sought. These were concerned primarily with increasing the supply by planting woodlots and fuelwood plantations, and reducing the demand by promoting fuel-efficient stoves. The spectre of imminent environmental collapse injected a measure of alarm and urgency and large-scale afforestation projects were hastily implemented.

The inadequacies of the above analysis, now dubbed the 'energy-gap model', have been highlighted by several authors (for example Foley 1988, Leach & Mearns 1988, Eberhard 1992). The critics point out the following:

- The assumption that the demand for fuelwood grows in proportion to the population is flawed. It ignores fuel switching 'upwards' to transitional fuels like paraffin, and 'downwards' to crop residues, dried dung and twigs.
- The role of fuelwood harvesting in woodland degradation has been exaggerated.
- The energy-gap model overlooks the ways in which trees are managed and protected by local practices, beliefs and customs.
- Insufficient attention has been given to the regenerative capacity of woodland.

5.1.2 Deforestation and the underlying causes

If policies are to be drawn up to deal with deforestation, it is first necessary to answer three questions:

i) Is deforestation actually a problem?

Even this simple question does not have a simple answer. It is clear that there has been considerable loss of forest. For example, in KwaZulu 250 forests were proclaimed in terms of the 1936 Land Act, but by 1980 all but 50 had either disappeared or been so badly damaged as to be no longer worthy of being called forests (Murless 1983). Clearly the rate of depletion must have slowed, otherwise there would be no forests left now. Just what the current rate of depletion is is not known. In Zimbabwe, the most rapid rates of decrease have been experienced in well wooded communal areas which have experienced rapid increases in population. Where woodland was already seriously depleted, little further decrease occurred (Whitlow 1988, cited by Bradley & Dewees 1993).

The picture of deforestation may change according to the measure used to evaluate it. In comparing a heavily utilised area of communal grazing land in Gazankulu which had been subjected to wood harvesting for decades with an adjacent protected area, Shackleton (1993a) found that the utilised area carried a markedly lower species richness and number of woody plants, but no significant difference in total wood biomass.

ii) Where is it a problem?

Areas where rapid deforestation is occurring should be targeted, the causes investigated, and appropriate steps taken.

iii) What is the cause of the problem?

If the problem is deforestation, then it is important to know its causes. In reviewing the situation in developing countries generally, Leach & Mearns (1988) concluded that agriculture and land clearing were far more significant causes of deforestation than fuelwood gathering. Moreover, there are many factors which act simultaneously and interactively on woodland, making it difficult to isolate single factors. For example, the impact of wood harvesting is strongly dependent on the intensity of grazing or browsing which accompanies it, and on the frequency and timing of veld fires.

In South Africa there has been no thorough investigation of the causes of deforestation.

5.1.3 Shortages versus constraints

Many of the writers in the 1970s who drew attention to the fuelwood resource crisis also described the human hardship caused by wood shortages (for example Eckholm 1975, Arnold & Jongma 1978, Digernes 1979). It was widely accepted that it was a poverty problem as well as a resource problem. However, while the human dimension of the problem was acknowledged, the human dimension of the solution was not. Hosier et al (1982) drew attention to the fact that energy policies in developing countries are dictated by constraints rather than choices, and that energy problems are essentially political rather than resource crises.

On the fuelwood issue specifically, a new paradigm is emerging within which the problems of supply and demand for fuelwood within the sociological and economic constraints of rural poverty can be understood (Eberhard 1992). These constraints need to be tackled to ease the fuel burden of poor families. These include labour scarcity, lack of transport, competing demand for wood products, access to trees, land tenure rights and population settlement patterns (Eberhard 1992). Fuelwood collection is one of many hardships for rural households, and women in particular. As such, it is connected to other fundamental aspects of survival and production.

5.1.4 A new intellectual framework

Foley (1988) wrote that a new intellectual framework is required for the discussion on household energy. To some extent the concept of 'regional political ecology' provides that framework. It was proposed as an analytical framework for understanding the relationship people hold to the land and resources (Blaikie 1985, Blaikie & Brookfield 1988). Reduced to its simplest form, the model first identifies the 'land managers', who are the people like farmers and wood cutters whose decisions and actions impinge directly on resources and the environment. These decisions and actions are shaped by a host of social, political, economic and environmental factors and constraints, which they experience directly. These factors in turn are shaped by the decisions of others which reflect different influences. And so on.

The model has a number of cogent characteristics. Firstly, its primary focus on the land manager concentrates attention on the people-environment interface. Secondly, it describes both the relation of people to resources and the environment, and vice-versa. Thirdly, it can capture the complexity of situations since it does not rely on simplistic linear chains of causality, but rather on overlaying fields of causality. Fourthly, it can take account of the socio-political history of an area, and how that has affected the social structures and the relationship between people, land and resources. This type of analysis was used by Wisner (1987) to describe how the rural energy crisis has taken on a very different complexion in Lesotho and Kenya (though the problems appear to be similar) because of the different political and economic histories.

In the case of the rural wood users, their decisions and actions can be viewed as coping mechanisms within a set of conditions and constraints. These responses might range from protecting or planting trees, to protecting fireplaces in order to enhance fuel efficiency, to purchasing wood or other fuels. The actions may be taken for reasons other than, or in addition to, meeting basic energy needs. Planners and policy makers need to accept that these are rational 'best practice' responses to a situation, and endeavour to understand them.

5.2 The starting point for intervention

5.2.1 Targeting the intervention

Policy interventions for fuelwood need not necessarily be directed specifically at fuelwood production. It will often be sensible to target some other area of the regional political ecology such as factors which constrain people's ability to respond to the fuelwood problem themselves. Alternatively it may target other factors with the intention of shifting patterns of resource use or energy consumption.

With any intervention, there must be clarity about its rationale, what the desired result is, and how it will lead to that result. This may seem obvious, but there are examples in which none of these conditions apply. For example, stumpage fees have sometimes been introduced without a clear rationale and only a blurred notion of what effect they might have (see Chapter 12).

5.2.2 Prioritising research

The process of formulating policy for intervention in the area of fuelwood will raise many questions which require research. As we have seen, there is very little information about the extent, the causes and the processes of woodland degradation in South Africa. There is also very little information about a host of relevant socio-economic factors from local woodland management practices, to price elasticities of rural energy carriers.

5.2.3 Adaptive and participatory approaches

Such is the complexity of the system described by the regional political ecology model, that it is extremely difficult for outsiders to appreciate and understand the subtleties of all the interrelationships. This indicates the need for participatory approaches to planning and implementation. There are no hard and fast rules about the form of participation, which would depend on the situation.

Similarly, the outcome of interventions cannot be predicted precisely, and will vary from place to place. Intervention policies therefore need to be flexible and adaptive in contrast to some rigid woodlot development programmes of the past.

5.2.4 Linkages with other sectors

The fuelwood issue does not stand in isolation. It is part of integrated rural energy planning, and consequently shares the linkages which exist between the energy sector and the rest of the economy. Most important of these is the linkage between energy and rural development policy. However, the fuelwood issue must also be part of an holistic strategy for the whole woody biomass component, and thus it connects with a number of sectors on which other aspects of energy do not impinge. It is intimately bound up with questions of land-use, natural resources and conservation. A starting point for the formulation of a comprehensive policy on wood biomass interventions is the identification of these linkages and the establishment of a framework for a coordinated multi-sectoral initiative.

5.3 Convergence of commercial and social forestry

'Convergence' refers to the bringing together of the commercial forestry sector and social forestry. The term social forestry refers to tree planting and woodland management in populated environments by the local people for their own needs. The dimensions of social forestry are discussed in detail in Chapter 8. Convergence is necessary to achieve the holistic strategy for the whole woody biomass component advocated above.

The principle of convergence applies not only to forestry, but has parallels in other sectors in relation to the reincorporation of the homelands and the shift away from dual economy paradigms.

There are many areas in which the conventional divisions between first world and third world forestry can be broken down. A few examples are given below; they are discussed in detail elsewhere in this document:

- out-grower schemes;
- small-scale primary wood processing;
- multiple product forestry;
- use of forestry wastes and residues;
- nurseries and seed banks;
- urban forestry;
- management of natural forest and woodland; and
- forestry training and curriculum development.

Convergence has implications for policy and institutions. Firstly, planning and policy in the broadest sense would be brought together in a single integrated forestry policy. Secondly, there would have to be institutional integration to give expression to the integrated policy.

CHAPTER SIX

Management of indigenous woodland

6.1 Overview of savanna woodlands

The estimated total national consumption of domestic fuelwood is just over ten million tons per year (Section 2.3.5). On the basis of the scant data available, it would appear that two-thirds or more of this comes from indigenous woodland.

Within South Africa, the savanna woodland regions are the main source of fuelwood. Closed canopy forest, xerophytic grass/shrub associations (karooid vegetation) and macchia (fynbos) contribute minimally in this regard. The term savanna, as used here, encompasses those plant communities containing both a tree and shrub stratum and a conspicuous herbaceous layer composed of grasses and forbs. The extent and productivity of the different woodland types is covered in Chapter 3. The main forms of land-use in savanna and the ecological processes are described below.

6.1.1 Land-use mix

Current and recent past land-use in savannas has been predominantly geared towards livestock production, both in the so-called 'commercial' (mainly white) and 'subsistence' (mainly black) areas. (We say 'so-called' commercial, because a host of favourable interventions including various subsidies place a question mark on the overall economic viability of much of the industry.) Nature conservation is a further significant form of land-use, given the biodiversity, particularly of large mammals, which characterises this biome.

Cattle, however, remain the most numerous and widespread species and, as such, the focus has invariably fallen on the management and use of the herbaceous layer. Elaborate range management systems, involving rotational grazing and resting, have been developed with the express aim of maintaining or enhancing the productive potential of the herbaceous layer. This predominantly agro-pastoral approach to savanna management has resulted in the relative neglect of the production potential and utility value of the woody component. Indeed, in the commercial areas, the woody component has come to be regarded as a threat: so-called 'bush encroachment' is regarded as a national problem, seriously reducing the production potential of the rangeland resource and resulting in some cases in subsidised programmes of bush control. Recently, there have been some moves towards incorporating browsers (mainly goats) into commercial ranching systems, but problems such as disease, predators, the need for additional small stock fencing and the limited amount of browse available at the lower level, militate against this becoming a widespread or universal practice. The incorporation of indigenous wild ungulate browsers such as kudu, bushbuck and giraffe, and mixed feeders such as impala and eland, is increasing in woodland areas. The impact on the woody layer is, however, limited by the intrinsic social and behavioural characteristics of game and, in most areas, by limits imposed on stocking densities by a winter browse 'bottleneck' resulting from the deciduous nature of many woody species.

The use of wood in these commercial ranching areas is negligible in relation to its abundance. Most of it is used by resident labourers and the export of fuelwood from these areas is limited. In contrast, in woodland areas situated within the homelands, wood is often a scarce resource, but the woody component has several uses. Apart from being the major source of energy, it is used for construction material, medicine, fruits, dyes and carving.

While current approaches to the management of woodlands emphasise the herba-

ceous component, earlier and traditional systems recognised the utility value of trees, and practices evolved to regulate the use thereof (see Section 2.5). Many of the controls have fallen into disuse under the pressures of the social changes and crowding caused by racial policies.

6.1.2 Dynamics of woodland ecology

The amount and nature of the woody component of savanna woodlands is influenced by the prevailing driving forces. Fire, large herbivores (especially elephants in natural systems) and the use of wood by people, all influence the density and floristic composition of woody vegetation.

Under the prevailing commercial cattle ranching systems, large indigenous herbivores have been mostly eliminated and replaced by a single grazing species, cattle. Compared to former times, particularly during the iron age and the early stages of European settlement, there has been a marked reduction in wood utilisation. The presence of cattle on rangeland, year in and year out, militates against the build-up of a herbaceous fuel load able to generate the type of hot fire needed to achieve a kill of woody plants. Trollope (1990) suggests that a fuel load of some 4 tons/ha of herbaceous material (with a low moisture content, ignited when relative humidity is less than 30% and air temperature is 25-30°C) is needed to generate a fire which will achieve an effective kill of woody plants.

The factors described above favour an increase in the woody component. The so-called bush encroachment problem results. On the other hand, in moist savanna regions, herbaceous matter accumulation is often sufficient for frequent firing of such woodlands, thus reducing the regeneration rate of woody vegetation, as fires are most effective in killing seedlings and small woody plants. The main implication of these dynamic processes is that certain management steps can be taken to 'push' the woodland in a desired direction, depending on the land-use objectives. Should sustainable wood harvesting become a major objective, then the woodland can be 'held' somewhere near an optimal tree-shrub density by formulating and applying a suitable burning regime, manipulating livestock and other herbivore grazing and browsing pressure, and implementing a controlled, selective wood harvesting programme.

6.1.3 Development options

We suggest that the current land-use mix in savanna regions is unlikely to change markedly in the near fuure. There is an inherent upper limit or production ceiling in terms of agro-pastoralism, dictated by climatic and edaphic constraints. The total contribution of rangelands to the GDP is of the order of 2%, although they cover some 80% of the country. The opportunities for increased productivity, incorporating fertilisation and irrigation on a sustainable, economically viable basis, are limited. Fiddling with veld management systems geared primarily towards the herbaceous layer similarly offers little scope for major increases in productivity. The increasing incorporation of wildlife exploitation into the land-use mix does offer opportunities for deriving added value from the savanna resource base, but the land-use mix is unlikely to change dramatically within the near future. This implies that the present fuelwood potential will not change much.

Future development initiatives in savanna seem likely to be geared towards increasingly incorporating the woody component into the overall production system, thereby obtaining further added value from the resource base (rather than treating it as an expensive problem). From a policy perspective, interventions or incentives which facilitate any such initiatives are indicated.

6.1.4 Land-use regimes

The sections that follow address factors associated with the sustainable use of

fuelwood under three broad land-use regimes, each of which is made up of a spectrum of land-use practices. These land-use regimes are:

- communal lands;
- formally conserved areas under a conservation authority; and
- commercial ranching in freehold areas.

In communal lands, a further subdivision is recognised between ordinary grazing commonage where the traditional systems of tenure and access to resources apply (in theory, at least) and resource management areas (RMAs) in which major innovations have been introduced in planning and management, aimed at sustainable resource use. There is actually a continuum of possible resource management strategies and the dividing line between ordinary grazing commonage and RMAs is blurred.

6.2 Communal areas

6.2.1 Potential benefits of woodland in communal areas

The term 'communal' is used here to refer to areas which *all members of a given community* are entitled to enter and where they are able to use the free and common resources. Access to the resources may be entrenched in the traditional land rights, but is not necessarily free and unrestricted. Customary controls which regulate the use of certain resources are discussed below. The communal nature of these areas does not result inevitably in the 'tragedy of the commons' scenario (Cousins 1992), though elements of that syndrome may be seen where regulatory customs and practices have been eroded. In RMAs, access may be more severely regulated, but the basic principle still applies that the common resources belong to the whole community and should benefit all its members.

Woodlands in communal areas provide a wide range of products and benefits:

- wood for fuel, construction, fencing, carving and woodwork and, in some cases, for high-value timber;
- food: fruit, wild vegetables, mushrooms, honey and various insects and animals;
- in some areas, ilala palms (Hyphaene coriacea) provide sap for brewing and fronds for basketry;
- rope from the bark of Acacia tortilis in particular;
- medicines from a wide variety of plants;
- dyes from Euclea species, Schotia brachypetela and others;
- fish poisons from Euphorbia species;
- grasses for thatching and weaving; and
- livestock grazing grounds.

The value of these benefits has been estimated for woodland in Zimbabwe, but estimates vary widely depending on the basic assumptions and methods of economic analysis (Bojo 1993). A study based on market prices valued the benefits at Z$200 to Z$300 per hectareper year at 1992 prices (Bojo 1993). However, a contingent valuation analysis, whereby relative importance is placed on woodland and non-woodland items, yielded estimates of only Z$24 to Z$94 per hectare per year (Campbell et al 1991, quoted in Bojo 1993). The latter estimate is equivalent to Z$120 to Z$470 per family per year, since the study assumes 5 ha of woodland per family. (Z$1.00 is approximately R1.60.)

Elsewhere in Africa, there has been a shift in emphasis in forestry to give greater consideration to options for the management and conservation of indigenous woodland. There is greater appreciation of the value of the indigenous woodlands and concern that excessive utilisation is causing degradation. New policies are being aimed at enabling rural communities to secure the sustainable utilisation of their own indigenous woodland resources. Although the emphasis of this paper is

on the fuelwood resource, this cannot be regarded in isolation from other woodland resources, and from the ecological and management processes which regulate the whole woodland system.

Open access areas, therefore, represent a resource for meeting certain basic needs and maintaining and possibly accumulating cattle which, in turn, have a benefit stream in which cash earning is a relatively minor consideration.

6.2.2 The status of communal rangeland

There are 14 million ha of communal non-commercial rangeland. The total annual wood biomass increment from this area was estimated to be 11.6 million tons, of which it is reasonable to assume that half is suitable and available for use as fuelwood (Aron et al 1989). By the conventional standards of pasture science, the condition of communal rangeland is generally poor. Stocking rates of livestock are high by commercial pasture management standards. However, over much of the communal rangeland, livestock numbers seem to have stabilised at a level approximating the prevailing ecological carrying capacity, defined as the level at which a herbivore population will stabilise in relation to available forage. Both sheet and gully erosion occur on a wide scale. Rangeland management has continually confounded rural developers. It is an area which has proved intractable and resistant to innovation. Solutions to the perceived problems of overgrazing seem remote.

6.2.3 Changes to the tree component of communal areas

6.2.3.1 Deforestation: immediate and underlying causes

Deforestation threatens some of the areas in savanna regions under traditional (or so-called 'tribal') control. There is a complex web of both immediate and underlying causes. Clearing land for arable fields and residential areas, the cutting of live trees for building poles, the effects of grazing, browsing and fire, are important immediate factors. Underlying factors are found in the socio-economic and political circumstances which surround rural communities. Deforestation is a symptom of poverty and high population densities resulting in an over-dependence on inadequate local resources. This is compounded by a history of rural neglect and apartheid policies (Durning 1990) which have led to high population densities and a high dependency ratio. Furthermore, the misguided policy of betterment planning has led to the destruction of wood resources as people and arable fields were relocated, and has also weakened the social cohesion of rural communities.

6.2.3.2 The impact of fuelwood gathering

The extent to which fuelwood gathering is implicated in the process is obscure. Gatherers will go to considerable lengths to collect dead wood before resorting to cutting live trees and, in many areas, only a little or no live wood is cut for fuel. There, the impact of wood gathering is minimal. However, in other areas, there is considerable cutting of live trees and shrubs for fuel and the signs of such intensive harvesting may be obvious. These are mainly areas of high population, or areas with mosaic vegetation such that harvesting is concentrated on patches of woodland. Another factor which affects the proportion of live wood harvested, is the commercialisation of fuelwood. Wood sellers may harvest a limited area intensively for a truck load. There is little or no data on the quantities or sources of fuelwood sold in the informal sector in South Africa.

A study of the impact of wood gathering in an area of valley lowveld in Zululand showed the following:

- the offtake of wood (including building and fencing material) was equal to the utilisable production;
- 8% of fuelwood was cut live;

- fuelwood accounted for 92% of all wood taken, but only 41% of all live wood cut;
- over a 20-year period, the overall effect of this and other impacts had been to convert open savanna with tall trees to a shrubby type with smaller woody plants: woody aerial cover had increased by 38%, but the number of tall and medium-sized trees had been halved (Gandar 1988).

In parts of the Mhala District of Gazankulu, canopy cover of woodland has been declining by an average of 0.9% per year over a 34 year period (Schwabe & Martin 1992).

The effect of wood harvesting is not an isolatable factor in these changes. Using a simple stage structured model to simulate the effects of wood harvesting in an area of the Zululand coastal plain, Cleminson (1993) found that the parameters to which the model was most sensitive were seedling recruitment and seedling growth and mortality. These quantities are affected most by influences such as livestock and fire. In other words, the impact which wood cutters have on the woodland, depends more on other influences which act on post-chopping recovery, than it does on the actual number of trees which they cut.

Wood harvesting, on the other hand, can influence the impact of grazing. There is evidence from Botswana that wood harvesting acts as a brake on bush encroachment induced by overgrazing (Parris & Childe, 1973).

6.2.4 Responses of savanna woodland to wood harvesting

Savanna woodland, unlike forest, has a high degree of ecological resilience. It is naturally subjected to widely fluctuating rainfall conditions with periodic severe droughts and to hugely disruptive fires from which it recovers. Most of the trees and shrubs coppice readily and regrow with compensatory rapid growth, provided the regrowth is not kept down by browsers. The growth rate of trees on commonage in KwaZulu was found to be consistently higher than that of trees in the neighbouring Umfolozi Game Reserve (Gandar 1988), possibly because the heavy utilisation keeps the trees in a younger (or coppiced), more vigorously growing form and also because of reduced competition from grasses.

6.2.5 Community institutions in resource management

6.2.5.1 Management of common property resources

The management of common property resources is a political issue which reflects local power relations, since management brings into question the issue of control. The term 'community' is sometimes taken to imply cohesion and homogeneity, but there are inevitably different interest groups. Conflicts over property rights and access to communal resources may arise as groups assert their particular interests. There is now a large body of literature on the subject of common property rights. Analysis of common property problems must take account of the dynamics of conflict and competition between different social groups located in history and social systems (McCay & Acheson 1987, quoted by Cousins 1992). Emphasis is also placed on economic and ecological factors and the need to see the place of common resources in the context of a larger production system.

The politics of common resources also includes relations between community and other forms of power and authority, notably the state. Addressing the issue of woodlands specifically, Shepherd (1992b) states that many of the difficulties over trees and forests derive from the state's modification of locally evolved tenure systems. Local political authority is undermined and land rights simplified to fit national norms. Rights of dispute settlement pass from the local level to a more remote body. However, there is currently a swing back towards the recognition that assets such as woodland may well be more effectively managed and protected by those who live nearby (Shepherd 1992b).

Some of the community institutions involved in the management of common resources in South Africa are described below.

6.2.5.2 Traditional authorities: regional differences

'Traditional authority' (TA) refers to the so-called 'tribal' authority under a chief or headman. The TA systems differ slightly from area to area, but all are based on hereditary leadership by a chief. While some of the differences are unimportant, there is a significant distinction between traditional authority in the eastern and south-eastern parts of the country and the extensive dry western parts. It has been suggested that the differences in traditional authority, differences in settlement pattern and differences in the ecology of the two areas are all interrelated (Preston-Whyte & Sibisi 1975).

Due to the richer resource base in the eastern areas, extended households or kinship groups were able to satisfy much of their needs from the immediate vicinity of their home. Thus, a pattern of settlement with scattered homesteads arose. In the drier western areas, this form of self-sufficiency was not possible. Livestock required larger areas of rangeland and resources generally were more dispersed. In this situation, settlements were more nucleated. Villages formed and communities utilised the extensive areas in between. Mobility was important and households tended to have outposts for herders as well as at their fields. With the scattered homesteads and dissected terrain of the eastern seaboard making communication difficult, a more devolved authority structure arose. The system of land allocation, for example, was based on the practice of *khonsa,* whereby a newcomer needed to canvass the sponsorship of an established kin group. Although the chief's authority was necessary for a formal allocation of land, the kin group head had a lot of influence in land allocation. There was thus a high degree of autonomy of kin group heads in the control of resources.

In the western areas, there was clearly much more opportunity and need for centralised authority over resources, and TAs were in a more powerful position in relation to resources than their eastern counterparts. The centralised control of resources, together with the village pattern of settlement, created the need and an opportunity for mechanisms to involve villagers in decision-making. The *kgotla* or village forum, under the chief or headman, is a particular characteristic of these communities.

Thus, in the traditional system of the eastern parts, the TA has less influence in resource control, whereas in the west the TA has more influence but, at the same time, is more answerable. In the changing times of the late twentieth century, the authority of the latter over resources seems to be proving to be the more durable.

6.2.5.3 The future for traditional authorities

The suitability of TAs as vehicles for rural development has been questioned (Daphne 1982, McIntosh 1990). Amongst the points raised are:

- leadership is hereditary, not based on merit;
- TAs do not have to be answerable to their people;
- TAs respond in a reactionary manner to new developments if seen as a challenge to their power;
- homeland administrations have usurped some of their powers;
- various administrations have allegedly coopted or bribed chiefs as agents in imposing unpopular laws and regulations; and
- TAs are inefficient and often corrupt.

While the need for more democratic, responsive and answerable local structures is widely accepted, traditional authorities will not simply wither and die, and indeed may have a positive role to play in a society in transition. Statements from the ANC seem to indicate that the future of the traditional leadership is recognised, though

the actual role has not been articulated (McIntosh 1990). The emergence of the Congress of Traditional Leaders of South Africa (Contralesa), which is sympathetic to the ANC, indicates that a significant number of these leaders are not satisfied with the status quo and recognise the need for traditional authorities to adapt to new circumstances.

6.2.5.4 New community-based structures

Community-based organisations (CBOs) are constantly forming at village level around development issues. These include an assortment of farmers' associations, interest groups, women's groups, and others. For the most part, these structures are answerable to a section of the community only and have little or no control over natural resources.

Exceptions are found in the area of water supply, where several village water committees have formed, particularly around spring protection projects in the eastern and southern areas. In the arid areas, provision of borehole water supplies is a state responsibility. Community committees have also formed around the establishment of woodlots with the intervention of a non-governmental organisation (NGO), but these are rare and nearly all 'community' woodlots fall under TAs (Gandar 1991a). These water and woodlot committees have an uncertain and sometimes uneasy relationship with TAs. They are most effective where the TA is either coopted or very weak.

Sometimes, with NGO intervention, umbrella development organisations have been formed from a number of smaller interest groups, such as Simunya in KwaZulu (Mann and Ndelu 1988) and Ncedisiswe in Transkei. These have a high degree of accountability via the participating groups. They also have fairly wide scope for planning the use of community resources and the allocation of land to projects, but at the end of the day, TA approval is required.

In Ciskei, traditional authority was disbanded in 1990, but the chiefs were retained. Local TA structures (known as area authorities) were replaced by residents' committees, but the whole experiment collapsed in the wake of confusion about roles, as well as political upheavals (Manona 1990).

A more successful institutional transition occurred in the Inanda area of KwaZulu with the formation of the Qadi/Nyuswa Services and Development Board. This is a representative organisation covering two chiefs' wards. TAs are on the board, but do not dominate it. This sort of mixed solution is a possible model for building accountability into local authority in the short term at least. Solutions which are wholly dependent on TAs or completely independent of it do not seem to offer realistic solutions (McIntosh 1990). The viability and legitimacy of new and participatory institutions in the long-term will depend largely on the extent to which they can channel services and development. In the Qadi/Nuyswa case, their effectiveness at delivering and administering services is one of the reasons for their success.

The range of issues around which CBOs have formed goes beyond the development and delivery of basic services. CBOs have emerged around winning rights, resisting removals and other issues of local political importance. The rural CBOs are often politically powerful in their areas, though weak in planning and management, and usually have minimal resources. However, the CBOs are the embryonic forms of future rural administration, which will come with the political transition in South Africa. We are likely to see many CBO leaders winning elections to local or regional government in their areas. It is, therefore, critical that the organisational and institutional capacity of CBOs should be developed. There is already a trend amongst rural development funding organisations to direct funds to CBOs, either directly or through an intermediary.

In Bophuthatswana, on the initiative of Bophuthatswana Parks Board, regional

Community Development Organisations (CDOs) have been formed. One of the functions of the CDO, consisting of nominated members of the community representing all interest groups, is the identification and management of RMAs (see Section 6.3.4). Although they are in an early stage of development, it is envisaged that these CDOs, which operate in tandem with the TAs, will have increasing input into the way the renewable natural resources, including wood, are used.

When it come to the planning and management of open access areas, the legitimacy of the institution is of paramount importance. Adequate policing of large areas is not feasible, so the success of any resource conservation or management strategy depends on the involvement of the people in its formulation and the nature of the institutions involved.

6.2.6 Traditional management and control of resources

6.2.6.1 Traditional resources management strategies

Management strategies which require radical changes to established patterns of resource utilisation are almost certainly doomed to fail. It is very important to be aware of and to understand customary practices of resource use and to build on these. Several are undergoing change or falling into disuse and it is also necessary to understand the underlying causes.

There are numerous such practices which have the effect of regulating the utilisation of indigenous common resources (Cunningham & la Hausse, nd). Some may have a deliberate conservation intention, others may inadvertently regulate utilisation. Most important amongst the former are tenurial regulations and usufructory rights controlling access to resources. These are or were effected by spiritual or hereditary political leaders. The inadvertent controls include taboos, seasonal and social restrictions, and technical inadequacies.

6.2.6.2 Traditional and customary controls on tree harvesting.

In this section, we look at some of the ways in which regulation and control is exercised.

i) Tenure and access

An understanding of the customary practices and systems of access and tenure is important in developing strategies for the management of common resources. Tenure of trees was the strongest customary regulatory mechanism. Tenure issues related to trees have not been researched and documented to the same extent in South Africa as they have in some other countries (Fortmann & Bruce 1988), so we have to rely on anecdota reports.

Trees in the open access areas traditionally belong to the chief or TA. The gathering of dead wood for fuelwood was freely allowed, but harvesting of live trees was forbidden unless specific permission was obtained from the TA, often for a small fee.

In much of KwaZulu, the controls on the cutting of live trees has fallen into disuse, and people are only vaguely aware that these controls still exist in theory (Gandar 1988). This is probably true of many other areas as well. Sometimes a token attempt at enforcement is made by the chief's 'police'. In parts of Gazankulu, at least, there is a serious attempt to enforce this traditional custom with the policing function being taken ovr by the Gazankulu Nature Conservation Department's rangers. People are aware that they may be arrested for cutting live trees, but this has not eliminated the practice (Griffin et al 1992).

In Gazankulu too, the issue of access to trees with economic value, is under review. Commercial woodworkers use almost exclusively kiaat (Pterocarpus angolensis), which is a fairly common constituent of the communal rangeland. At present, they register as woodworkers with the TA, but the Department of Nature Conservation's

ranger supervises the cutting, collects the money and certifies the wood as legal. Alternative systems are under discussion, but what is significant is the involvement of the woodworkers, now formed into an association, in the process of negotiation about their role in the planning, managing and policing of the resource.

The officers of the Bophuthatswana Parks Board also supervise the cutting of commercially valuable trees in communal rangeland, particularly tamboetie (Spirostachys africana), which is used for furniture.

An interesting adaptation of tree tenure in response to the commercial value of certain trees occurs in the Maputaland area of northern KwaZulu. The ilala palm (Hyphaene coriacea) has value as a source of fronds for basketry and, particularly, for sap for traditional palm wine. A palm tapper may be granted the sole right to all the palms within delineated portions of the open access areas, for which a tribute to the chief is due in cash or kind. This becomes the tapper's own economic resource and it is his (tappers are men) responsibility to manage it sustainably (Cunningham & la Hausse).

When an area of land ceases to be communal and is allocated to an individual for residence or cultivation, the trees thereon become the property of the 'owner' of the land, as does the rest of the biotic component, including wild spinach, and other plants.

ii) Inadvertent regulation of tree harvesting

Amongst the customs and practices which inadvertently regulate the impact on the wood resources of open access areas are the following:

Women frequently go out collecting wood in groups, both for conviviality and for safety. As a result, they choose to gather in areas in which they do not have to forage so widely that the cohesion of the group breaks up. When a gathering area starts becoming denuded, they will switch, if possible, to another gathering ground.

Gender divisions, which place the task of wood harvesting on women, limit the amount of effort that can go into wood harvesting. To what extent this reduces the amount of fuelwood used and possibly accelerates the switch to other fuels, is a matter of conjecture. However, it is noticeable that the involvement of men in fuelwood harvesting is increasing as the resource becomes more commercialised.

6.2.7 Development of open-access areas for resource use

6.2.7.1 Production, equity, sustainability

The two main benefit streams which come from the openaccess areas (namely, livestock and natural resource use) are sufficiently different to warrant separating them. These are examined below in the light of three broad principles which govern development: productivity, equity and sustainability.

Livestock

The benefits include draft, meat, milk, skins, manure, cash and saving, and perhaps social and cultural benefits. As stated in the introduction above, there is a low ceiling on the livestock productivity of rangeland.

On the question of equity, livestock ownership is characteristically skewed. The grazing resource is inadequate for all families to hold sufficient animals to meet their primary needs.

Although the remarkable resilience of savanna rangeland continues to defy prophesies of imminent collapse (Shackleton 1993b), there are localised indications of irreversible breakdown and the long-term sustainability of intense use by livestock remains questionable.

Use of common resources
The benefits, listed fully above, include a range of useful and edible materials. All households are able to derive benefit from the resource. There is evidence that poorer households are more dependent on some common resources, namely fruit (Bradley & Dewes 1993) and fuelwood (May et al 1993) than the wealthier households. This highlights the importance of woodland resources in meeting the basic needs of the poorest.

The rate of utilisation of certain common resources exceeds sustainable levels at times. This applies to fuelwood (see Section 6.2.3) and to some medicinal plant material, especially bulbs and bark (Cunningham 1990).

Implications for development
The focus of development for common rangeland needs to be widened beyond the question of livestock. There is a low ceiling on the agricultural productivity of savanna rangeland, and the use of natural resources is a relatively important component of the benefits of the system.

Equity and sustainability are overarching considerations in the management of communal areas, and are at least as important as productivity. Both of these development goals have been elusive in grazing systems. Integrating the utilisation of natural resources into a management strategy is a step towards realising a degree of equity and sustainability.

6.2.7.2 Tenure reform
There has been an ongoing and unresolved debate about land tenure reform in communal areas. The argument for a freehold system is based on the premise that it is necessary for greater productivity and environmental care, while the argument for communal tenure is based on principles of equity and security for the poorest. It is argued that over-exploitation of resources is an issue of poverty and crowding rather than insecurity of tenure. A purely freehold solution for the present commonage would have obvious adverse social and environmental repercussions if the poorest people were even further dispossessed. In reviewing the issues, Cross (in the World Bank's Agricultural Study in South Africa, in prep.) sees the need for flexibility and responsiveness in tenure reform, with a mixture of land rights and a body of tenant protection law.

The implication for free access areas is that tenure reform should recognise the diverse forms of benefits and the different interest groups. A two-tiered (or more) system of land and resource rights might well be most appropriate, one which recognises the different circumstances of graziers and of the wider community which uses the common resources.

Although circumstances change from place to place and from time to time, ownership of a resource (it may or may not be community ownership) is absolutely fundamental to management, and that recognition of ownership in a public way is a sine qua non (Shepherd 1992a).

6.2.7.3 Management for communal woodland
A large body of relatively recent international literature has emphasised the importance of the decentralisation of control and management of indigenous woodland and forest to village level institutions and individual farmers, and of management strategies built on local traditions and practices (see, for example, Poffenberger 1990; Shepherd 1992a & 1992b).

There are three main components to the management of natural woodland:
- planning and decision-making;
- regulation, administration and implementation;
- policing and enforcement.

The institutional arrangements may or may not be the same for all of these functions and there may be the involvement of external agencies in one or more of the areas. The crucial issue is that whatever institutions are involved, need to be legitimate and accountable.

6.2.7.4 Some practical options for wood management

The options for management of the wood component of the open access areas are essentially forms of regulation of the utilisation. In theory, tree planting is also an option, but the practical problems of protecting the young trees are immense.

i) Regulation of the area of wood harvesting

The woodland is divided into blocks which are harvested in rotation for poles and fuelwood, allowing a cycle of intensive harvesting, followed by periods of recovery. This is basically a coppice system or a coppice-with-standards system, in which a few mature trees of the utilised species are left as seed sources for natural regeneration. Such systems are the oldest known woodland management systems. There is archaeological evidence of such systems being used in Europe and the Middle East 5 000 years ago.

A management system incorporating a coppice-with-standards system was proposed for the Acacia erioloba – Terminalia sericea woodland of the Matsheng villages in Botswana (White 1979), but there seem to be no subsequent reports or evaluations.

ii) Regulation of the time of wood harvesting.

Areas may be closed to wood gatherers for periods by decree, to allow for regeneration. There is hearsay evidence of this in parts of Bophuthatswana, and in Transkei some patches of indigenous forest within communal areas are managed in such a manner.

The larger demarcated forests in Transkei are subject to government regulations which prohibit the cutting of trees and allow only the gathering of dead wood. However, these regulations do not apply to smaller so-called 'headman's forest'. The headman, or sometimes the sub-headman, has the prerogative to stop harvesting in such forests. The period of closure may be months or a year or two. While these periods allow a degree of regeneration, the period is too short to allow complete recovery. The system does, however, serve to regulate the offtake of wood averaged over a long period of time. The same system of management is sometimes applied to planted woodlots which fall under the TA (Gandar 1991a).

In some cases in which a ward contains a few headmen's forests, the closure of forest is sometimes implemented rotationally, thus approximating a system like those described in i above.

iii) Regulation of the material harvested

Control over the cutting of live trees is traditionally vested in the TA, with prior permission being required before live wood might be cut. However, the custom has largely eroded away.

Regulation could relate to quantity, species or size of trees cut, and could be administered on a permit system. Permit systems for wood harvesting are sometimes used to regulate wood harvesting in conservation areas and RMAs.

A management system on these lines would need:

- a harvesting plan based on sustainable offtake (in practice, the cost of research and monitoring in order to match the allowed harvest to sustainable offtake may exceed the cost of growing alternative sources (Muir 1990), so an adaptive rule-of-thumb approach is needed);

- a means of implementation; and
- a means of enforcement.

One chief in KwaZulu claims to encourage people to selectively harvest an invader species, Dichrostachys cinerea (which is a favoured fuelwood species anyway), but it is doubtful whether this has much effect.

iv) Regulation of access
The restriction of access to a group of professional wood harvesters has sometimes been put forward as a management option for forest and woodland management (Muir 1990). This may be appropriate in conservation areas and RMAs. In free access areas, such a system might well conflict with the goal of equity, although it need not necessarily do so.

6.2.7.5 Research needs
While we emphasise the need to build upon local practices, there is no clear overall picture of local practices in woodland management. The picture we have painted is patchy and based largely on anecdotal evidence, but that is all there is. Where research has been done, it has tended to concentrate on offtake and environmental impacts rather than management and decision making processes.

Specific projects will require their own surveys into local systems of resource management and control. At the same time, there is need for a coordinated programme of research into the dynamic patterns of management and the regulation of communal areas.

6.3 Communal areas: resource management areas

6.3.1 Introduction to resource management areas
RMAs are a special case of communal area management and many of the planning and institutional issues covered in the previous section are applicable to RMAs. The main attribute of RMAs is that these are proclaimed as areas for sustainable resource use and are managed as such for the benefit of the whole community. Access to the area may be restricted, but access to the benefits should be equitable and any profits belong to the community as a whole.

The proclamation and management of communal RMAs is evident in southern Africa. The extent of RMAs in the South African homelands is, however, limited as a result of land pressure caused by resettlement and the various racially-based Land Acts. In Botswana, fairly elaborate management plans have been drafted for large parts of the country, while in Zimbabwe the CAMPFIRE (Communal Area Management Programme for Indigenous Resources) gains momentum (Martin 1986).

In parts of South Africa, including Bophuthatswana, KaNgwane and KwaZulu, RMAs contribute towards meeting people's natural resource needs (for example fuelwood, thatching material, magico-medicinal plants, and others), as well as providing economic and employment opportunities where the commercialisation of woodland products and tourism form part of the land-use mix. Where commercialisation has occurred, the emphasis has largely been on the faunal component, for example, in the sale of surplus game to fee paying hunters. These areas do, however, contain harvestable or saleable plant products, including fuelwood.

Although still very limited in extent in South Africa, the concept of such areas may prove to be a useful model for the future.

6.3.2 Nature and objectives of RMAs
The approach to organising and managing RMAs may differ in detail from region

to region, but the common essence is usefully illustrated by reference to the Zimbabwe CAMPFIRE model. Conceived by the Department of National Parks and Wildlife Management and incorporated into the National Conservation Strategy in 1985, its declared objectives are inter alia to:

- initiate a programme for the long term development, management and sustainable utilisation of natural resources in the Communal Areas;
- achieve management of resources by placing the custody and responsibility with the resident community;
- allow communities to benefit directly from the exploitation of resources within the Communal Area; and
- establish the administrative and institutional structures necessary to make the programme work.

A useful set of guidelines for the management of RMAs, embracing and summarising all relevant factors, has been developed by the Bophuthatswana Parks Board (Bop Parks) in the form of Project SECURE (Sustainable Environmental Conservation through Use of Resources). The five main principles are:

i) detailed knowledge of the community;

ii) the generation of income and sustainability (both financial and ecological);

iii) the use of community development expertise;

iv) effective communication, which underpins the whole programme; and

v) the establishment of an appropriate formal and registerable institutional framework.

RMAs may be formally delineated as separate, discrete entities within the communal areas and managed separately from the ordinary rangeland. Alternatively, the entire communal area may be formally managed as an RMA.

6.3.3 Institutional arrangements and community empowerment

Successful projects are invariably characterised by a strong element of local participation and ownership (as compared with projects where state or other authorities are in control). Where control over and responsibility for the woodland resources fell under the state authority, such as during colonial rule, it has been necessary to devolve such ownership back to the local institutions. The transition from the 'punitive deterrent' approach prevalent in the past, to the devolution of control back to community level, needs to be responsibly executed. Problems may arise if responsibility is merely 'dumped' onto ill-prepared communities. It is clearly the task of the responsible lead agency to ensure that local communities and individuals gain the capacity to assume such responsibilities.

Whatever the existing local authority, the formation of an appropriate, formal Resource Management Committee which sets and enforces terms and conditions relating to the management and harvest of goods from the RMAs is essential. Such a committee should be registerable if it receives and allocates funds on behalf of the community. Options are the formation of a Trust, Section 21 Company or other body corporate, depending on local circumstances. Such an institution needs decision making powers and control and it may be necessary to change existing legislation which often vests control of natural resources in the hands of the state departments. Transparency and equity should be features of decision making on to whom and how surplus resources are allocated.

In summary, the critical issue is not so much what rules are applied, but the strength of the community institutions setting and enforcing them (Leach & Mearns 1988).

6.3.4 RMAs in practice: the experience in Bophuthatswana

6.3.4.1 The Ba Kgatla RMA

6.3.4.1.1 Background and land acquisition

A recent example of the development of an RMA comes from the Ba Kgatla region of Bophuthatswana. The community has demarcated an area of 3600 ha for an RMA/game reserve. The area, about 40 km north of Pilanesberg, was bought by the Ba Kgatla to establish a game reserve because of the perceived benefits of the Pilanesberg Reserve nearby. A decision was taken at the *kgotla* (see Section 6.2.5.2) to levy R40 per head to raise the sum of almost R1 million to purchase the land.

6.3.4.1.2 Feasibility study

The community approached Bop Parks to undertake a feasibility study to look into the ecological sustainability and the economic viability of the project. The study concluded that the project was acceptable on both counts. The most cautious scenario predicted a profit of R6 per hectare per year, or upward of R20 000 per year. The financial projections were similar to those for cattle ranching, but the RMA had more economic benefits. It would create more jobs, more turnover in the local economy, it would be more equitable and serve the whole community, not just a handful of stock-owners, and would provide non-commercial benefits in the form of resources for local use.

6.3.4.1.3 Plan for the RMA

The plan for the use of the reserve has three components:

- Hunting safaris and, outside of the hunting season, game-viewing tourists. Initially, a rustic bush camp will serve these visitors. At the same time, a preferential package with lower fees will apply for local people wanting to hunt. It is anticipated that local demand will account for about 10% of hunting permits, but if its proportion becomes so high as to threaten the viability of the project, the system will be reviewed.

- Outdoor recreation facility for local use. This need arises particularly from the fact that many members of the community are weekly migrants and want recreational facilities when they return at weekends. An area has been set aside for high density outdoor recreation with a kiosk, music and picnic area.

- Access to natural resources. A permit-based system of access to natural resources such as fuelwood, medicinal plants and thatch will apply. The permits are for regulation rather than income and the cost of the permit scarcely covers the administration cost. Another resource in the RMA available for local people is a deposit of usable (noritic) clay, and a slightly different system of regulation is needed in this case since it is non-renewable and economically exploitable.

6.3.4.1.4 Management

The TA approached Bop Parks to manage the RMA on behalf of the community, but Bop Parks refused flatly because it conflicted with its policy in regard to community development, which is to assist communities to build the capacity to manage their own affairs. The reserve, instead, is under Ba Kgatla management, with Bop Parks providing advice and appropriate training in park management. A CDO was formed on the initiative of Bop Parks to oversee development in the region, including the RMA. One of the responsibilities of the CDO is to allocate the profits from the RMA to community projects.

6.3.4.1.5 Current situation

The area has been fenced at the expense of the community, though they obtained donations for some of the materials. At the time of writing, stocking with founder populations of game is about to begin. Bop Parks is 'donating' some R200 000 worth of animals, which is part of a belated compensation package for land the Ba Kgatla

lost in the establishment of the Pilanesberg Game Reserve.

While broad policy for the area has been agreed, the CDO is formulating some of the details. Mechanisms are still unfolding with regard to, for example, the details of the permit system(s) of access to wood and other resources and the concession to operate the kiosk.

6.3.4.2 Other initiatives

Although the Ba Kgatla RMA is not yet fully up and running and proven, there has been spontaneous interest as a result of the perceived benefits of such a model and, at the time of writing, there are indications that at least three similar schemes are envisaged by other communities in Bophuthatswana. The interest comes particularly from areas characterised by a strongly skewed ownership of cattle. The RMA model is perceived as inherently more equitable than individual freehold by those already owning cattle. As one councillor expressed it: 'If this land is used for cattle, three or four people will benefit. If we develop it [as an RMA], the whole community will benefit".

6.3.5 The future of RMAs

RMAs are limited in extent in South Africa at present. As SADT and other state land becomes available, various RMA models might be appropriate.

A programme of land redistribution is likely to find that marginal land is more readily available than high potential land suitable for intensive smallholder schemes. RMA models might allow some of the dry savannas to make a contribution towards land equity, although clearly it is not possible to build meaningful redistribution predominantly on marginal land.

None of the land for the present and proposed RMAs in Bophuthatswana has been under any form of communal use or tenure in the recent past, nor has it been communal land. However, RMAs might also be established on commonage, as evidenced by the large (about 10 000 ha) RMA at Nkomazi West in KaNgwane. This is currently being established on the combined grazing lands of four villages. It differs from the RMA described above in that livestock is included with the other forms of utilisation, including hunting.

6.4 Formally conserved areas

6.4.1 Overview

6.4.1.1 Description

By formally controlled areas, we mean those areas such as national parks and game and nature reserves which have been formally proclaimed as 'protected areas' under relevant legislation. Control over these areas is vested in either the National Parks Board of South Africa, the 'independent' states, various homeland authorities and the four provincial conservation bodies, each with their own legislation. This fragmentation, while undoubtedly causing duplication and non-uniformity, has allowed the emergence of progressive agencies who have developed policies and strategies reflecting the needs of the developing societies which they serve (see below).

6.4.1.2 Historical perspective

The proclamation of reserves or hunting areas has a long history and tradition in South Africa. For example, during the nineteenth century, the Zulu king, Shaka, established royal hunting rights in the areas occupied by the present Umfolozi Game Reserve (Hall 1977). Hunting reserves persist in Swaziland today.

Subsequent to the widespread decimation of wildlife which characterised the first

few centuries of European settlement, a rearguard attempt at preservation by legislation and proclamation of sanctuaries was implemented during the late nineteenth and early twentieth century. The 'big stick' punitive and deterrent approach adopted, hardly endeared the conservation movement to the local populace, whose access to and customary use of resources was summarily curtailed. Subsistence harvesting of wildlife products, including fuelwood, became a punishable offence. Customary controls, often enforced quite strictly by community policemen and peer pressure were overridden (Cunningham & la Hausse).

The proclamation of conservation areas also often involved the relocation of local communities. The extent to which such unilateral interventions were rejected by angered local communities is exemplified by the systematic 'protest killings' of rhinoceros in the Amboseli National Park by Masai people incensed about the alienation of land for wildlife preservation (Western 1982). The removal and exclusion of people from reserves typifies the Eurocentric thinking of the time. People were seen as external to and intruders in 'natural pristine wilderness'.

6.4.1.3 Recent policy initiatives

Latterly, a more modern approach of 'conservation by utilisation' and 'peoples conservation' has gained acceptance among some conservation agencies, spurred on by the IUCN-UNEP-WWF Strategy for Sustainable Living (Caring for the Earth). Internationally, the concept of Integrated Conservation-Development Projects (ICDPs) has gained increasing interest and support in principle (Wells & Brandon 1992).

In South Africa, sustainable harvesting of animal and plant products has been permitted in some (but not all) formally proclaimed reserves.

6.4.2 Wood harvesting in conservation areas

6.4.2.1 Conservation policies related to wood harvesting

Conservation bodies in the greater South Africa have varying policies relating to the harvesting of wood and other products from formally proclaimed areas. Some examples are given below, although it is not a comprehensive list of the policies of all conservation bodies in South Africa.

Natal Parks Board (NPB) permits the cutting of thatching grass and reeds on a sustained yield basis. Thatch cutters operate on a 'one for one' basis, with a bale of thatch going to NPB for each bale removed. During periods of drought, hay is cut and supplied by neighbouring communities. Wood is made available as a result of alien invasive species such as wattle, and from bush control programmes. In the latter case, local people are permitted to cut the encroaching bush under supervision and keep the wood (see Table 7 below).

Transkei Conservation authorities also permit thatch cutting and the custom of *teza*, the gathering of dead wood, is permitted in forest reserves by law.

In Bophuthatswana, neighbouring communities are permitted to gather dead wood from parks and reserves. A letter of authorisation from the traditional authority is presented to the park warden, who issues the necessary permit. Policy is formulated with local communities by means of a Joint Management Committee. Guidelines for the sustainable harvesting of resources such as thatching grass, fuelwood and medicinal products, and access to sacred places, like ancestral burial grounds situated within the parks, are jointly discussed. Around the Pilanesberg National Park, this process has progressed to the stage where partnership ventures, in the form of the development and management of rest camps, outdoor recreational facilities and entrance gates, are being implemented. The community in whose area a particular gate is situated receives a percentage of gate takings and, in some cases, owns a share in the local rest camp. The management of such projects is conducted by a formally registered CDO, formed for the purpose of managing the funds

generated from joint ventures.

The National Parks Board does not permit the removal of any fuelwood from the Kruger National Park.

6.4.2.2 Fuelwood in formally conserved areas

The formally conserved area network is well represented in the savanna woodland areas: over 7% of the savanna biome is conserved, compared to the national average of just under 5%. At a rough estimate, the potential contribution of these areas to the fuelwood supply is some 1 to 2 million tons per year in total. However, their potential impact in this regard lies more in their proximity to resource-poor local communities. For example, present fuelwood harvesting rates in parts of Gazankulu, bordering the Kruger National Park, have been shown to be non-sustainable (Griffin et al 1992).

Just how much of this wood is accessed by rural people is uncertain. Much of it is not recorded. Bophuthatswana, for example, records permits, but does not, at present monitor quantities, though this will soon change. The KwaZulu Bureau of Natural Resources records permits for live-cut building material, but not dead fuelwood.

Table 6.1 gives the rates of fuelwood removal from three reserves where it is measured. While it is risky to extrapolate from such limited data, it indicates that the total fuelwood yield of conserved areas may be of the order of a few thousand tons per year and most certainly less than 1% of the potential sustainable offtake.

	Hluhluwe	Umfolozi	KaNgwane
1988	1 880	84	
1989	186	120	12
1990	63	24	21
1991	388	458	28
1992	554	75	202

TABLE 6.1 Fuelwood yield from bush control in Umfolozi and Hluhluwe Game Reserves and harvested by permit in the MtethaMushwe Reserve, KaNgwane in tons per year
Source: Data supplied by S. McKean, Natal Parks Board, and M. Stalmans, KaNgwane Parks Corporation

6.4.3 Management issues in resource harvesting from Reserves

Despite some of the innovations mentioned above, certain issues associated with the concept of harvesting or gathering wood from reserves merit debate. Park authorities are often reluctant to permit harvesting. Arguments against it include:

- problems of controlling the access and activities of wood gatherers;
- the presence of dangerous game;
- the disturbance of ecological processes such as the decomposition of dead wood, and nutrient recycling; and
- anxiety over the snaring of game, accidental fires, and other problems.

A reorientation in thinking by park management toward a more people-centred approach, is obviously a prerequisite for the widespread managed harvesting of fuelwood or other woodland resources in parks and reserves. The question of equitable access to the resources by individuals also needs addressing.

The creation of an appropriate forum, including all stakeholders (for example, park authorities, community representatives and development agencies), is needed to resolve the issues affecting any exploitation of the fuelwood resource present in formally conserved areas.

6.5 Fuelwood from rangeland on commercial farms

6.5.1 Fuelwood yield

6.5.1.1 Fuelwood for farmworkers

The supply and consumption of domestic energy by farmworker households in South Africa has only recently been investigated (Gandar 1992, Hofmeyr 1993). Farmworkers and their families probably account for between a quarter and a third of the total fuelwood used as a basic domestic fuel in South Africa.

The fuelwood situation on commercial farms varies from a surfeit of fuelwood in the extensive ranching areas to situations of acute shortages.

6.5.1.2 Fuelwood leaving farms

The commercial farming sector is a net exporter of fuelwood. Some townships and homeland areas are heavily dependent on neighbouring white-owned farms for fuelwood. It is not inconceivable that as much as a quarter of the fuelwood consumed in KwaZulu originates from the commercial agriculture and forestry sector in Natal (Gandar 1992).

6.5.1.3 Source of fuelwood on commercial farms

In the survey of farms in Natal and Transvaal (Gandar 1992), the percentage of farms in which a particular fuelwood source was utilised was found to be:

Indigenous vegetation	34%
Woodlots	21%
Waste/residues of commercial plantations	28%
Wattle or other exotic invasives	33%
Other	5%

Only 33% of the farms in the sample had any bushveld and an additional 12% had other indigenous species. However, the potential yield of fuelwood from bushveld was on average 430 tons per year from each farm with bushveld. Taking all farms together, bushveld was responsible for 66% of the fuelwood resources, excluding forestry waste.

6.5.2 Fuelwood harvesting in farm management

The harvesting of fuelwood can be a useful tool in the control of wattle, and some farmers have incorporated it into ad hoc efforts to do so. The same principle might apply to indigenous savanna rangeland. Most farmers in the extensive ranching areas perceive bush encroachment as a problem and encourage fuelwood harvesting, some providing workers with saws for the purpose, but generally regard the impact of wood gatherers to be minimal (Gandar 1992).

The impact of wood harvesting on bush encroachment is likely to be more significant where wood cutters with transport take large amounts for sale. This may occur when there are dense rural settlements near commercial ranches with an encroachment problem. Such a situation exists in the Natal Midlands, for example, where loads of fuelwood of indigenous acacia species (especially Acacia nilotica) are cut on white-owned farms for use on the African freehold areas, or so-called 'black spots' (AFRA 1991).

Some examples have been noted of fuelwood from cattle or game farms in the eastern Transvaal being taken to nearby Gazankulu (J Venter, pers comm.). There

were three different approaches. The first had clear management objectives, with wood being cut by a contractor according to a strict bush thinning strategy to create a desired woodland structure. The contractor stacked the wood in cords in the veld. Wood merchants then purchased the wood and removed it themselves in their own vehicles. In the second system, there was no contractor: the fuelwood dealer cut, loaded and removed the wood. Thus, there was less fine control over the resulting woodland structure. In the third example, wood gatherers (mainly women) were permitted to collect dead wood and trim dead branches, which were removed in headloads. The objective in this case was presumably not woodland management.

Sometimes farmers themselves have marketed fuelwood derived from bush clearing, as a luxury item in the cities: 'genuine bushveld braai wood'. Frequently, they have found that they have not been able to cover the packaging and transport costs. However, there is a well-developed fuelwood trade with professional wood cutters clearing Acacia saligna (Port Jackson willow) and Acacia cyclops (rooikrans) on private land in the western Cape and selling it through formal outlets. It is lucrative, with a turnover of over R20 million per year (Azorin 1991).

6.6 Policy implications

6.6.1 Primary goals

The savanna areas are the main source of domestic fuelwood for rural people in South Africa. Overall the savannas produce ample fuelwood, but most of it is on commercial farmland and conservation areas where only a small fraction of the potential offtake is used. Meanwhile in the communal areas in the homelands, the resource is often over-used and in some areas its long-term survival is threatened.

There are two main broad goals:

- to secure sustainability and equitability of use in the open access areas; and
- to make much better use of the under-utilised savanna areas.

6.6.2 Managing the open-access areas

6.6.2.1 Social forestry

The management of the indigenous wood resource in the communal areas should be regarded as an integral component of a social forestry programme.

Social forestry in its broadest sense refers to any planting and management of trees in populated environments, by local individuals, groups or communities. Subsequent chapters will describe the breadth of social forestry, the policy and institutional aspects of it, and the implications for extension and training.

6.6.2.2 The trigger and process for implementing resource management strategies

One particular point is frequently emphasised throughout this paper: that social forestry (including the management of natural woodlands) must be part of the development process and that integrated and coordinated initiatives are required.

The starting point is to create the framework for natural resource management to be integrated into the wider development sphere. The sustainable management of resources should be the agenda of all major rural development initiatives.

There is no simple formula for implementing resource management strategies. Either top-down or bottom-up planning, or a combination of the two, can be viable, depending on local specificities, the content of planning and the macro-environment (Nhira 1992). There is very limited experience to draw on in this area in South Africa at present. Therefore, it is suggested that efforts should be directed towards

supporting innovative initiatives for the sustainable and equitable use of woodland resources, rather than formulating a uniform policy amongst the various conservation and development agencies.

6.6.2.3 Research on traditional management systems

While the importance of building on local or traditional practices in the management of resources is acknowledged, there is limited published material on the subject in South Africa. In the absence of any coordinated research programme it has been necessary to rely on very patchy and anecdotal information.

Traditional practices are changing: in some cases they are adapting positively to new circumstances, and in others they are being eroded by the influences of modern society and of racial policies.

6.6.2.4 Support for RMAs

We suggest that support for RMAs requires specialist inputs and should therefore be the responsibility of the appropriate nature conservation authority, which could be called upon should the possibility of an RMA be indicated. This would require a redirection of conservation efforts to establish the necessary outreach capacity.

The parks and conservation sector is in a state of flux at the moment as new people-oriented policy directions are being sought, and the political transition in South Africa will inevitably bring institutional changes to existing conservation authorities. There is now a window of opportunity for the nature conservation sector to adapt to new roles.

6.6.3 Access to fuelwood elsewhere

6.6.3.1 Conservation areas

One component of the reorientation of nature conservation policy relates to the relationship between parks and neighbour populations. On the one level there is the practical matter of access to the parks and the resources. At a deeper level, there is also a question of neighbours as stakeholders and their right to a say in management decisions. There are strong pragmatic reasons for neighbour-friendly park policies.

However, given the diversity of situation and the limited experience in South Africa (and elsewhere) in this area, it is more appropriate to support selective bold initiatives which might later serve as models, than it is to seek uniformity in park management.

6.6.3.2 Commercial farms

There are huge under-utilised wood resources on commercial stock and game farms. While there are logistical constraints on its use (particularly distances between source and demand), the amount of fuelwood obtained could certainly be increased. There are two main conditions needed to achieve this:

- cooperative farmers with an understanding of the benefits of wood harvesting in a farm management strategy; and
- the emergence of a class of wood entrepreneurs who are trusted by farmers and who have their own transport.

The opportunities for intervention are limited, but the extension services and the agricultural unions could help facilitate the former, and small business development units or NGOs could possibly assist with the latter.

CHAPTER SEVEN

Distribution and commercialisation of fuelwood

7.1 Commercialisation of fuelwood

A number of surveys of the use of fuelwood by rural households in South Africa have indicated that the purchasing of fuelwood is a widespread phenomenon.

Bophuthatswana
In selected rural communities 32% of families buy firewood, and in peri-urban areas close to Mmabatho and Mafikeng, 57% buy all or most of their firewood (Eberhard & Dickson 1987). In peri-urban Amatelang, all wood-using households buy all or most of their fuelwood (Eberhard 1986).

Gazankulu
In four rural communities in the Mhala District, up to 19% of households buy firewood (Griffin et al 1992) while in more peri-urban settlements in the same area the range is 34% to 68% (Eberhard 1986, Kennedy 1990, Griffin et al 1992).

KwaZulu
In a sample of eight rural areas of KwaZulu, a third of those who used fuelwood bought all their wood and only 12% bought none (May et al 1993). In Vulindlela, which is more semi-rural and peri-urban, 56% bought all their wood and 15% bought none (Eberhard 1986). In parts of KwaZulu, where indigenous wood is relatively accessible, very little is bought. Virtually no wood is bought in Ingwavuma (May et al 1992) or in the valley lowveld areas of the Mahlabatini District, but a minority of households in nearby grassland areas buy wood (Gandar 1988).

In a few scattered rural surveys in Transkei, Ciskei and Lebowa, up to 38% bought wood, depending on the local availability of free wood (Eberhard 1986).

People frequently hire transport for the collection firewood, and depending on the nature of the transaction with the haulier, this might be regarded as bought wood or collected wood. The review above possibly underestimates the commercialisation of fuelwood since some of the 'collected' wood seems to have been transported and therefore has a monetary cost (Eberhard 1986).

In the larger urban complexes, nearly all the fuelwood used has to be bought. However, the consumption of fuelwood in these areas is low (Williams 1993). Of the fuelwood used by low-income families in South Africa, only roughly 5% is used in urban areas (Table 2.5). In South Africa, there is not the massive transfer of woodfuel (as firewood or charcoal) into the cities from outlying areas which characterises many other parts of Africa.

7.2 Distribution systems for fuelwood

The commercialisation of fuelwood is clearly a response to local fuelwood shortages. What commercialisation does, in effect, is extend the area from which the community obtains its wood and thereby enlarges the available fuelwood resource. This implies the need for a transport and distribution system, which is responsible for most of the cost to the user.

Fuelwood and charcoal distribution networks have been investigated in a number of African countries (Leach & Mearns 1988, Boberg 1992) and can be quite complex

and obscure, as in southern Mozambique (Williams, pers comm). There has been no such study in South Africa, so what information we have on fuelwood distribution systems is anecdotal, and very limited.

There are a few broad categories of fuelwood distribution systems which can be identified:

i) Incidental wood gathering to supplement income. Wood is sometimes fetched on foot by women in KwaZulu (Gandar 1988) or, in Bophuthatswana, by children with hand-pulled carts (Eberhard & Dickson 1987) and sold in the village. An instance has been recorded of women in KwaZulu walking to farms in neighbouring Natal where they were 'paid' in wood for their casual labour. They would carry the wood home to sell in the village (Gandar 1988). These activities do not result in significant movements of wood.

ii) Transporting. It has already been stated that people sometimes hire transport to fetch fuelwood. Transporting is often done by tractor and trailer, with many tractor operators doing haulage jobs outside of the ploughing season (Gandar & Auerbach 1993). Transporters may do only a part of their business carrying firewood. They are functionaries rather than participants in the fuelwood distribution system. Sometimes transporters fetch and deliver fuelwood to the user on contract, and in such instances they operate more like vendors.

iii) Vending. This is sometimes the simplest distribution system with the vendors fetching wood, carrying it in their own transport, and selling it directly to the users either by delivering loads to homes or hawking wood in towns and villages. However, many street vendors do not fetch wood themselves but rely on some other supply.

iv) More developed networks. In an example recorded in Bophuthatswana, a woodcutter cleared land for agriculture under contract. He sold the wood to a truck owner who on-sold it to stores and coalyards to sell to the public (Eberhard & Dickson 1987). In the Natal and KwaZulu areas, the author has observed wood merchants with large trucks obtain wood from commercial plantations and wholesale it to stores which may be 100 km away.

v) Formal networks. These involve the commercial production and packaging of fuelwood, formal sector distributors (for example Natal Coke and Coal), and retail outlets in urban areas. Though not aimed at the low income market, a certain amount may be used in this sector. The formal sales of fuelwood from plantations, as recorded in the official statistics (Department of Water Affairs and Forestry 1992) amount to 195 000 tons per year, or between 1% and 2% of total roundwood production.

7.3 The sources of commercialised fuelwood

7.3.1 Sources in the homelands

Within the homelands, the main sources of fuelwood for distribution and sale are the natural woodlands, and woodlots and plantations. There is very little information about the distribution of wood from these sources.

Indigenous woodland supplies some very local fuelwood economies where the method of transport limits the distance the wood can be carried (for example headloads, hand-pulled carts and donkey carts). The extent to which indigenous wood is carried in large loads over longer distances is not known. A prerequisite for the significant redistribution of indigenous fuelwood within the homelands is the existence of extensive, well wooded, sparsely populated areas within economically transportable distance of densely populated areas where wood is in short

supply. Such conditions might be found in Venda, and in areas where settlement patterns are highly nucleated (for example Bophuthatswana). The transport and distribution of indigenous wood from areas newly cleared for cultivation has been reported, but such sources of supply are too irregular to support a reliable distribution network (Eberhard & Dickson 1987).

7.3.2 Sources in commercial farming and forestry

Significant quantities of fuelwood are potentially available in the commercial farming and forestry sector for distribution in the homelands. The main sources are plantation wastes and residues, wood from the thinning and clearing of bushveld, and from the control or removal of invasive species. The extent of these resources has been described in Chapter 3.

Wood from range management operations feeds into fuelwood distribution networks in Natal and the eastern Transvaal (see Section 8.5.2). Fuelwood is obtained from invasive exotic trees on commercial farms in the Natal midlands, the western Cape and probably elsewhere. Forestry plantations in Natal and Transvaal are major suppliers of fuelwood to the homelands.

The quantity of fuelwood originating in the commercial sector is unknown but there are indications that it is substantial. For example, Gandar (1992) suggested that it is plausible that as much aa a quarter of the firewood used in KwaZulu originates from commercial agriculture and forestry in Natal. Subsequent data collected in eight rural areas in KwaZulu (May et al 1993) indicates that a higher proportion, possibly over 50%, of the fuelwood used in these particular areas comes from farms and plantations in Natal.

7.4 Transport distance

There is little information available on the distances over which wood is transported. The distance will be limited by the means of transport: donkey cart, tractor and trailer, bakkie or truck. The transporting of fuelwood up to 100 km by truck has been noted in Natal and KwaZulu. The following assumptions have been made to calculate an economic maximum transport distance. The wood is carried in an owner-driven 7-ton truck. No allowance is made for the cost of employing a driver. The costs, below, have been derived from the 1992 costs of transporting timber (SATGA 1993). The transport cost is calculated per km of lead distance, but includes the cost of the empty return leg.

	Rand/ton
wholesale price delivered	120.00
wood cost at plantation	10.00
labour cost (loading)	4.60
labour cost (off-loading)	1.10
profit margin	20.00
transport	0.54 per km

On the above figures, the maximum economic distance is 156 km. Transport of fuelwood over distances of this order is not uncommon elsewhere in Africa (Boberg 1992).

CHAPTER EIGHT

Strategies for afforestation and social forestry

8.1 Experience to date in South Africa

8.1.1 Historical overview

Regulations concerning the cutting of trees for fuel and timber were passed almost as soon as the first Dutch settlers established themselves at the Cape, and there was evident concern about overexploitation (Grut 1977). In the 1680s, the first small afforestation schemes (woodlots in effect) were established. The early conservation regulations and forestry were directed towards the needs of the colony, and it was not until the late nineteenth century that attention turned to the requirements of rural black populations. In 1891 Mr Harran, a District Forest Officer, drew attention to their dependence on indigenous forest for kraalwood, firewood and fencing. Storr Lister emphasised the environmental consequences, noting that 'the annual removal of millions of saplings for hut-building is nothing less than annihilating the rising generation of natural regrowth' (le Roux 1979). The first woodlot to provide firewood and hut material for rural blacks was established in 1893 near King William's Town. Further wattle plantations were established in the Ciskei shortly thereafter, and further east in the Transkei at the turn of the century.

Woodlot development continued in the eastern Cape. Some of the woodlots are still in existance in Ciskei and Transkei and date back to the late 1940s and 1950s. At the same time a number of municipalities in those areas established woodlots for the growing black populations around towns. The number of woodlots increased gradually through the 1960s and at a greatly accelerated rate (particularly in Transkei) in the 1970s and early 1980s. The driving force behind these and earlier woodlot programmes was primarily an environmental concern. It was only from the mid-seventies that proper woodlot programmes were put into place outside of Transkei and Ciskei.

Evidence was accumulating that the procedure of handing over woodlots to traditional (or 'tribal') authorities was not very satisfactory (see 8.1.3 below). For this and other reasons, there has been a slowing down of fuel and pole woodlot programmes to the extent that they are only being actively promoted in Venda at the moment.

Small homesite woodlots date back at least 60 years. Some of the homesite woodlots had a commercial orientation, producing wattle bark or timber. Since 1982, major timber companies have been engaged in promoting small-grower timber production. This is the only type of woodlot showing significant expansion at present.

With the slowing down of woodlot development has come an interest in other open-ended approaches to afforestation in the homelands, which fall in the broad category of social forestry, described more fully below. Social forestry is still relatively new and untested in South Africa. It has been accompanied by a fundamental change of key role-players. The homeland administrations, which were in the forefront of woodlot development, have proved to be slow to adopt the new approaches. It has fallen on NGOs to promote social forestry projects. At the same time, central government has become directly involved, particularly through initiatives in the Energy Branch of the Department of Mineral and Energy Affairs, and the Forestry Branch of the Department of Water Affairs and Forestry.

Outside of the homelands, farm woodlots on white-owned commercial farms have a long history and have provided firewood for labourers and their families. As

mentioned previously, the provision of firewood and other forms of energy for farmworkers is the subject of a separate paper in this series (Hofmeyr 1993).

8.1.2 Betterment planning

No account of woodlot development in South Africa can ignore 'betterment planning'. It has had a profound effect on the rural landscape and rural communities, and specifically on the shape of woodlot programmes. Betterment planning, or 'rehabilitation' as it is called in Transkei and Ciskei, was the cornerstone of policy regarding subsistence agriculture. It involved the resettlement of people on a massive scale in the interest of land-use planning. Scattered residential sites were consolidated into nucleated settlements with individual sites large enough only for residence and a small garden plot. The area of highest agricultural potential was set aside as arable, and families allocated fields within this. The arable area was fenced as a block and grass banks established on contours for conservation reasons. Less productive areas were declared grazing commonage, and for each community an area was demarcated for a woodlot, even though the betterment package did not include woodlot establishment. Throughout the homelands, maps were drawn up of betterment plans, whether they were implemented or not.

Betterment planning was founded on the concept of the economic household unit even though the Tomlinson Commission showed that it was physically impossible to create sufficient economic units under the existing conditions. For many reasons, betterment failed as a development strategy, and has often been bitterly, sometimes violently, resisted by rural people (Daniel 1970, Mare 1980, Yawitch 1982). The land capability assessments on which plans were based were cursory at best, and no account was taken of people's wishes. Betterment was implemented on a large scale in the 1960s and early 1970s particularly. While it remains the stated policy in the homelands, there is an effective moratorium on implementation. However, as late as 1986, communities in Pondoland and Transkei were instructed to destroy their homesite woodlots in preparation for implementation of betterment.

The closer settlement pattern of betterment schemes virtually rules out homesite woodlots. Practically all homesite woodlots are found outside of betterment areas.

Betterment maps still exist showing designated village woodlot areas all over the homelands in a somewhat arbitrary fashion. Any new woodlot development has to fall within these designated areas. Despite the poor communication which characterised betterment planning, many communities are still aware of the exact area which was designated for a woodlot.

Should a designated area be unsuitable for social or silvicultural reasons, government approval is supposedly necessary to use an alternative area. It is not normally a difficult procedure to get approval, but at least one community has had a woodlot project obstructed as a result of an outdated betterment plan.

8.1.3 Traditional authority (TA) woodlots

8.1.3.1 Institutional responsibilities for TA woodlots

The usual practice in woodlot programmes was for the relevant department to establish the woodlot and for the TA to take over responsibility for management, maintenance and harvesting, though many of these woodlots are totally neglected in practice. Revenue from the sale of wood accrues to the TA. Some woodlots in Ciskei and Lebowa, for example, remained under departmental control for several years and were only handed over when the trees were mature. In KwaZulu, greater efforts have been made to involve local communities because of the belief that the greater the local participation in establishing the woodlot, the greater will be the commitment to maintaining it. In practice, this only means that the TA organises the labour force, either unpaid or at its own expense. It is doubtful whether these woodlots are any better maintained.

While details of the institutional arrangements vary between the different homelands, one consistent feature is strong departmental involvement in the establishment of woodlots, and local involvement in their management and maintenance (in theory, at least). There are obvious financial reasons for this arrangement: departments are wary of incurring substantial recurrent costs in the maintenance of small scattered woodlots.

In practice, the establishment of a TA woodlot usually involves more than one department, and coordination between them is often inadequate. In Lebowa, as a typical example, the agricultural section is responsible for fencing and initial land preparation, the forestry section provides the trees and supervises planting, and the Department of Works grades the firebreaks. The development of woodlots there was halted in 1989 when the agriculture section exhausted its budget for fencing, and has never been restarted.

A further problem arises from the lack of clarity about the respective roles of government and the community. As a result, local people are confused about the status of TA woodlots, about who initiated the project and who owns the trees. Trees are perceived as belonging either to 'the government', or to the chief personally, but very few people regard the trees as belonging to the community. Villagers also generally believe that responsibility for managing woodlots lies with the government rather than the community.

Furthermore, the suitability of TAs as agents of rural development has been questioned. This issue and the question of alternative local institutions were discussed earlier in connection with the control and management of local resources (Chapter 6). Allegations of the appropriation of woodlot revenues by the chief, or of favouritism in granting access, have been made in certain instances (Gandar 1991a).

8.1.3.2 Sizes and condition of woodlots

TA woodlots vary greatly in size, from less than 1 ha up to 100 ha. In Transkei and Ciskei these are commonly between 20 and 50 ha in extent. Elsewhere TA woodlots are generally smaller, mainly from 2 to 8 ha with a mean of 5 ha. In KaNgwane, Schoemansdal plantation (formerly a commercial plantation under the KaNgwane Department of Forestry) was handed over to the Matsamo TA in 1982, so it is, in fact, a unique TA 'woodlot' of 1 400 ha. In the absence of any extension and management support for the TA, the condition of this potentially valuable resource has deteriorated alarmingly.

The very small woodlots were established in the hope that TAs would be encouraged to enlarge them at a later stage. In practice, examples of TAs requesting enlargements to their woodlots are very rare.

The condition of TA woodlots has been disappointing and some internal departmental reports have expressed a degree of disillusionment with these, sentiments echoed by various foresters employed in the homelands. Indeed, some TA woodlots on record are barely recognisable on the ground. A study of woodlots in Ciskei (Bembridge & Tarlton 1988, Bembridge 1990) noted that only 21% of woodlots are being managed at a reasonable level. Fencing has been maintained on only 52% of woodlots, and in half the cases it has disappeared. 60% of woodlots are being grazed by cattle. No preparation of firebreaks was noted. Where felling is taking place it is usually uncontrolled and often at a height of up to 1 m or more above the ground resulting in poor coppice growth and loss of biomass. This is a fairly valid description of the situation in other areas as well.

In many of the woodlots the trees are already too large for poles and firewood. Sometimes these are felled, the thinner tops utilised, and the rest, too large for poles and firewood, left to rot. There are examples of the TA selling the standing crop of

overmature woodlots to a commercial contractor for timber, and the contractor selling the offcuts locally as firewood.

The management of TA woodlots generally does not seem to include silvicultural practices. Management, if any, consists of controlling access to the woodlots, collecting revenue, and in a few cases maintaining fences and controlling livestock. However one or two rare examples of coppice reduction have been noted, and there are a few examples of intercropping with food crops between the trees in Lebowa, Gazankulu and KwaZulu.

The ways in which access to TA woodlots is controlled are as follows:

i) *Zero management.* No restrictions are placed on people's access to the woodlot and they may harvest as they wish without payment, and no attempt is made to enforce the exclusion of animals.

ii) *Open and closed periods.* When open, there is free and unrestricted access, but the TA periodically declares the woodlot closed to allow regeneration. Closed periods may last months and sometimes years. The enforcement of closure is often half-hearted. This system appears to be an adaptation of traditional forms of regulation of indigenous forest (see Chapter 4).

iii) *Selective access.* It has been reported sometimes that the TA grants selective access to certain favoured people.

iv) *Access after receipt of payment.* People wanting wood pay in advance at the TA office and then cut the wood themselves. In Ciskei, at least, wood is supposed to be cut under supervision of the ranger. This is the only system in which records are kept of how much wood people are obtaining from the woodlots. Sometimes the records show very few sales per month, and those are nearly all of poles, not firewood. This is possibly because people cut illegally, but is more likely a result of the system of access. It is inconvenient for the buyer, and scarcely worth the trouble for a headload of firewood, though people will buy a load of poles to build a hut or house. It sometimes takes hours of time spread over two or more days to make all the arrangements to obtain the wood (Gandar 1991a). Furthermore, a common unit of sale is a standing tree which also discourages the buying of firewood.

   The fact that recorded sales were almost all poles, once led foresters to conclude erroneously that the demand for poles far exceeded that for firewood. This perception has also become ingrained in the minds of local people (in Ciskei, at least) who regard the importance of a woodlot in producing poles to be greater than that of firewood (Bembridge & Tarlton 1988). This is probably not a reflection of their relative basic needs as much as it is of access, which has led to the situation in which only a minority of people living near a mature woodlot say they derive any benefit from it with regard to firewood (Bembridge & Tarlton 1988).

v) *TA harvests and sells the products.* This was only encountered in two TA woodlots: Upper Regu in Ciskei, and Machaka in Lebowa. The TA had purchased a chainsaw and was harvesting the woodlot in rotation and selling the products.

In woodlots with little or no restriction on harvesting, the trees are often stumps with short fairly dense coppice. There is no rotational system of harvest. Shoots are mostly too small for poles, so gatherers generally select the larger shoots for firewood. This acts as coppice reduction, and the woodlot effectively becomes a continuously harvestable resource. The number of plants per hectare is frequently low as a result of mortality, due presumably to animal damage and poor harvesting technique. The result is somewhat horrifying to a conventional forester, but this

could possibly be the basis of a very appropriate woodlot harvesting method with a minimal amount of extra care. It has been suggested that the productivity of these woodlots is low, but there is no evidence as to what the productivity actually is.

8.1.3.3 Attitudes of local people to TA woodlots

The attitude of local people to TA woodlots is not very favourable. There is confusion about ownership and responsibility (see above). Many villagers expressed the view that consultation had not been adequate with the discussions involving only the department and the TA, not the community itself. The arrogance of some headmen has not helped: one said emphatically 'It all [the woodlot] belongs to me'. Some people expressed distrust of the TAs, and others seemed reluctant to discuss it (Gandar 1991a). In one area of Transkei where a TA woodlot and a departmental woodlot are in close proximity, people preferred to use the departmental woodlot. Woodlots generally were not seen as a high priority – lower than job creation, water supplies, clinics and schools (Bembridge 1990).

8.1.4 Departmental woodlots

Departmental woodlots are those which have been established by the relevant government department or parastatal agricultural development corporation, usually on land released to them by the TA. The department takes full responsibility for the establishment and running of the woodlot, bears all the costs, and sells the poles and firewood to the local population. The department may pay the TA a nominal rental for the land (for example R2 per ha per year in Lebowa), and makes work opportunities available for local people. However, there are examples of communities releasing good agricultural land for a woodlot because of the jobs (albeit temporary) not the wood.

There are no formal or legally binding lease agreements with TAs over land provided for woodlots. The understanding seems to be that the department has the right to operate the woodlot indefinitely. This contrasts with Lesotho where there are clearly agreed and formalised 25 year lease agreements between the TAs and the Lesotho Woodlot Project.

Departmental woodlots are considerably larger on average than TA woodlots and some are more like plantations than woodlots. They range from about 30 ha to 300 ha, though there are smaller ones in Lebowa. Below about 50 ha, it is not viable to have a fulltime trained forester stationed at the woodlot. The distinction between departmental woodlots and the commercial forestry operations of some homeland Departments of Forestry is blurred. The latter will usually also sell poles and firewood. Some of the plantations or larger departmental woodlots have nurseries which sell tree seedlings to the local population but have been rather unresponsive to requests to supply non-forestry tree species.

There have been examples of departmental woodlots being managed by a third party: Measured Farming, a consulting firm, manages two in Lebowa.

In Transkei, the Department of Forestry has established woodlots adjacent to areas of protected indigenous forest so local populations have an alternative source of wood.

8.1.5 Municipal woodlots

In Transkei, 12 municipal woodlots, mostly about 100 ha each, were established at various towns in the 1950s or earlier. This was done to provide for the growing populations in and around the towns. These woodlots have run into disrepair, and some are barely recognisable as woodlots. At least one, however, still provides wood which can be bought through the municipal office.

Municipal woodlots are uncommon in the other homelands: one at Peddie in Ciskei

is possibly the only other. However, municipal woodlots are not confined to the homelands. The Municipality of Malmesbury, for example, has a woodlot, although it is not its policy to make wood available to the local population.

The City of Pietermaritzburg has its own extensive plantations as part of a green belt plan, but also as a source of revenue for the City Council which, until recently, had its own Forestry Section to manage the plantations. Since October 1988 the management of the plantations has been contracted out to the Natal Co-operative Timbers (NCT). The plantations are mostly orientated towards commercial timber, but about 700 tons of firewood per year is sold to contractors and a substantial (but unknown) amount of firewood is scavenged from brush lines.

8.1.6 Community woodlots

'Community woodlots' refers to those established by members of the community themselves, and run by them or by a committee chosen by them. TA woodlots have often been referred to as community woodlots, but the community has little control over these woodlots. Some TA woodlots have woodlot committees but these are just extensions of the TA and are invariably chaired by the headman.

Not much attention has been given to genuine community woodlots in South Africa. There have been only two programmes which actively promoted community woodlots and these barely achieved a total combined area of 50 ha. One was implemented by the Transkei Appropriate Technology Unit (TATU) in Transkei, and the other by The Valley Trust in KwaZulu.

The work of TATU was part of the Local Energy and Forestry Programme (LEAF) supported by the Development Bank of Southern Africa. Between 1987 and 1990, 35 ha of community woodlots were established. An evaluation has been made of the programme (Gandar 1990b) which concluded that the project had been successful and 'stood out as a rare example of a genuine community approach to woodlot development. The success of the programme has been founded on community training and organisation building at a local level. The creative use of workshops has been the spearhead of this aspect of the programme'. However, although the decision making and problem solving capabilities were built up in the committees, they lacked the authority to give effect to the decisions since that authority lay with the sub-headman who was not always cooperative.

The woodlots promoted by the Valley Trust were different in that money for materials and wages for workers was available through the Department of Manpower's employment scheme. The daily wage may sometimes have been more of an incentive than the promise of wood. Some woodlots were linked to existing community projects like community gardens, for others the organisational capacity had to be created from scratch.

Community woodlots have thus far proved hugely expensive, at least in the early stages. There are large hidden costs in the time and travel of extension staff (see Section 9.2.3 below). One reason for including community woodlots in the LEAF programme was the hope these would become an affordable way of afforesting a large area by mobilising local resources. Although the costs per hectare are bound to decrease as the programmes settle down, the possibility of community woodlots becoming an inexpensive self-propelling movement is very remote. Indeed, the LEAF programme has been terminated, and the Valley Trust woodlot programme is dormant.

8.1.7 Privately-owned woodlots

Thousands of rural households have established their own small woodlots.

8.1.7.1 Homesite woodlots for poles and firewood

In some areas, like Pondoland, a high percentage of households own their own woodlots. These are generally in the range 0.1 ha to about 2 ha. Those near Bizana in Pondoland date back about 60 years when two migrant workers independently of one another brought some wattle seed home and planted it near their homes. Soon other people collected seed for themselves and planted it, often in the form of a windbreak near their homes. With time the windbreaks grew into homesite woodlots. Now about 30% of homesteads in the area have established small woodlots with virtually no outside intervention. A similar situation has been described in parts of Swaziland (Allen 1986).

Livestock is often used as a management tool. Since the woodlots are next to the home, access to the woodlot can be controlled, so cattle are allowed limited access, not enough to do much damage, but sufficient to prevent the woodlot becoming wattle jungle.

8.1.7.2 KwaZulu wattle bark producers

In KwaZulu, about 2 000 private wattle woodlot owners have registered as wattle bark producers. The total area of their woodlots is of the order of 4 000 ha. KwaZulu is granted a bulk wattle bark quota of some 2 600 tons per year which is divided amongst the small producers. With the cash incentive of the wattle bark, these woodlots tend to be slightly larger than those in Pondoland. After sale of the bark, the wood is available for fuel or building. These woodlots were also established largely on the spontaneous initiative of the local people themselves. The KwaZulu Department of Forestry has now assigned an extension forester to assist the wattle growers to increase their production.

8.1.7.3 Small-scale timber production

This has become a rapidly expanding area of woodlot development over the last ten years since two major timber companies began promoting small-scale timber production amongst private growers in KwaZulu. However, small commercial woodlots pre-dated the entry of the timber companies into the area, and over 300 independent timber growers with some 750 ha of small plantations of eucalypts have developed more or less spontaneously over the last 20 or 30 years, particularly in the Kwambonambi area. With the intervention of the timber companies, a further 4 600 new growers have entered into contracts with the companies. The aim of the small-grower schemes is to encourage afforestation in KwaZulu, assist people to make a living, and secure timber supplies for their mills.

There are three main schemes:

- Project Grow was started by SAPPI in 1982. The grower enters into a contract with SAPPI to supply the timber to SAPPI. SAPPI in turn provides interest free loans, free seedlings and advice, and makes advance payments on the future crop. Most growers have between 1 ha and 5 ha of timber. SAPPI has a project team, including extension staff, for Project Grow in the Zululand area. While there are benefits to SAPPI in the scheme, it is also seen as a social responsibility programme.
- The Kulunathi scheme of Mondi grew out of a small-grower programme started in 1987 near Eshowe by NTE (now incorporated into Mondi) working with the Institute of Natural Resources and the KwaZulu Department of Agriculture and Forestry. Although Kulunathi is similar in many ways to Project Grow, it is more of a business deal than a social responsibility programme. For example, Mondi charges 10% interest on loans, and does not provide free seedlings. Mondi also

promotes higher levels of inputs: clones rather than seedlings, more fertiliser and intensive site preparation. Thus Kulunathi members take greater financial risks in order to try to achieve higher growth rates. Mondi also has a more aggressive approach to recruitment and extension, and annual planting targets are set in order to justify the expense of a relatively large complement of field staff (Cairns 1993).

Mondi has also been involved in the planting of large blocks in the Ubombo and Nkandla districts. These have been sources of conflict within the communities, and large tracts have been lost to both careless and wilful destruction. The problems arose partly out of the haste with which Mondi implemented the projects.

- Since 1989 the Lima Rural Development Foundation, a development NGO, has been contracted by SAPPI to extend small-grower schemes to the areas of southern KwaZulu. Lima is responsible for project management and fieldwork. This arrangement has the advantage that Lima is able to present other enterprise options to farmers (fruit trees, irrigation schemes, vegetables) and help towards rational land-use in a way that a timber company like SAPPI is not able to do (Cairns 1993). In total there are 5 000 growers with 7 000 ha of timber (Table 8.1).

	No of growers	*ha*
SAPPI Project Grow	1 538	3 058
Lima	1 600	1 084
Mondi Kulunathi	1 553	2 039
Independent	364	746
TOTAL	5 055	6 927

TABLE 8.1 Area planted by timber small-growers in KwaZulu

There is potentially a reasonable profit for the small-scale commercial timber grower. A survey of growers in all three schemes (Cairns 1993) showed that the net profitability of timber is R2 124 per ha for the first rotation. On average, the mean age at felling was 6.24 years (which is about one year earlier than the economic optimum) so the average annual net productivity is R340 per ha. Higher profits are possible: a participant in Project Grow who harvested in 1990 achieved a net profit of R16 942 from 6.3 ha on a six-year first rotation, which is equivalent to R450 per ha per year. This is achievable if nothing goes wrong, but in practice there are a number of possible hazards, the greatest of which is fire.

This level of profitability is only possible because small-growers have no land cost and do not insure their trees. The price paid for timber in South Africa is actually quite low (Section 4.2) and this is an issue that needs to be addressed in relation to the expansion of the small-grower sector and its long-term viability.

The Kulunathi small-grower scheme has been evaluated from the standpoint that development is a process combining social, political and economic goals rather than merely a means of meeting a production target (Friedman 1991). There is still much to be done to ensure that the project meets people's needs, that project structures do in practice allow adequate representation of the growers, and that local management capacity is developed to sustain the functioning of the project. Friedman (1991) draws attention to some of the advantages and disadvantages of working within these small-grower schemes.

The advantages are that some of the problems of rural production are alleviated by providing loans to overcome the lack of capital, providing extension, guaranteed

markets, and inputs like seedlings. At the same time the formation of 'interest groups' of small-growers could possibly lead to a greater organisational capacity in the community. There might also be infrastructural spin-offs such as improved roads for timber extraction. In the Kwambonambi area, where small-growers have emerged spontaneously, so too have contractors, but attempts to set up local contractors for the Kulunathi project have not run smoothly.

There are several potential problems and disadvantages in such schemes:

- The contract precludes cutting and selling wood as needs arise, or the utilisation of the woodlots for poles and firewood. Project Grow will, however, allow premature harvesting, up to a point, if the grower is in financial difficulty.
- Immediate basic needs are not the first focus.
- The relationship between the grower and the company is not an equitable business contract. For example, the grower bears all the risks (as yet, no insurance is available to the growers), contracts are not negotiated and growers are not represented on the project steering committee.
- There is a danger of creating a dependency on the company since companies on their own have little interest in community development per se.
- There is potential for conflict of various types. Within the community inequalities may be reinforced, and there may be land right disputes since trees become a way of fixing a land right to a specific owner. In fact there have been examples of fires being deliberately started. There has also been evidence of conflicts within the household in instances (by no means uncommon) in which women do the work but men get the money. The only women who are permitted to enter contracts on their own behalf are widows.
- Local, decentralised processing is pre-empted.

These concerns are echoed by Cairns (1993).

The question remains as to what contribution the commercial woodlots make to local fuel needs. Near Kwamonambi, where there are many independent growers, there does not appear to be a firewood problem. Although the primary purpose of the trees is to produce commercial timber, a certain amount is taken for local requirements.

Growers who have entered into contracts with timber companies are expressly prohibited from using any of their crop for fuel, except for the harvesting wastes and coppice reduction. SAPPI say they are prepared to turn a blind eye to small amounts of harvesting for local use, though they do not communicate this to the growers, for obvious reasons. After the first rotation, growers are free to do what they like with the wood unless they renew their contracts.

Surveys of growers showed that their reasons for growing eucalypts did not, in fact, reflect a domestic wood requirement (Friedman 1991, Cairns 1993). Nevertheless, the parent company, Mondi, was repeatedly requested to supply wattle seeds in addition to the eucalypts. This they have started to do on the pretext that it reduces theft from nearby white-owned plantations (Friedman 1991). About a quarter of growers in all 3 programmes also have non-commercial woodlots from which they obtain firewood (Cairns 1993).

8.1.8 Summary of woodlots

Table 8.2 summarises the total area of woodlots in the homeland according to the type of woodlot and the region.

	TA	Dept	Munic.	Comm-unity	Com'rcial small grower	Private & non-com'rcial	Other & not classified	TOTAL
Bop'tswana	1 000	1000						
Ciskei	350	425	50	825				
Gazankulu	13	14	17	44				
KaNgwane	1 457	1457						
KwaZulu	582	31	10 927	250	2280	14 070		
Lebowa	38	841	216	1095				
QwaQwa	550	550						
Transkei	12 000	14 570	1 000	35		5 000	10 000	42 605
Venda	596	45	641					
TOTAL	16 036	16 400	1 050	66	10 927	5 295	12 513	62 287

TABLE 8.2 Classification of woodlots in the homelands (total areas in hectares)

8.1.9 Social Forestry

8.1.9.1 Definition

Social forestry is a broad term to describe the planting of trees by local communities, groups or individuals. The purpose is to satisfy one or more of a range of local needs including social and environmental needs. Social forestry also implies significant community participation in design, implementation and management.

There are many components to social forestry:

- some of the locally rooted woodlot projects described above, namely community woodlots and privately owned small woodlots;
- agroforestry, which is a collective term for systems in which trees and shrubs are grown in association with crops and livestock in such a way that there are positive economic and ecological interactions between the tree and other components;
- reclamation forestry in which trees and other plants are used primarily for soil conservation and land reclamation, though other benefits may ultimately be yielded; and
- greening projects, which are not as focused as the examples above, and broadly seek to promote the planting of trees at homesteads, schools and village open-spaces, for example. One of the objectives is to create pleasing and comfortable living spaces, but there is a whole range of other potential benefits depending on which trees are used and how. Greening projects may be urban or rural.

8.1.9.2 Social forestry in South Africa

The concept of social forestry grew as the limitations of existing woodlot programmes became apparent. There was a flurry of workshops and seminars around the subject of social forestry in the late 1980s, with fairly wide acceptance that the narrow terms of reference of conventional forestry have to be widened. Interest was initially focused on agroforestry, a component of social forestry. A number of reports appeared at that time recommending agroforestry as an appropriate form of land use for the homelands (for example Fenn 1988, Erskine 1988, Loxton Venn & Associates 1990).

Nevertheless, there were very few actual programmes before 1990. Between 1985 and 1990 there were a few sporadic research projects which did not produce any conclusive results. There were also a few small isolated NGO initiatives, but the overall impact was negligible. Typically these consisted of a small nursery, with a few demonstration trees planted nearby, supplying trees to the neighbouring community. Agroforestry was included as component of the LEAF programme in Transkei (see Section 8.1.10).

Because agroforestry was initially seen largely as an alternative to woodlots, it acquired a tree bias which is still discernible today, and stands as a barrier to a more interdisciplinary approach to agroforestry.

Since 1990, there has been a notable increase in social forestry initiatives, both in the government and NGO sectors, though the scale of the projects is still small compared to some other countries in Africa. Amongst the current social forestry projects, there is a variety of approaches which are being tried or are planned. It is too early to evaluate these with regard to their long-term sustainability, or their eventual impacts in terms of the number of trees surviving to maturity.

However, there are some important points that have emerged about social forestry as a whole in South Africa.

- Facilities for training in social forestry are virtually non-existent. The only centre offering social forestry training is the Community Agroforestry Renewal Organisation (COAFRO), an NGO based in the eastern Cape.
- Possibly the main constraint facing social forestry projects is in the area of extension and fieldwork. Firstly, the shortage of trained people, and secondly, the difficulty obtaining funding for salaries, is responsible for this situation. As a way of getting round this problem, the Herschel Social Forestry Project is experimenting with a system of contracting out specific extension tasks to local people who are trained, but not formally employed, by the project. These contract extension workers also have their own nurseries and supply trees to the project.
- It is common for social forestry projects to lack the necessary in-house technical expertise. This points to the need, firstly, for information networks and, secondly, for people professionally trained in social forestry.
- Social forestry cannot flourish in isolation. It has natural linkages with other aspects of development such as agriculture, water development and others. Furthermore, since trees, firewood and the environment are seldom at the top of the list of the priorities of rural communities, social forestry has the best chance of success when coupled to initiatives which address the most pressing needs. This indicates the need for social forestry to be located within broader development schedules, and underlines the importance of coordinated and integrated programmes.

The recent increase in the number of social forestry projects is partly due to the Biomass Initiative which originated in the now defunct National Energy Council. The Biomass Initiative formally began in April 1992 with the approval of Phase 1 by the Cabinet, but did not get fully under way until 1993. It is under the overall control of an interdepartmental steering committee.

The Biomass Initiative has three elements: assessment, production and dissemination. It is the production element which is directly concerned with support for social forestry on a pilot project basis. The initial emphasis is on setting up effective tree delivery systems, including nursery establishment, training of nursery staff and extension workers, water supply provision and developing distribution networks. A synthesis pulling together the results and lessons of Phase 1 is planned for 1994.

8.1.10 The LEAF Programme

The Local Energy and Forestry Programme (LEAF) was initiated at the end of 1986 in Transkei, and ran until 1990. LEAF was funded by the Development Bank of Southern Africa. Although the practical achievements of LEAF were modest, and the programme was terminated after a preliminary Phase 1, it did mark something of a turning point in woodlots and social forestry in South Africa.

It consisted of two sections with contrasting approaches:

i) an institutionalised approach of establishing woodlots owned and controlled by the Transkei Department of Agriculture and Forestry (TDAF); and

ii) a community-based approach implemented by the Transkei Appropriate Technology Unit (TATU) and two subsections, namely community woodlots and agroforestry.

The former was the main component of the project and received most of the funding. In practical terms, it achieved 558 ha of TDAF woodlots, 35 ha of community woodlots and a few small agroforestry projects.

LEAF marked the first big step in abandoning the TA woodlot formula in favour of departmentally run woodlots. Although there was no formal evaluation of this part of the project, there was tight monitoring of progress and financial record-keeping. It did highlight difficulties in keeping costs down to levels comparable to those in commercial forestry (see Section 9.2). It also indicated potential problem areas such as communities which requested woodlots for jobs rather than trees. However, there were no grounds for rejecting institutionalised woodlots outright, and provided certain conditions are met, this remains a valid option for afforestation.

It was the first time that social forestry had been incorporated into a large afforestation programme. This component was more thoroughly evaluated than the TDAF woodlots (Gandar 1990b, Loxton Venn & Associates 1990, Bolus 1991) and the beginnings of a methodological framework for implementation emerged, particularly in the community woodlot component.

The community woodlot approach was shown to be potentially workable but with high programme costs for extension (see Section 9.2.3). The agroforestry component met with mixed fortunes. Most of the progress was made with homesite agroforestry (which also included general non-agricultural tree planting). Interventions in the livestock and grazing sector were much more difficult, and really needed to be linked to wider livestock programmes.

A principle of the original LEAF proposal was that TDAF should retain active involvement in the community-based section while building up the capacity to undertake its own community woodlot and agroforestry programme. In other words, TATU was to test and develop approaches to community-based tree projects, and the techniques and methods would be transferred to TDAF.

In practice, changes required for TDAF to become involved in community forestry and agroforestry projects had been underestimated, and LEAF failed in its objective of transferring the techniques of community-based development to a department grounded in conventional forestry approaches. The transition requires changes in outlook, infrastructure and modus operandi. Resources and training at all levels are needed to effect this, not to mention the will and confidence which appeared to be lacking in TDAF. These requirements for the transformation of conventional forestry institutions into vehicles for social forestry proved to be substantial.

The compartmentalised structure of the programme was a problem. Even the community woodlot and agroforestry components were separated in practice, and this was partly responsible for the high programme costs. The programme also

suffered from being isolated from other development initiatives.

LEAF also highlighted the issue of research in relation to implementation. The original proposal included some 'on station' technical research on agroforestry systems to be undertaken by TATU. This was not done, because TATU's resources were caught up in the immediacy of implementation. The lesson is that research by the implementing agent should be participatory on-farm research. Technical research should be in the proper organisation with research facilities rather than appended to a programme of implementation. This raises the need for the coordination of research and for establishing links between research and implementation.

8.2 Summary of main lessons from previous experience

- The system of the establishment of woodlots by a government authority and subsequent handing over to a local authority (TA) does not work well.
- Liaison and participation is not enough in itself: communities must have a strong sense of ownership of the woodlot and an understanding of the responsibilities this carries.
- Institutional woodlots can be effective, but ideally need to be large enough to have a full-time forester, or employ a local person with very basic forestry training.
- Community liaison is no less important in the case of institutional woodlots than in more community-based projects.
- Wood production for local use can effectively be mixed with commercial timber production.
- Unwieldy institutional arrangements combined with inadequate coordination (for example between different departments) can bring woodlot programmes to a halt.
- It is essential to understand the motives of local communities for wanting a woodlot (or other tree planting project), which may have more to do with the creation of temporary jobs than the provision of wood.
- There are a number of valid approaches to woodlots and the suitability of any particular approach depends largely on the area, settlement patterns, and ecology. Homesite woodlots, for example, are best suited to areas with scattered homesteads and conditions which favour a readily seeding species like wattle.
- Commercial timber and wattle bark woodlots are an area of potential growth, but small-growers are still outsiders to the commercial forestry sector. Strong associations of growers are needed to represent their interests.
- Small-grower timber production is potentially profitable because the low price paid for timber is offset by the fact that the growers have no land costs or insurance costs since they do not insure.
- The wattle bark quota system is an obstacle to the expansion of the small-grower sector.
- Programmes directed specifically at community woodlots are not cost effective, but community woodlot projects may be appropriate components of other social forestry or rural development programmes.
- Social forestry is too young to have advanced far along a learning curve.
- The adoption of social forestry paradigms has opened opportunities for NGOs

to play active and vigorous roles, whereas woodlot programmes were largely the domain of government institutions.

- The transition from plantation forestry and woodlots to social forestry is not a simple one. New intersectoral links are needed, as well as a new set of support services. Large changes to and the expansion of forestry extension, which had previously been very poorly developed anyway, are also required.

8.3 Options for future strategies

8.3.1 Institutional woodlots

By 'institutional woodlot' is meant a woodlot for which some form of state or local government body has responsibility. The departmental and municipal woodlots described above (Sections 8.1.4 and 8.1.5) are types of institutional woodlots.

A prerequisite for an institutional woodlot is a suitable institution with the capacity to implement and administer the woodlot project. There is no reason why municipalities should not fulfil the role in some situations.

However, there really needs to be a capacity to establish and manage woodlots on a regional scale. At present, most homeland administrations have such a capacity to varying degrees, but the future of these forestry departments is not clear. With the reincorporation of the homelands, they will presumably be absorbed into a regional structure under the Department of Forestry. The Department of Forestry has, however, shed its commercial operations to a separate state-owned company (see Section 4.2), which means that it no longer has the capacity to undertake afforestation. If that policy were applied to homeland forestry, there could be a lack of capacity on the part of the state, which would have to be addressed. Either the Department of Forestry would have to set up a woodlot division, or the forestry operations might be contracted out.

Institutional woodlots would probably be between 50 ha and 300 ha in size in general. Each woodlot, or a close cluster of woodlots, would be under the control of a full-time forester, who might be a local person trained in basic silvicultural techniques. The woodlots could produce multiple products, including a portion of roundwood or wattle bark for commercial markets. Some woodlots, especially the larger ones, might include a nursery to produce for its own needs and to supply neighbouring communities with planting stock.

The woodlots would be developed with maximum local benefit in mind, meeting local needs, providing employment, and supporting local contractors and 'bush' mills (small rural sawmills) as far as possible. Access to the produce of the woodlot would be convenient and equitable, with regular and frequent sales of firewood and building material.

Community liaison and consultation, which was not a strong point of earlier institutional woodlots, would be strongly emphasised.

Institutional woodlots provide an opportunity for planned and targeted interventions in areas in which there are particular needs, and this may include urban woodlots and greenbelt plantations.

8.3.2 Commercial small-grower

It is necessary to distinguish between three types of private small-growers:

8.3.2.1 Growers under contract to timber companies

This is an area of potential growth, which could bring economic and social benefits. There are presently some problem areas to be ironed out, particularly with regard

to the relationship between grower and company, and to the fact that small-growers remain outside of the commercial forestry sector (see Section 8.1.7.3).

One direction in which the development might move is towards out-grower schemes involving communities living next to large plantations. This would open up opportunities for the small-growers to share in the infrastructure of the forestry operation, the fire protection strategy, and insurance cover. Also the community could derive some of the downstream benefits which could include jobs, work for small private contractors, local small-scale processing (for example sawmilling, creosoting), and rural wood-based manufacturing workshops.

Developments such as this might have a place in land redistribution programmes. These might also be a way of resolving the conflicts which currently exist in some areas between the expanding commercial plantation sector and rural communities already on the land.

8.3.2.2 Independent small-growers of timber

Most of the independent growers started in timber before the company-linked schemes began. The recent entries into the small-grower class are almost all contracted with a timber company because of the extension, inputs, and financial packages available through these schemes. Were support services available to independent growers, it is likely that many more would have chosen this route. Independence offers the flexibility to produce wood for various markets including local ones, and to meet local needs. It would open more opportunities for local downstream involvement in processing and manufacturing. For this reason, it is recommended that support and extension be made available to independent growers as part of a programme of social forestry.

8.3.2.3 Measures to encourage small-growers of timber

Apart from extension and direct assistance to small-growers which has been mentioned above, there are other measures to promote this activity. The first is a good price for timber. The present price for timber in South Africa is low. The vertical integration of timber production and processing is largely responsible for this (see Section 4.1).

Secondly, the isolation of small-growers from the commercial forestry sector must be addressed. In practice they do not have access to the timber cooperatives, including their insurance schemes, the Forestry Training Services and so on. This points to a need for some form of representation for small-growers. One possibility would be the formation of a strong association. Existing associations are still weak, fall under the control of the company and serve mainly to enhance communication among dispersed farmers and to resolve local conflicts over land (Cairns 1993). Alternatively, small-growers' interests could be represented through the South African Timber Growers Association (SATGA) provided it undertook to recruit small-growers and reorientated itself to their needs.

8.3.2.4 Wattle bark producers

Wattle bark production is ideally suited to small private woodlots in that the commercial side does not necessarily conflict with satisfying local needs for fuel and poles. Although wattle woodlots can tolerate a high degree of neglect, the proper silviculture of wattle demands more management than other common timber species. Extension and training for bark producers should be given high priority and aimed at rehabilitating existing woodlots as well as the new planting of wattle.

The quota system for wattle bark is a major obstacle for the development of small growers. A large proportion of the limited extension service to wattle growers in KwaZulu is taken up with the administration of the quota system. The system is a barrier to other potential producers' entering the market. Numerous households

already have wattle microwoodlots but are unable to sell the bark. In the interest of equity, it is recommended that the quota system for wattle bark should be abolished.

8.3.2.5 Implications of an increase in small-growers

Concern has been expressed that support structures for other land-use options should match those offered by timber companies, otherwise large areas of arable land will be 'lost' to trees (Cairns 1993). At present, only in the Lima programme are a range of options offered on an equal basis (Section 6.1.7.3). The timber companies are said to have a 'gentleman's agreement' with the KwaZulu government not to plant land with less than 12% of slope, but in fact a third of small-grower plantations is on such land (Cairns 1993). However, Cairns does not see a serious diversion of resources away from food crops at present.

If there is very large growth in this sector, the question of regulation will have to be addressed. The permit system administered by the Department of Water Affairs and Forestry to regulate new afforestation does not apply to KwaZulu. With the reincorporation of the homelands this will change. At present, there are no satisfactory guidelines for dealing with small blocks of plantation, but a joint committee of the Departments of Water Affairs and Forestry and of Agriculture is looking into it. The solution might be a set maximum size (say from 3 ha to 5 ha) which may be planted without a permit. Hydrological models suggest that a patchwork pattern of small blocks has a less detrimental effect on ground water than a single plantation (Cairns 1993). Already some areas of KwaZulu have 25% under Eucalyptus in a patchwork pattern.

8.3.3 Community woodlots

Community woodlots remain an option within a multifaceted afforestation programme, but it is not anticipated that this particular approach will make a large impact on the total area of woodlot. Initiatives aimed specifically at community woodlots appear unlikely to be cost-effective (Section 9.2).

Where interest in a community woodlot emerges from other social forestry or rural development initiatives, support and assistance could be given provided there are already reasonable levels of motivation and organisation. There are indications that the minimum inputs would be extension, silvicultural advice and supervision, and free seedlings.

8.3.4 Woodlot rehabilitation

With so many of the TA woodlots in poor condition, the possibility of a programme to rehabilitate woodlots has been raised, but never seriously followed through. Some woodlots are beyond rehabilitation, and complete replanting would be necessary.

In most instances, rehabilitation would only be warranted if the system of control of the woodlot were also changed. Persuading TAs to relinquish control of the woodlot appeared to be a problem when the matter was raised in Transkei even if they did not actually exercise that control. However, indications are that there will be a trend of declining authority for TAs, even if they do not actually disappear (Section 6.2.5). Indeed the trend has already started.

Two options for restructuring TA woodlots are outlined below.

- The woodlots could be taken over by the Department of Forestry or another institution, and run on behalf of the community on a cost-covering basis. This would would only be an option for the largest of the TA woodlots.
- The woodlots could be privatised into local hands, with either a single owner or a number of owners of subdivisions. This would raise difficult questions

about who would become owners and how; questions similar to those which land redistribution programmes would have to address. It would also raise land issues (for example whether the woodlot owners would have any rights to the land if the trees were cut down). Privatisation would require a project package including selection criteria, training, extension, lease and financial arrangements and so on. While privatisation may appear to be a desirable solution, it should be approached on a pilot-project basis initially because of the complexity of issues.

8.3.5 Agroforestry

Agroforestry (as defined in Section 6.1.8.1) involves the growing of trees on the same land as crops, pastures and livestock. The components are arranged in such a way that there are positive economic and ecological interactions between them. Agroforestry implies planned and deliberate combinations and spatial arrangements, and therefore a degree of management and expertise.

8.3.5.1 Agroforestry systems

In the past, agroforestry has suffered from a rigid adherence to specific systems or technical packages. One of the clearest lessons from agroforestry projects throughout Africa is the need to test the technical package under local conditions before trying to disseminate it (Kerkhoff 1990). Flexibility is a crucial ingredient of agroforestry projects.

Having said this, there are specific forms of agroforestry which have particular relevance to less developed situations.

(i) Crops and livestock in plantation forestry

The planting of crops in plantations during the first few years after tree establishment has been practised successfully in South Africa both in the homeland woodlot situation and in commercial plantations bordering on homelands (Gandar 1991a, Gandar 1991b). This system, often called *taungya*, would seem to have potential in many situations, particularly in small-grower schemes.

The benefits include reduced weed competition for trees, 'free' land for farmers, and improved neighbour relations between forestry and agriculture.

However, *taungya* is only appropriate if it addresses a major constraint in agriculture. Where a shortage of arable land is the main constraint, *taungya* would ease that constraint, but the establishment of plantations in such areas in the first place, should be questioned. In many homeland areas, arable land is underutilised for a variety of socioeconomic and logistical reasons, which include constraints related to labour and tractive power for land preparation (Gandar & Auerbach 1993). Where the silvicultural package includes complete land preparation which has been advocated for commercial forestry, *taungya* could ease those constraints.

Other possibilities in relation to plantation forestry include:

- The cultivation of crops in firebreaks. The maintenance of firebreaks has commonly been a weak link in woodlot management (Bembridge 1990, Bolus 1991) and the cultivation of crops consistent with fire protection would be an advantage. Bananas have been grown in the firebreak of a woodlot in KwaZulu (Gandar 1991a);
- The cultivation of crops under closed canopy. There is an example in Gazankulu of groundnuts being grown in Eucalyptus woodlots (Gandar 1991a), but research is needed on the choice of crop and the production levels which are obtainable;
- Livestock is grazed in plantations but for short periods only to minimise tree

damage (Loxton Venn & Associates 1990). Livestock is sometimes used as a management tool in wattle micro-woodlots (Section 6.1.7.1).

(ii) Alley cropping

Alley cropping is the planting of parallel rows of trees or shrubs in hedges spaced anything from about 3m to 20m apart, and cultivating between the rows. The hedges are periodically pruned or cut to yield a fodder or a mulch, while the wood is available for fuel or other uses. A variant of alley cropping is the planting of hedges along contours. The trees are usually leguminous nitrogen-fixing species. The benefits claimed for alley cropping systems are wood production, and a whole range of environmental benefits which result in improved crop production. Up to now, practical examples of alley cropping in southern Africa are extremely rare, and until it is incorporated into sustainable agriculture programmes on a significant scale, alley cropping is not likely to make much impact.

(iii) Windbreaks

Windbreaks can benefit crop production by reducing evapotranspiration and thus are likely to have the greatest benefit in arid or windy areas. Data collected world-wide over the last 60 years indicates that windbreaks improve crop yields by an average of from 40% to 50% (Anderson 1987) although in a few cases a decrease in crop yield has been reported. This underlines the importance of the design and choice of species for windbreaks to avoid turbulence and the funnelling of air, and competition with crops for moisture and nutrients.

Windbreaks can provide wood on a regular basis if these consist of rows which are harvested alternately (Haigh 1988).

(iv) Trees in croplands and gardens

Trees are commonly left standing in and around arable fields (Cunningham & La Hausse, Campbell et al 1993) for a variety of practical reasons or according to customary beliefs. These trees, particularly fruit-bearing trees, increase the range of products available from the arable lands. It is often said that trees may enhance crop production, but there is limited hard evidence of this except in the case of Faidherbia albida (formerly Acacia albida). It is a common practice of agriculturalists all over Africa to retain or plant F albida in fields and cultivate under its canopy (Lai & Khan 1992, Campbell et al 1993). However, there do not seem to be any reports of the practice in South Africa despite the fact that some of the homeland areas in the Transvaal fall in the natural range of F albida, and the species has shown promise in an agroforestry demonstration in the Natal Midlands (personal obs.)

Homestead fields and gardens have been identified as a potential area for agroforestry intervention, particularly in areas of scattered settlement which have not been betterment planned (Bolus 1990). The supply of fruit trees can be used as an entry point for the introduction of other trees. However the process can be slow and demanding of fieldworkers' time (Bolus 1991). An alternative approach involves building up a relationship with interested farmers and initiating on-farm trials. The concept involves the farmer's becoming an experimenter, demonstrator, and later a trainer, and distributor of trees (Bolus 1991). The choice and arrangement of trees for homesteads is more *ad hoc* than in the systematic methods such as alley cropping.

(v) Silvopastoral systems

The establishment of trees in communal grazing lands as shelterbelts or for other reasons, requires a large input of extension and the sustaining of a high degree of local organisation over a long period. One such shelterbelt was established in the course of LEAF (Section 8.1.10) but it is questionable whether the time and effort can be justified for one-off projects (Gandar 1990b). Silvopastoral systems should only be considered as part of broader grazing and livestock management programmes, and even then it would seem from experience in Kenya for example

(Kerkhof 1990), that better results can be achieved by placing the emphasis on the participatory management of natural vegetation rather than on tree planting.

(vi) Fodder banks and cut-and-carry systems
Fodder banks are generally high density stands of fodder trees (up to 80 000 trees per hectare) which are not allowed to reach above 1.5m in height (Loxton Venn & Associates 1990). These may be browsed directly or cut regularly and the fodder taken to livestock. Fodder banks have been proposed in another report in this series for the late-winter feeding of draft animals (Gandar & Auerbach 1993). Fodder banks can also be used to fatten animals before slaughtering, for drought relief, or in zero grazing units.

8.3.5.2 Agroforestry and land reform
Agroforestry might have particular relevance to a programme of land redistribution in South Africa. Much of the debate on the subject of land redistribution centres on the establishment of a large number of small-farming units (Jack 1993). There is evidence from other African countries that small-farm units and agroforestry practices are very compatible. For example, in Kenya, tree planting is most commonly practised in areas which are densely settled and intensively farmed (Bradley 1988). There would be more opportunities to plan agroforestry systems from scratch on land set aside for settlement than there is on land with long-established patterns of settlement and land-use.

8.3.5.3 Agroforestry in the context of rural development
South Africa has lagged behind many other African countries in promoting agroforestry as a development strategy. One of the reasons why agroforestry has not received the attention it deserves in South Africa is the strict division of institutions into disciplines which do not match the realities of rural land-use (Erskine 1990). It should be acknowledged that agroforestry is concerned primarily with agricultural systems, and therefore belongs in the sphere of agricultural development although it has benefits which extend to energy, conservation and other sectors. Agroforestry, however, implies significant changes to conventional practices of high-input crop production. It is often argued that modern agriculture faces many serious problems, both economically and environmentally. At the same time peasant farmers struggle and often fail to achieve sub-subsistence needs. Taylor (1991) argues that there is a need for new systems, of which agroforestry is but one, which look towards a best-mix of modern and traditional knowledge, and that in formulating these systems, a participatory approach, which puts the interests of the farmers first, is essential .

Agroforestry belongs within a coordinated programme to support the development of agriculture along sustainable lines. Specific agroforestry systems may have some of the following characteristics which are compatible with sustainable agriculture:

- a diversity of components and products;
- a relatively large component of perennials;
- measures to improve soil structure and fertility, and reduce soil erosion; and
- reducing the reliance on external inputs by utilising the flows of materials and nutrients within the system.

8.3.6 Planting trees at homesites
It was noted earlier that homesite fields and gardens are promising entry points for agroforestry projects. By the same token, the homesite is also a focal point for other forms of tree planting apart from agroforestry type multipurpose trees. These include ornamentals, shade trees, trees for shelter and windbreaks for the home, and hedges. Planting along boundary lines is common practice when trees are available.

Tree planting at homesites might also include microwoodlots (Section 8.1.7.1). These woodlots are frequently elongated and serve as a boundary markers or windbreaks for the home environment.

Programmes to promote homesite planting will clearly overlap with agroforestry programmes, but the requirements for extension, demonstration and on-farm trials are not so great.

8.3.7 Schools and village greening programmes

Schools, clinics, TA courthouses and other public places where trees can be protected are possible targets for tree-planting programmes in rural villages. The objectives are primarily to create a pleasing and comfortable living environment, but there may be many other benefits including some firewood. These programmes may be linked to other local environmental action.

Of these targets, the most important is arguably the schools, which are the most common and visible of the rural institutions. There are obvious spin-offs and multiplier effects to be exploited by focusing on the schools. Teachers and principals are an easily targetable group. Schools also offer the opportunity to link tree planting to other activities like environmental education projects, school gardens and nurseries. In township situations, school tree planting programmes initiated by Trees for Africa have led to much wider greening and environmental action (Gandar 1993a).

8.3.8 Reclamation forestry

Reclamation forestry is the term used to describe the planting of trees in projects aimed specifically at the revegetation and rehabilitation of denuded and eroded areas. Species are selected primarily for their ability to stabilise the soil. Non-tree species can be used in addition.

The successful establishment of reclamation forestry can also provide a range of products, and ideally a denuded area is transformed into a resource area for the community.

Indications are that rural communities would be willing to undertake such projects provided that they do not have to bear all the costs, which might be considerable since fencing is almost certainly a prerequisite. An additional consideraton is that the costs and effort of planting in such areas is greater than for woodlots, and it takes a long time for the benefits to be felt.

Subsidies will be an essential component of reclamation forestry programmes. This is perfectly reasonable since soil-reclamation and catchment-protection measures benefit the wider society. Also, local communities should not have to bear the full cost of repairing environmental damage for which past racial policies must share in the blame. Subsidies should, as far as possible, support local initiatives (for example by buying trees from village nurseries).

8.3.9 Tree delivery systems

There can be no tree planting without tree delivery. Skutch (1983) found the lack of seedlings to be the most serious constraint on tree planting in Tanzanian villages and that this was actually a transport and distribution problem as seedlings were available at district nurseries. There is every likelihood that the same constraint applies to rural areas in South Africa. Tree distribution over relatively short distances may be a constraint since potted trees are not easily carried (Dickson 1993).

The need for a network of small nurseries in rural areas is now widely accepted, and the establishment of such nurseries is the main thrust of the Biomass Initiative production component. Nursery development in South Africa is in its infancy, and

there is very little instructive experience to draw on. In projects elsewhere in Africa, there are different types of nurseries. Some are centralised with production rates of perhaps as many as one million seedlings per year. However, even with a system of distribution to collection points, it is common to find that less than half the seedlings grown in a central nursery find their way to the communities they are meant to serve (Kerkhof 1990).

Intermediate nurseries serving more restricted areas might have production rates of from 10 to 50 thousand trees per year. These might be run by development agencies or NGOs, community groups or individuals. There would still be distribution difficulties, and it is unlikely that such a nursery could operate without access to a vehicle.

Kerkhof (1990) has observed that there is increasing interest in promoting smaller village-scale nurseries, sometimes referred to as farm nurseries since these are usually owned and run as a sideline to small-scale farming and indeed, in part of Kenya, a survey revealed that as many as a third of households had set up micro-nurseries without any outside assistance.

Small household nurseries in Herschell in Transkei are said to be capable of producing upward of 5 000 seedlings (Fenn pers comm), but nurseries in Zimbabwe producing in excess of 5 000 seedlings have proved to be economically unsustainable without considerable subsidy (Scoones et al 1993). The authors refer to these as 'large centralised nurseries'.

Nurseries vary greatly in size, design, cost, ownership, management and financing. In promoting decentralised nurseries, it is important not to repeat the mistake of the early woodlot programmes which became locked into one particular way of doing things. The inputs required by village nurseries will depend on the sophistication of the operation, but all nurseries need seeds and water. To some extent seeds can be collected locally, or ordered from the central government seed store in Pretoria, though, from remote villages this is easier said than done. Also, the seed of some of the important multipurpose trees is not available from this source. Access to seed, nursery materials and innoculum for leguminous plants, will have to be addressed.

Ensuring adequate water supplies for nurseries is a problem. The viability of a low-cost nursery could be undermined if costly water developments are needed to serve it. This underlines the need for nursery development to be coordinated with water development programmes.

CHAPTER NINE

Auxiliary functions and services for social forestry

A national programme of social forestry would have to address the issues of extension and support services for projects, and of training and research. The Biomass Initiative Workshop on Social Forestry, held in July 1993 in Durban, addressed these matters. This chapter has been shaped largely by the discussions and recommendations of that workshop (Gandar 1993c).

9.1 Extension

9.1.1 New models for forestry extension

It was mentioned in the previous chapter that reorientating a conventional forestry department towards social forestry is a formidable task. Elsewhere in developing countries, the extent of the changes have often been underestimated. Van Gelder and O'Keefe (1992) note that a common strategy in supporting rural development is to extend and decentralise the existing forestry organisation and infrastructure, staff, nurseries and transport facilities. All simply move out of the plantations and forests into the rural areas. They point out, however, that in practice, social forestry implies more fundamental changes in the orientation of forestry, as illustrated in the following table.

From	*To*
Working for the interests of the forestry department	Working for the interests of the rural people
Forest management	Forestry extension work
Protecting the forest against local people	Involving people in the management of woody biomass in and outside of gazetted forest areas
Seedling production and distribution	Facilitating local tree regeneration
Plantation management	Total woody biomass management
Timber and pulp trees	Multipurpose trees and shrubs
Standard forestry management systems	Management systems adapted to farmers' conditions and needs

TABLE 9.1 Steps to be taken in the reorientation of conventional forestry towards social forestry
Source: Van Gelder & O'Keefe 1992

The reorientation of forestry along these lines has profound implications for extension (Mahony 1987, Fenn 1993) and the nature of relations between foresters and villages (Shepherd 1992, van Gelder & O'Keefe 1992). Traditional models, based on the concept of technology transfer with the extension worker as the carrier from research to farmer, have been challenged. Participatory methods are more appropriate for forestry extension work. Success is more likely if rural communities cooperate, not only on tree planting, but also in maintaining natural woodland. Forestry extension also needs to take account of the fact that trees are an integral part of the farming system in both ecological and economic terms, and therefore needs to take a greater interest in the agricultural and livestock requirements of the

communities it serves.

Existing forestry extension services have no tradition of this kind of work. The extension section of the Forestry Branch was directed solely at commercial timber growers on white owned land. Only in 1993 did the process of reorientation towards the needs of rural communities begin. In the homelands, forestry extension has never been strong. Such resources as existed there, were geared towards woodlots rather than the broader scope of social forestry.

Considerable adjustments will have to be made. New skills, techniques and technical knowledge will be required by forestry extension workers. The extension services will also have to change their *modus operandi* to accommodate varied and unpredictable work programmes, and revise their procedures for the management of staff and the measurement of performance.

9.1.2 Integrated extension services

The issue of the size of a forestry extension service and its terms of reference in relation to other branches of extension, will have to be addressed.

In Zimbabwe, it has been argued that the forestry extension service should not be greatly expanded, but the activities merely reorientated. A slim, well qualified, well paid and motivated extension service is envisaged, that complements but does not compete with other agencies (Scoones et al 1993). In particular, close collaboration with the Department of Agricultural, Technical and Extension Services and the Ministry of Education was proposed.

It is difficult to envisage a self-contained forestry extension service in South Africa capable of meeting all the requirements of social forestry. It will be imperative for links to forged between forestry and other branches of extension. Indeed, the Biomass Initiative Workshop on Social Forestry identified an urgent need for the integration of the existing diverse branches of rural extension, like agriculture, forestry, health, community development, conservation and others (Gandar 1993c). Within this spectrum of extension is a cluster, including forestry, which focuses on farming systems and land-use.

The question was raised as to whether the integration should be achieved by effective coordination at national and regional levels, or by the creation of a single unified and holistic extension service. Even in a unified extension service there would still be a need for some specialists from the different sectors (Gandar 1993c). This is a question which does not require an immediate answer since unification of extension would be an incremental process which would have to begin with effective coordination anyway.

The agricultural sector has the largest network of extension workers. At present, the agricultural extension services are not equipped to meet the new challenges. In general, logistical support is inadequate, morale and motivation are often low, most agricultural extension staff have no personal experience of farming themselves, and the package-orientated approach used is not suited to the participatory and responsive methods advocated above. Agricultural extension has, historically, paid scant attention to livestock and the management of bushveld, or to agroforestry.

It is proposed that a whole series of workshops should be held to examine and review rural extension, and to plan the mechanisms whereby coordination can be effected. All government extension services ought to be involved, as well as NGOs with a large outreach capacity.

9.2 Training

9.2.1 Training for project personnel and extensionists.

Retraining of existing extension staff is a *sine qua non*. This applies equally to agricultural and forestry staff. Social forestry extension, as sketched above, will require a change in extension techniques as well as a basic knowledge of multipurpose trees, agroforestry principles and woodland management. At present there is no government facility offering training for extension personnel in social forestry. The only comprehensive training in social forestry and nursery management for project personnel is provided by the Community Agroforestry Renewal Organisation (COAFRO), an NGO in the eastern Cape. Training courses will have to be developed in modular form to provide the flexibility needed to meet diverse requirements. At the same time, different regional needs will have to be addressed, possibly by having regional facilities, or mobile facilities.

9.2.2 Professional training

The following tertiary educational institutions offer training in forestry:

- Faculty of Forestry, University of Stellenbosch;
- Faculty of Forestry, Port Elizabeth Technicon, Saasveld; and
- Fort Cox College, Ciskei.

In addition, the Subdirectorate of Forestry Extension gives lectures at agricultural colleges on aspects of forestry and agroforestry from the commercial agricultural and forestry perspective.

The tertiary education sector has not, as yet, responded to the needs of social forestry. While some aspects of existing forestry courses have relevance to social forestry, there is no training course for professional social foresters. The obstacles are a lack of interest, will and resources on the part of the tertiary institutions, as well as uncertainty about the potential job market. It is probable that one tertiary institution could meet all the needs for social foresters in South Africa.

Universities and colleges are likely to change in response to the changes unfolding in the country as a whole. Indeed, some of these changes are already happening, with educational institutions becoming more involved in and responsive to the dynamics of the wider society. In the rural sphere, this has spawned a number of institutes, units and centres with outreach programmes to sections of the rural community. These units help to anchor the training and research of the university in real rural issues, and also make some of the resources of the universities available to disadvantaged communities. Some of these units are active in social forestry.

9.2.3 Coordination of social forestry training

The need for the planning and coordination of training in social forestry has been highlighted by Bolus (1993), and the recommendation put forward that the coordinating body should consist of three units:

- A Training Unit which would be concerned with providing a wide spectrum of training to a range of target groups.
- A Media Unit which would coordinate and develop media materials for training and public awareness.
- A Curriculum Development Unit which would engage with educational institutions to bring about the necessary changes to curricula.

A southern African network for training in social forestry would help to rationalise facilities on a regional scale, and permit exchange programmes for trainees and students.

9.3 Support services

Support for social forestry initiatives is needed at two levels. Firstly, support is needed for members of rural communities (the tree planters themselves). Social forestry projects on the ground are being supported by local service organisations, most of which are NGOs. These might, for example, provide a stable supply of suitable plants, a delivery system, advice and access to inputs, and demonstrations (Dickson 1993).

Secondly, the service organisations themselves require support. These organisations face a daunting array of constraints, some specific to social forestry and others to do with working in the rural sector in general (Dickson 1993, Gandar 1993b).

Rural projects would benefit from support in a number of areas:
- access to information and technical advice;
- technical services (for example laboratory services);
- basic infrastructure, especially water development and transport;
- networks of practitioners in social forestry;
- extension: personnel and training;
- finance (for example loans for nursery owners);
- access to supplies (for example nursery and propagation materials, good quality fruit trees);
- local and regional coordination of development; and
- research: a coordinated programme of monitoring and evaluation.

At present service organisations and support services for social forestry are few and far between, and poorly developed. Local support services must focus on the needs, wishes and capacity of the local households. The presence of such services is a precondition for the establishment of social forestry activities. National and regional service structures and networks can only be effective if strong local organisations are in place (Dickson 1993).

9.4 Research

9.4.1 National programme

Research in social forestry and related fields has been sporadic and uncoordinated. It is only through the recent Biomass Initiative that any attempt has been made to develop a programme of social forestry research. A national programme of social forestry research would have to be planned and coordinated. It should be multi-institutional, and concentrate on existing research facilities, but also develop new sites or facilities as required.

Von Maltitz (1993) identifies three broad classes of research in social forestry:
- policy-orientated research:
- systems, species and silvicultural research; and
- community based and participatory research.

These categories would apply equally to tree production systems and woodland management systems.

9.4.2 Institutions involved in social forestry research

The organisations which might potentially have a role in conducting research are listed below.

9.4.2.1 Government

The Forestry Branch no longer has the capacity to undertake research, since the South African Forestry Research Institute has been incorporated into the Council

for Scientific and Industrial Research's (CSIR) Division of Forest Science and Technology (Forestek). The various government research bodies in the agricultural sector have been lumped into the Agricultural Research Council (ARC). An important role is envisaged for ARC in social forestry research. The role of the government is likely to be in technical research, particularly long-term species and systems research.

9.4.2.2 Parastatals

The CSIR's Forestek and Energy Technology (Enertek) divisions have research interests which potentially include aspects of afforestation, social forestry, and fuelwood. The Foundation for Research Development (FRD) and the Human Sciences Research Council (HSRC) are other parastatals with possible interests in social forestry. Forestek is likely to be an important role-player in a national programme of social forestry research. It has recently broadened its capacity to include social research and environmental research in its Ecosystem Management Services. It is already actively involved in all three forms of social forestry research above, as well as wood biomass assessment, research management, and pilot projects in social forestry.

9.4.2.3 Universities and colleges

Forestry faculties at universities and colleges are not involved in any specific research in social forestry, though a few trials with multipurpose trees are relevant. A number of university based institutes and centres for rural development are well placed to engage with rural communities in action research programmes. These include the Institute of Natural Resources and the Farmers Support Group (University of Natal), the Centre for Low-Input Agriculture Research and Development (University of Zululand), and Wits Rural Facility (University of the Witwatersrand) which are all presently actively promoting social forestry in one form or another. The EPRET project, highlights the role universities can play in policy research.

9.4.2.4 Non-government organisations

NGOs are generally not very good at technical or systems research, and are unsuited to the long-term research required to test tree-growing systems. They are better at participatory research and testing innovative methods in rural development, but their research capacity is limited. There are some young NGOs dedicated to policy research, and the Land and Agriculture Policy Centre, and the Minerals and Energy Policy Centre are two which have a potential interest in social forestry.

9.4.2.5 Private sector

A research programme might also draw in the private sector through the timber industry and consultants.

CHAPTER TEN

Afforestation strategies: economic considerations

10.1 Available information

There have been no thorough economic analyses of afforestation strategies in South Africa. There are a few scattered financial records of some woodlot projects giving some direct establishment costs as well as some of the programme overheads, but there has been no comprehensive financial audit which presents the full range of costs to any programme or the value of community contributions to the establishment of woodlots.

When it comes to more open-ended social forestry programmes, even less is available on the financial aspects. Social forestry programmes are much more recent than woodlot programmes and have not yet been fully evaluated financially. We therefore have to rely mainly on information from some of the larger internationally funded social forestry programmes elsewhere in Africa which have been in operation for longer than the local ones.

10.2 Costs of woodlots

The different categories of costs are:

- the direct costs of establishment (including the costs to the project and the costs to the community);
- the direct costs of maintenance of the woodlot (project and community costs);
- extension costs; and
- the indirect costs (project management and overheads).

These costs vary from one type of project to another. The total costs, and the proportions in each of the categories are very different for the departmental and TA woodlots compared to community woodlots or to private small-grower woodlots.

10.2.1 Establishment costs

10.2.1.1 Departmental and TA woodlots

As a budgetary guideline for the establishment of woodlots by a forestry department, a figure of about R800 per ha was used by both Ciskei and Transkei in 1990. This was for marking, pitting and planting (fertilisers are seldom applied in woodlot establishment). To this basic figure one must add the variable costs such as transport, supervision and fencing. This cost estimate is compatible with that of the establishment of commercial plantations (SATGA 1993).

In practice, it is optimistic to expect woodlots to be established within such a budget. Between 1987 and 1990, 558 ha of departmental woodlots were established by the Transkei Department of Forestry in the course of LEAF. The programme costs were R2 267 per ha which included fertiliser, fencing, and huts for the foresters. Only a small portion went towards overheads. The Department of Forestry was concerned at the abnormal expenditure, and suggested that the reasons were incorrect allocations, lack of supervision, and Transkei's minimum wage regulations which resulted in the high cost of unskilled and casual labour.

The cost of the LEAF woodlots may not be that abnormal, but simply reflect the remote situation in which woodlots are established without the sophisticated

infrastructure and trained labour of commercial forestry.

Costs may be site-specific. For example, when three identical woodlot trials were established in the same general area of KwaZulu, the direct establishment costs varied by 68% (Institute of Natural Resources, unpublished).

10.2.1.2 Community woodlots

The direct cost to a woodlot programme of establishing community woodlots may be low since some costs are borne by the community, usually the labour cost. Indeed, in the community woodlot component of LEAF in Transkei, the actual establishment costs were fairly low: R425 per ha made up of R225 per ha of fencing material delivered, with the bulk being the cost of the delivery of seedlings. Most of the seedlings were donated by the Transkei Department of Forestry and a more realistic cost per hectare would be from R650 to R700 (Bolus 1991).

In contrast, a small community woodlot in KwaZulu cost R4 400 per ha in direct establishment costs. In this instance, however, local labour was paid, and even tools were provided by the programme (Mann 1988).

10.2.1.3 Private small-grower woodlots

In the Lima Project, costs are worked out per 1 000 spots:

seedlings:	R120
fertiliser:	R80
labour –	
pitting, planting and fertilising:	R74
weeding:	R68 (R32 per year for 2 years)

This gives an establishment cost of R581 per ha for inputs and labour (since there are 1 700 spots per hectare). Not included in this is the cost of fencing, which is the responsibility of the grower. The labour costs are related to those which apply to tightly managed commercial operations and are generally lower than those in less developed areas. Note that the small-grower is paid the specified labour costs by the timber company in the form of a loan. This is recovered together with the cost of the fertiliser (but not the seedlings, which are free to the grower) in the form of a deduction from the price ultimately paid for the timber. If more labour is required than what is budgeted for by the company, the excess is, in effect, a cost borne by the grower.

Local contractors are frequently employed to establish woodlots in Mondi's Kulunathi project, but are generally unable to carry out the work within the budgeted cost.

10.2.1.4 Fencing costs

The cost of fencing may be a critical part of the cost of woodlot establishment. Von dem Bussche (1987) gave the costs of fencing woodlots in Lebowa as R706 per km for materials plus from R250 to R320 per km for labour. Nowadays, the cost of materials delivered to site is about R3 000 per km for a seven-strand fence. Depending on the circumstances, fencing may account for over 50% of the establishment costs especially in small woodlots. For example, the cost of putting a goat proof (bonnux) fence round a 1.1 ha woodlot was R1 614 (Mann 1988). This raises the question of whether it makes sense to fence a woodlot at all. The small-grower schemes make no provision for fencing.

10.2.2 Maintenance costs

Von dem Bussche (1987) estimated that the cost of woodlot maintenance in Lebowa was R39.27 per ha per year, made up of the salary and transport of the Chief Forester plus 10% of the salaries of the Agricultural Officers. In 1990, however, the entire Lebowa woodlot budget of R134 246 went on the maintenance of 841 ha of

departmental woodlots and 38 ha of TA woodlots (no new woodlots were established in Lebowa during that period). This is equivalent to over R150 per ha per year, and does not include all costs: extension costs are not included, and only the diesel costs of grading the firebreaks is included.

In the Lima Project, an annual allowance of R65 per 1 000 spots is made for maintenance and firebreaks, which is equivalent to R110 per ha per year, or R770 per ha over a seven year rotation.

The following maintenance costs apply to commercial forestry (SATGA 1993):

weeding saplings:	R190 per ha for eucalyptus species, and slightly less for pine and wattle;
weeding and pest control in subsequent years:	R18 per ha per year; and
firebreaks:	R39 per year.

Maintenance costs are largely labour costs and, in the case of community woodlots, this would be a contribution by the community and would not be a project cost. In practice, very little actual maintenance is carried out on most woodlots. Firebreaks and fences are seldom maintained.

10.2.3 Management overheads and extension costs

10.2.3.1 Departmental woodlots

In none of the woodlot programmes of the homeland administrations, has there been a detailed breakdown of the management, administrative and infrastructural overheads, and how these are shared between woodlot development and commercial operations. Nor has there been an analysis of extension costs associated with departmental woodlots. These costs are probably low. In general, the woodlots are planted in response to a request from the community. There is no associated organisational development undertaken in the community. Liaison is, however, needed in the planning phase over such matters as site selection.

10.2.3.2 Community woodlots

There is a danger that community woodlot projects can be crippled by extension costs. The rationale behind the community woodlot component of LEAF was mainly cost reduction. It is true that the direct costs of establishment to the programme were less than those in the departmental woodlot component. The total project costs of the community woodlot programme, however, were very high. This is largely as a result of the amount of extension work required to build up the local organisational capacity necessary for a community woodlot. The total expenditure of project funds was R213 543, and the total area planted was 35 ha. Thus the project expenditure per hectare planted was over R6 000. Bolus (1991) points out that the start-up costs of programmes of this nature are high. The largest portion of the costs of the LEAF community woodlots went on fieldstaff in the form of salaries, transport and subsistence.

These extension costs were even more crippling to The Valley Trust woodlot programme. This programme was implemented in a densely populated area, so woodlots tended to be small. However, the amount of extension and organisational development is not dependent on size, and costs in relation to the area planted were excessively high. Over the period from 1986 to 1990, R997 625 was spent on the programme and during this time fourteen woodlots with a total of 26 ha were established. That is equivalent to R38 370 per ha. There were high labour costs as well as extension costs since workers in the woodlots were paid. Salaries and wages accounted for 89% of the costs. Frequent germination failure (the method of establishment was line sowing of wattle seed) also contributed to the high costs of the programme.

It might be expected that costs would be reduced as the programmes move into a phase of mass implementation. For projects on communal land which require community organisation, there will always be significant extension costs until such time as people become more aware and trusting of the community woodlot approach. However, so far there has been no indication that a community woodlot programme is likely to develop a momentum of its own. The concept of community woodlots might be retained as an option in a wider social forestry programme, but programmes aimed specifically at promoting community woodlots are ruled out on extension costs alone.

10.2.3.3 Small-grower woodlots

Friedman (1991) states that the management overheads of small-grower schemes are higher than those of commercial forestry but does not quantify them. The only guide to extension costs and management overheads comes from Lima, the development NGO acting as agents for SAPPI Project Grow in southern KwaZulu. Lima charges for extension and management overheads as follows: R815 per ha of new woodlot established and R63 per ha per year for servicing existing woodlots. Thus the total overheads to first harvest (at seven years say) is R1 256 per ha. Since Lima is a non-profit organisation, this is probably a fair reflection of the actual costs. However, their costs may be lower than would be incurred by a forestry company since Lima is involved in other aspects of rural development and forestry extension can piggyback on this to some extent.

10.2.4 Summary of costs

There is a real need for an in-depth auditing of woodlots. Until that is done the real costs of woodlots will remain a matter of conjecture. It seems, from somewhat scant evidence, that direct costs have generally been underestimated and indirect costs ignored. Until such an audit is done, the tentative guidelines in Table 10.1 might be adopted for woodlot programme budgeting.

	Departmental	*Community*	*Small-grower*
Establishment costs (R/ha)			
Direct costs	2 200	800	600
Indirect costs	700	4 000	800
TOTAL	2 900	4 800	1 400
Maintenance costs (R/ha/yr)			
Direct costs	60	0	110
Indirect costs	20	100	60
TOTAL	80	100	170

Note: Costs borne by the communities, or the small-growers themselves, have not been included. Direct costs include materials and paid labour, while indirect costs include extension, programme management and overheads. The direct costs to the programme of small-grower woodlots are actually loans recoverable when the timber is sold, but the indirect costs are not recoverable.

TABLE 10.1 Estimated whole-programme costs of different types of woodlot strategies (1992 costs)

By comparison, the costs of the Lesotho Woodlot Project are given in Table 10.2. Allowing for inflation, these figures are not inconsistent with the estimates for departmental woodlots in TABLE 10.1. It should be noted that the Lesotho Woodlot Project was also generating its own income of nearly R100 000 per year from sales.

	Govt or donor funds	Hectares planted	R/ha
1973-1985	R7.3m	4 822	1 512
1985-1987	R2.8m	1 738	1 604

TABLE 10.2 Lesotho Woodlot Project: whole-programme costs per hectare of establishment
Source: Henry 1988

10.3 Social forestry programme costs

10.3.1 Examples from elsewhere

The social forestry programme in Haiti is widely regarded as one of the most successful. Twenty seven million trees were planted at a cost of $16 million (Fenn 1992).

The PAP agroforestry project in Rwanda has an annual budget of $760 000 per year and through its network of nurseries, produces 2.4 million trees per year (Kerkhof 1990). The budget excludes some government staff salaries, and does not adequately reflect the start-up costs since the programme evolved out of an agroforestry research and development project.

The Soil Erosion Control and Agroforestry Project (SECAP) in the West Usambaras, Tanzania, has an annual budget (exclusive of salaries) of $430 000 per year and has established decentralised village nurseries which produce 600 000 seedlings per year (Kerkhof 1990).

These examples indicate that the total costs of reasonably successful social forestry projects are of the order of $1 per tree distributed. There are examples, however, of poorly implemented projects which have astronomically high costs per tree surviving. In one such project in the Sahel, the cost per tree planted was $11, but such was the high mortality that this translated to $580 per surviving tree (Leach & Mearns 1988).

10.3.2 Cost of village nurseries

The cost of a village nursery depends on the design and size. A small homestead nursery made from one standard roll of shade cloth and six or eight poles would cost less than R1 000. This might produce 5 000 to 10 000 trees per year. A larger nursery with a good fence and lockable storeroom might typically cost R15 000 and produce 20 000 to 30 000 trees per year. These figures assume that no development of water supplies is necessary apart from some piping and a tap.

Let us assume that the average cost of a nursery is R4 000 and that the average production is 10 000 trees per year. The total cost of setting up a nursery is therefore:

Construction:	4 000
Training of nursery staff:	8 000
Extension/fieldworker:	5 000

The extension costs are incurred in the selection of candidates, preliminary negotiations and planning, and the estimate of R5 000 is entirely hypothetical. The training component is based on the cost of the five month course in nursery work and agroforestry offered by COAFRO in the eastern Cape.

Furthermore, an additional extension and training cost should be allowed after the nursery is complete: say R1 500 per year on average, though it may be more in the first year or two, and less thereafter.

Assuming that the production of the nursery is:

year 1:	4 000
year 2:	6 000
year 3:	8 000
year 4 onwards:	10 000,

and spreading the nursery start-up costs over 10 years, the costs to the programme work out to R0.46 per tree produced (R0.19 attributable to the cost of nursery establishment and R0.17 to subsequent extension).

The cost of a tree at the nursery (nursery materials, labour and mark-up) might be of the order of R2.00 per tree on average (excluding fruit trees). In order to achieve the projected output, some form of intervention is sure to be needed: a subsidised price, and the social forestry programme's meeting the cost of certain trees for school projects, soil conservation projects and others. We assume that 60% of the gross income of the nursery (R1.20 per tree) comes from such interventions.

According to the above scenario, the cost to a social forestry programme of trees from a rural nursery is R1.66 per tree, including the cost of developing the network of rural nurseries.

10.3.3 Whole-programme costs

There are other components to a programme:

- promotional and media work to create awareness;
- support for social forestry projects;
- village-level extension (as opposed to extension support for nursery staff);
- training and education;
- research;
- seed-bank of appropriate species;
- planning and coordination; and
- management and administration.

Consequently, the whole-programme costs would be closer to the figure of $1 per tree indicated by established social forestry projects elsewhere.

10.3.4 Benefits

Social forestry and woodlot development have a wide range of potential benefits (see below). The extent to which these are realised depends on the finer details of the programme and how well it integrates with other components of rural development. The benefits themselves are not easily quantifiable at the best of times. They are experienced in a number of different spheres: energy, environment and conservation, agriculture, forestry, and rural development in the broad sense. This raises the question to what extent a woodlot or social forestry programme is an energy programme. The question is pertinent to the financing and institutional arrangements. Unfortunately, there is no clear answer and consequently the financing of fuelwood-related interventions is more complex than that of other energy carriers.

(i) Tree products

Fuelwood is obviously of central importance from the energy perspective. Timber, poles, fruit and fodder plus a wide range of lesser products are also obtainable from trees.

(ii) Environmental benefits

Trees have a central role in soil conservation strategies and the reclamation of eroded areas. In villages, there is evidence of a demand for trees to improve the living environment (for example as windbreaks, shade trees and ornamentals).

(iii) Improvement of agricultural production

The introduction of trees into the agricultural system on agroforesry principles may lead to enhanced crop and livestock production and lower agricultural input requirements.

(iv) Income generation.

The development of rural nurseries offers opportunities for employment. Whether it is paid employment or self employment, full employment or partial employment, depends on the circumstances. Larger nurseries would also require casual labour. The most probable scenario is that most nurseries would provide partial self employment. The capital investment to create half a job (generate half of the income needed to support a rural household) is low, but the training and extension costs are high. The total cost is about R30 000. Employing nursery staff as part-time extensionists could provide the other 'half-job' with little or no additional investment.

Income-generating opportunities are to be found in timber small-grower schemes, and also in the enhanced production potential which accompanies agroforestry development. The development of mixed fuel, pole and timber production has the potential for generating downstream economic activity such as contracting and small-scale processing. Larger woodlots and reclamation forestry might be undertaken as job-creating public works projects.

CHAPTER ELEVEN

The extent of intervention and investment requirements

11.1 Scenario for afforestation and fuelwood provision

The following section puts forward a scenario for the development of social forestry and woodlots. The purpose is to put a rough figure to the likely requirements for investment and recurrent financing, and to estimate its possible impact on the fuelwood resource. It should not be seen as a target or a projection. In a social forestry programme, targets serve for evaluation. Programme implementation needs to be responsive and adaptive, not target-driven. It is impossible to project the impact of the programme on fuelwood supplies with any degree of certainty. Even in the case of woodlots, growth rates and the proportion of the wood used for fuel are unpredictable. In social forestry, the uncertainties are that much greater.

11.1.1 Woodlot development

Scenario: 1 500 woodlots (mostly 'institutional' woodlots – see Section 8.1.4) of an average of 60ha each, giving a total of 90 000ha of woodlot, will be established. Areas where shortages of wood have been identified, will be targeted.

The woodlots would produce wood for a mix of purposes. With the 90 000ha in full production this might be:

firewood:	370 000 tons per year;
poles:	280 000 tons per year; and
timber:	250 000 tons per year.

Costs: The total cost of establishment and maintenance to first crop (including management overheads) would be R260 million. After the first crop, all further costs would be met by sales.

11.1.2 Promoting commercial small-growers

Scenario: Support for commercial small-growers will result in an additional 60 000ha of afforestation, as the sector expands beyond the areas of KwaZulu to which it is presently confined. The anticipated production of firewood from this source is 60 000 tons per year on average over the first rotation, increasing to 180 000 tons per year subsequently.

Costs: The total cost of setting up these small-growers under a contractual system like that of the Lima Project, and servicing them to first crop would be R156 million. This would be made up as follows:

recoverable direct costs (loans and advances):	R69 million;
non-recoverable direct costs (seedlings):	R12 million; and
extension and management overheads:	R75 million.
TOTAL:	R156 million

The non-recoverable part of the cost (R87 million) would be borne wholly or partly by timber companies.

The above estimate of extension and management costs covers the whole period from establishment to first harvest. In the longer term a cost of R3 million per year will be incurred in servicing the small-growers.

(*Note:* The scenario does not take account of the possible increase in independent growers which might occur spontaneously at no cost to any project. If the wattle

bark quota system were abolished there would be a possibility that a large number of growers would emerge and produce substantial amounts of firewood as a by-product of bark production, with minimal external intervention required.)

11.1.3 Social forestry

Scenario: A national programme of social forestry is put in place. It involves the dissemination of trees for planting by individuals and groups, and includes homesite plantings and micro-woodlots, windbreaks, shelterbelts, reclamation forestry, community woodlots, agroforestry, school tree projects, and so on.

The programme will:

- lead to the establishment of 4 000 rural nurseries, each producing 5 000 to 10 000 trees per year on average, or a total of about 30 million trees per year;
- achieve a survival rate of 75% which is high compared to the experience of many social forestry programmes; and
- ultimately increase the sustainable yield of firewood by from 400 000 to 600 000 tons per year.

Costs:
Start-up costs: Planning and coordination, infrastructure, development of training facilities and curricula, educational materials, seed supplies, and other costs would have to be established. These might amount to roughly R15 million.

Nurseries: The cost of the establishment of a nursery, including training and extension, will be about R17 000 on average, so 4 000 nurseries will cost R68 million to establish.

Recurrent costs: Administration, management, coordination, research, extension, training of fieldstaff, subsidised trees and others: R40 million per year.

11.1.4 Distribution of wood surpluses

Scenario: Interventions will facilitate a 20% increase in the amount of wood surplus which is distributed, thus adding roughly 200 000 tons per year to the available supply of firewood.

Costs: The interventions in this scenario will be carried out largely by the existing extension services and by existing finance and development facilities for small businesses. Additional costs (for example research, coordination, liaison with wood merchants) are difficult to anticipate: possibly about R1 million over five years.

11.1.5 Management of indigenous woodland

Scenario: Woodland management practices will be introduced (or existing practices improved and reinforced) over a significant proportion of the communal grazing lands. Resource Management Areas (RMAs) will be set up in appropriate situations. The total yield of firewood will not be greatly affected, but the long-term sustainability of the woodland will be secured.

Costs: No additional budget is projected at this stage. The potential cost items are:

- extension, which will be met through the existing extension networks (particularly agriculture and conservation) as well as the new social forestry extension which is budgeted in 11.1.3 above;
- research, which will fall within the social forestry research programme; and
- implementation, which should not incur large direct costs in the case of management programmes for communal woodlands, while RMAs would be handled on a project by project basis.

11.2 Summary of costs and firewood yield

Table 11.1 summarises the costs and potential additional fuelwood yield of the scenarios for the different interventions as described above.

From a purely energy perspective, investment in firewood distribution systems has by far the best marginal returns in terms of increasing fuelwood availability. The actual cost of transport and distribution is passed on to the consumer.

However, the strategies must not be evaluated in energy terms alone. The interventions aimed at tree planting have a broad spectrum of benefits for development and environmental management. Since these strategies exist only as integrated packages, it is not possible to isolate the energy component from the other components.

The financial implications are greatly complicated by the fact that the fuelwood component is inseparably embedded in development programmes which cut across many of the conventional sectoral boundaries. While the energy sector within government might have a role in the funding and coordination of social forestry and afforestation programmes, the extent of its commitment in relation to other sectors remains a question of some uncertainty.

	Establishment (R million)	Net running (R mill/yr)	Firewood yield (000 tons/yr)
Woodlots	260	0	370
Small-growers	87	3	180
Social forestry	83	40	500
F'wood distribution	1	0	200

NOTES

1. *The establishment costs would be spread over a five-to-ten-year period.*
2. *The establishment costs of woodlot and small-grower plots include maintenance to first harvest.*
3. *The net running costs of woodlots could be negative, they could run at a slight profit.*
4. *The establishment cost given for small-growers is only the non-recoverable portion of the total cost of R156 million.*

TABLE 11.1 Strategies which could enhance fuelwood supplies: projected costs and increments in fuelwood yield

CHAPTER TWELVE

Pricing policy for fuelwood

12.1 Fuelwood economies

Domestic fuelwood comes from a number of different sources. These include communal rangeland, specific fuelwood production systems in woodlots and plantations, unwanted wood from the commercial agricultural and forestry areas, and the controlled and restricted harvesting of fuelwood in conservation areas. The wood from each of these different sources feeds into what is, in effect, a discrete energy system, which is fundamentally different to systems founded on other sources of fuelwood. The systems:

- have different environmental implications;
- involve different distribution networks; and
- are governed by different economic forces.

These systems have very little in common with one another apart from the fact that they are based on wood. In fact, they may sometimes be distinguished by the characteristics of the wood itself. It is quite wrong to imagine that there is a single fuelwood economy which is fed from a number of different sources. Instead, there are a number of different fuelwood economies which may or may not overlap to a limited extent. This has very significant implications for pricing policy, and it is argued below that it is not possible to have a uniform pricing policy for fuelwood in the South African situation. This chapter deals with some guidelines and criteria for setting prices in certain situations.

The final selling price of wood varies varies greatly, and may be several times the price at source. However, the distribution networks along which wood accumulates this price are largely within the informal sector and are not amenable to policy interventions. Pricing policies throughout the less developed world have focused on the price of fuelwood at source.

12.2 Fuelwood prices at woodlots

In this context, woodlots are defined in the broad sense to include all systems in which trees are grown specifically for fuelwood, and in which there are costs incurred in the production of that wood. There are a number of possible criteria for setting wood prices, and these depend in turn on broad development goals or principles.

12.2.1 Criterion of cost recovery

The argument has been put forward that the price of firewood should reflect the cost of production. If fuelwood prices were below production costs, this would undermine local initiatives in fuelwood production. Furthermore, it is only through a fuelwood price that is related to cost that woodlot programmes can be sustainable in the long term. Setting a fuelwood price to cover costs is not a straightforward task. Production costs are very variable from programme to programme, and from area to area (see Chapter 10). There is also a lack of information about the real costs of woodlots. Furthermore, in multiproduct woodlots there is the possibility of cross-subsidisation from pole or timber production to fuelwood, or the selection of substandard wood of lower value for fuel.

12.2.2 Environmental considerations

Early woodlot programmes were planted mainly for environmental reasons: to stop

the degradation of natural woodland which was ascribed to the harvesting of poles and firewood. Woodlots have also been planted next to proclaimed forest reserves in order to provide alternative sources of wood, and to make protecting the forest easier. The price of wood has accordingly been set very low in order to attract people away from cutting the indigenous vegetation. The objective of such a pricing policy is demand management: to induce 'fuel-switching' from one source of fuelwood to another. This illustrates the point made above, that different sources of fuelwood define different energy systems.

12.2.3 Principle of equity

Fuelwood is the staple energy of the rural poor. It might therefore be argued that it is a basic need and that it should be affordable to those most dependent on it. While the principle of equity was probably not a major consideration when fuelwood prices were originally set, it has created political pressures which make it difficult for the woodlot programmes to raise the prices of firewood. For example, in Transkei, where fuelwood is sold well below production cost, the Transkei government has prevented the Department of Forestry from raising the price.

12.2.4 Reconciling conflicting criteria

All three of the pricing criteria described have some validity, although they are clearly contradictory. The following guidelines might serve to reconcile them.

- Establishment costs of woodlots are regarded as an investment in rural service provision, development and basic needs fulfilment. These costs are not recovered.
- All subsequent costs are recovered through wood sales.
- In certain situations an environmental subsidy may be made to specific woodlots to keep the price of wood down. Such a strategy would probably be part of a wider package of local environmental management.

Although such a solution would mean that wood is sold at below the total cost of production, it is unlikely to undermine local tree planting initiatives, since experience has shown that these initiatives are only likely to regard firewood as a secondary benefit at best.

12.3 Unwanted wood

A characteristic of the fuelwood situation in South Africa is that a significant proportion of the wood originates from places where it has a zero or a negative value. These sources are in the commercial farming and forestry sector, and include plantation residues in commercial forestry, invasive exotics on farmland, and encroaching species in savanna rangeland.

Plantation residues obstruct forestry operations and are a fire hazard. The disposal of residues by stacking and burning on site is a forestry cost, and therefore the residues have negative value to the timber grower.

Timber companies do not have policies on the price of firewood ex-plantation. It is left to the regional foresters or plantation managers. Prices are low or zero, but examples of a negative price (paying gatherers or contractors to remove the residues) have not been encountered.

Wood harvesting can be a useful tool in the control of invasive exotic species and of bush encroachment in natural rangeland. In some extensive beef farms and game farms, the controlled harvesting of firewood has been incorporated into a farm management strategy. Areas which are infested with invasive woody plants or

areas encroached on by bush represent an economic cost to the farmer, because of the reduced productive capacity and lower market value of the land. Farmers will generally make fuelwood available from these sources free of charge to farmworkers on their own and neighbouring farms. Others are expected to pay, but prices are usually low and income generation is not a major consideration to the farmers in setting the price. Prices may be kept low in the interest of good neighbourliness, and to encourage the removal of unwanted wood, but fuelwood is seldom given away.

Reasons for charging for wood are:

- to be able to exercise some form of control over the operation and avoid a free-for-all;
- to compensate for perceived risks and costs (for example, broken fences); and
- to make the gatherers aware and respectful of the owner's property rights.

In transactions involving the sale of wood from these sources, there are costs and benefits on both sides, which are balanced through market forces rather than policy interventions. However, planning and policy may have a role in promoting the right environment for these transactions to take place in. The avenues to achieve this include the existing agricultural unions and extension services in the commercial sector, and prospective associations of wood cutters and merchants in the informal sector.

12.4 Natural woodland on commonage and state land

12.4.1 Permit systems

Many of the state conservation bodies are becoming increasingly sensitive to the need to allow access to the resources in conservation areas, and this is normally controlled and regulated by means of a permit for which a fee is payable. Under traditional systems, permission to cut live trees on commonage was required from the traditional authority (TA) and frequently a nominal fee was payable to the TA. These traditional practices have fallen into disuse in many areas, but in some instances have been modified by a conservation agency which helps to enforce them. An example is in the Hlatikulu Forest Reserve where the KwaZulu Bureau of Natural Resources (KBNR), in cooperation with the Nyawo Tribal Authority, has established a system whereby a person wanting to cut wood is required to purchase a permit from the TA. The system departs from the traditional situation in several ways, including:

- raising the fee to R10;
- the imposition of a thirty day cutting limit per permit;
- the placing of a limit on the size of the stems that can be harvested; and
- requiring woodcutters to give a breakdown per species of the quantities of poles and lath bundles they wish to harvest (Muir 1990).

Data from the permits are used by KBNR to monitor utilisation in the reserve.

This is one of many ways in which a permit system may operate. Such systems have been put in place largely as means of regulating and monitoring offtake, and the cost of the permit is based more on the recovery of administrative costs than on any assessment of the true value of the wood.

12.4.2 Stumpage fees

A stumpage fee has been variously defined as an environmentally protective tax (Teplitz-Sembitzky & Schramm 1989) or 'the financial concept of the value of standing wood resources' (Openshaw & Feinstein 1989). The latter authors maintain that a stumpage fee is not a tax but a form of compensation paid by the cutter.

Many, but not all countries charge a stumpage fee for fuelwood. South Africa is one which does not. Also, most of the less developed countries do not charge for fuelwood if it is for consumption by the gatherer because it is difficult, if not impossible, to collect from a large number of gatherers. However, as soon as wood products become commercialised, the levying of fees is possible especially if production is concentrated (Openshaw & Feinstein 1989).

The fixing of stumpage fees is a complex exercise. It needs to take account of many diverse factors such as the market value of wood, the hypothetical replacement cost of the wood, an environmental audit of harvesting, the effect on land value, and the cost of resource management. There is a dearth of information on these factors, and all of them are highly area specific. Firewood is particularly difficult to evaluate from an environmental perspective since most firewood, even live-cut firewood, comes not from felling trees, but from pruning.

In most countries the rationale for fixing fees is poorly understood (Openshaw & Feinstein 1989). Foley (1988) argues that two of the reasons commonly advanced for stumpage fees are not valid. Firstly, the fees do not make it any more attractive for rural dwellers to grow wood for sale, and secondly, there is no evidence that stumpage fees reduce the consumption of firewood. There may, in fact, be a small reduction. However, in the absence of information on price elasticities, the effect is unpredictable, so a stumpage fee is not a suitable tool in energy planning.

One problem with the concept of the stumpage fee as an environmental tax is that the burden of the tax falls on the poor. One World Bank paper (Teplitz-Semblitzky & Schramm 1989) even suggests that the revenues should be distributed generally in the economy and not used to the benefit of those from whom the revenues came, for this would weaken the incentive to undertake defensive measures like tree planting. This argument is flawed in that the cost to the woodcutter is immediate and internalised, but the benefits derived from the revenue are deferred and shared, even if these are directed at the source community.

It is suggested that policy interventions to institute stumpage fees would be inappropriate at the moment. Policy is likely to shift towards local community control of resources. This would open the opportunity for introducing a form of stumpage fee within local resource management initiatives which may be supported by conservation or development agencies. Fees would have to be set in accordance with local management objectives. Guidelines for a national policy might emerge at a later stage. It is suggested that these guidelines should be informed by such local initiatives, rather than the other way round.

CHAPTER THIRTEEN

An institutional framework for fuelwood and social forestry programmes

13.1 Existing institutions

This document has highlighted the multifaceted nature of social forestry and fuelwood programmes. Narrow interventions targeted at fuelwood production have not had a good track record. Fuelwood belongs in a much wider field, which cuts across many of the usual intersectoral boundaries. This puts the energy sector in an anomalous situation. Although fuelwood is the staple energy of rural households, and is therefore one of the most important components of any integrated energy plan, interventions fall mainly outside the domain of the energy sector. The sector supports research on the subject, and was instrumental in launching the Biomass Initiative in which it plays a management role, but it is not as actively involved in fuelwood or afforestation as it is in electrification or transitional fuels, for example.

There are several organisations and institutions involved in social forestry to a greater or lesser extent but there is no institutional framework in place. The complexity is made worse by the institutional duplication of apartheid. The role-players include:

- government forestry departments;
- the Department of Mineral and Energy Affairs;
- government and parastatal conservation agencies;
- non-government organisations, community-based organisations and civics;
- government agricultural departments and parastatals;
- agricultural corporations in the homelands;
- government education departments;
- provincial departments of community services;
- universities and colleges;
- Forestek;
- major funders like the Development Bank of Southern Africa and the Independent Development Trust;
- the private sector, particularly timber companies; and
- institutes such as the National Botanical Institute.

Some of the above are only minimally involved at present, but may have a potentially larger role in the future.

Changes are occurring in the organisational and institutional landscape as it affects rural development in South Africa. Firstly, profound changes at a regional level are imminent, with the reincorporation of the homelands and the establishment of new regional structures. What this will mean for institutions in the homelands which have been in the forefront of previous afforestation initiatives (mainly the several departments of forestry) is not clear at this stage, but it is commonly believed that these will be incorporated into regional branches of the respective central government departments. As reported earlier (Section 4.2), the Forestry Branch of the Department of Water Affairs and Forestry has reorientated and restructured itself to be able to absorb the homeland forestry extension services into a programme of social forestry.

Secondly, long-standing barriers between the state and other organisations are beginning to erode. NGOs are not as overtly hostile to the state as previously. The role of NGOs is shifting from resistance to development and service provision. This

opens the way for contractual arrangements for NGOs to undertake service provision and public works. At the same time it is quite likely that a future government might take over some of the functions carried out by NGOs. These include capacity-building at a community level, as well as the delivery of services which by default have become the responsibility of NGOs.

Thirdly, we are seeing the emergence and strengthening of a number of rural community-based organisations (CBOs). CBOs are the embryonic form of future rural local government and administration (Lund 1993). Like NGOs, some CBOs are adapting from a resistance role to a development one, and are engaging more and more with government over services and development. Some of the major rural development funders are shifting their funding policies to channel funds directly to CBOs as far as this is feasible.

13.2 Towards an institutional framework

An institutional capacity is required at three broad levels: national, regional and local. At the national level, the main functions will be policy-making, overall coordination, resource allocation and macrobudgeting, international linkages and cooperation (especially within southern Africa), and the operation of central services such as a seed bank and a data bank.

Social forestry and fuelwood programmes would be operationalised at the regional level, and integrated into other regional initiatives such as rural development programmes and integrated energy plans.

The local level is the area of project implementation, which requires the accessing, coordination and timing of a range of inputs and support services. Service delivery and development is not sustainable without local planning and decision-making, so organisational and institutional development at the local level is a critical component of the whole framework for a national social forestry programme.

13.2.1 Recommendations

1. Although social forestry cuts across many sectors, the Forestry Branch of the Department of Water Affairs and Forestry (DWAF) is the best positioned to provide an institutional base for a national programme of social forestry and woodlot development.

2. It is debatable whether the position of Forestry as a Directorate within DWAF is an ideal arrangement, although the association does have some advantages with regard to the hydrological planning of catchments. There are a number of options. Forestry, being a form of crop production, has obvious affinities with agriculture. With the uptake of agroforestry methods, the two sectors are becoming even more interconnected. Social forestry is intimately woven into the whole fabric of agricultural development.

   In most of the homelands, agriculture and forestry are institutionally linked, but in practice they operate independently of one another. In Zimbabwe, the Forestry Department was located in the Ministry of Agriculture until 1954 when the parastatal Forestry Commission was established (Katerere et al 1993). A parastatal status should be considered for forestry in South Africa too. It may free forestry of some of the bureaucratic constraints of government, making it more manoeuvrable, responsive and better equipped to deal with the diverse demands of social forestry. On the other hand, it might weaken it politically in its capacity to access funds and to coordinate other role players.

   It is recommended that a committee be appointed to review the institutional

location and status of forestry.

3. It is also recommended that a national advisory and coordinating forum for social forestry be convened. This might be done under the auspices of the Forestry Branch. It would be composed of people from different disciplines and sectors connected to social forestry, and have both government and non-government representation. The forum should set up working groups as necessary. These might include: a Policy Working Group; an Education and Training Working Group; an Extension and Support Services Working Group; and a Research Working Group. The forum might eventually be constituted as a statutory council.

4 An institutional framework will need a clear entry point for funds and demonstrably effective mechanisms for the delivery of these funds to where they are needed. This must include mechanisms for directing funds to NGOs and CBOs. Some of the most effective social forestry and tree dissemination programmes have been built on mobilising and supporting NGOs (Fenn 1991). However, government departments are not very good at giving money away, and complain that they do not have sufficient for their own needs (Gandar 1993b).

The putative framework depicted in Figure 1 incorporates a dual mechanism for delivering funds. One conduit is contained within the Forestry Branch and its parent ministry where it is to be used for such functions as the seed bank and the information and data bank. It would also be used to fund activities such as regional coordination, extension, the implementation of social forestry projects, and the establishment and management of woodlots.

The other funding conduit is through the social forestry forum or council. This would be directed to NGOs and CBOs on a contractual basis for the implementation of social forestry. It would also be directed to universities, colleges and research institutes in accordance with priorities for research and training set by the forum itself.

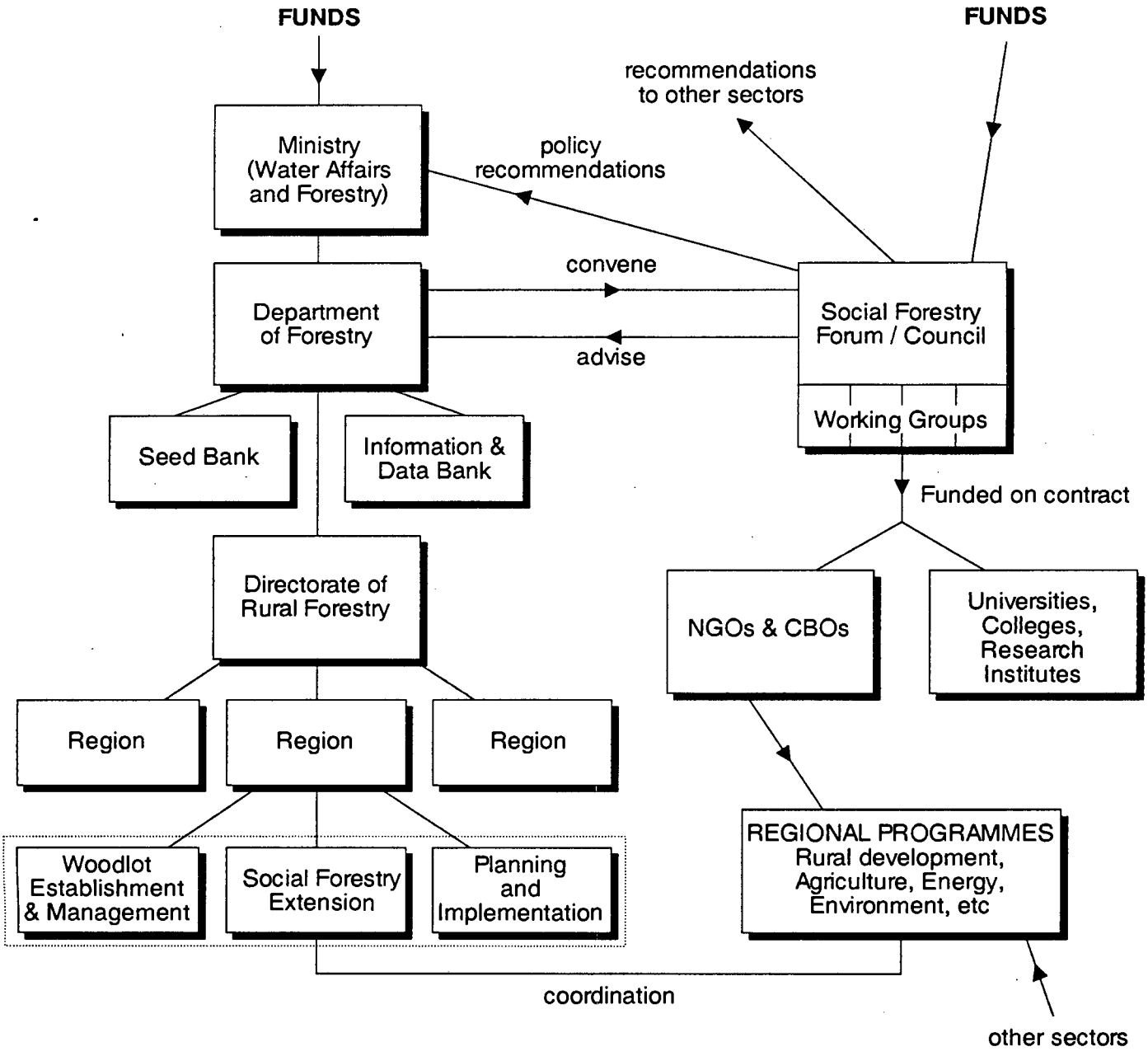

FIGURE 1 Hypothetical model for an institutional framework for social forestry and woodlot development

CHAPTER FOURTEEN

Summary of recommendations

14.1 Database for planning

An adequate database is a prerequisite for the rational planning of a programme of interventions in the area of wood biomass. In particular, data is needed on the extent and yield of the biomass resource, the rate at which it is being used, and on the economic implications of the policy options.

Fuelwood consumption

The present database on fuelwood consumption needs to be enlarged to achieve a more even spread of geographical areas, and of physical and demographic conditions. If the data were incorporated into a Geographical Information System, it could be analysed in relation to other factors to ascertain some of the determinants and indicators of fuelwood consumption. Data on the relative demand elasticities of different fuels would contribute to the basic understanding of fuelwood consumption patterns.

It is recommended that the necessary demographic, energy and other information be assembled to produce accurate, detailed and disaggregated information on fuelwood consumption, and to predict short- and medium-term changes to the demand.

Wood biomass resources

Information on wood biomass resources is required with a level of accuracy and a scale of disaggregation compatible with the data on fuelwood consumption. Changes occurring to the wood biomass resource need to be quantified and the causes understood. It is recommended that the two current programmes of research which approach the matter with totally different methodologies (the first using remote sensing, and the second using predictive models based on ecological variables) should be coordinated and further supported to produce a national inventory of wood biomass resources. Other woodland resources might also be inventorised as policy and planning needs arise.

Economic evaluations of policy options

Data is needed on the specific financial and budgetary implications of the various social forestry options, and also on the wider economic costs and benefits. This applies particularly to some of the more recent approaches to social forestry.

14.2 Policy directions

14.2.1 Framework for policy formulation

A new intellectual and analytical framework is needed for the so-called fuelwood crisis. It is necessary to understand the nature of the problem. It is not simply a resource shortage requiring narrow supply-side or demand-side interventions. The fuelwood issue must be placed in the wider context of rural poverty, and of the coping mechanisms and livelihood strategies of rural people. Thus the targets for intervention are constraints rather than shortages. The fuelwood problem may thus take on a different complexion in different situations. The concept of a regional political ecology as described in Chapter 5 is suggested as a useful analytical framework.

14.2.2 Policy implications

The above framework has two main implications for biomass policies. Firstly, interventions must be coordinated with and integrated into regional rural development strategies and integrated energy planning. A multitude of intersectoral linkages are required to effect this. Secondly, adaptive and participatory approaches to planning and implementation are necessary. It is necessary to understand the local best-practice responses to fuelwood shortages, and to build on these as appropriate.

14.2.3 Three-pronged approach

Within the guidelines already set out, three broad areas of intervention have been identified, which will help to improve the fuelwood situation in rural areas:

- the management of natural woodlands;
- promoting tree planting through a national programme ofsocial forestry; and
- the transport and distribution of local surpluses of wood.

The policy issues inherent in each of these are summarised below.

The management of natural woodland is an integral component of social forestry, but it does raise some specific policy issues which are dealt with separately.

14.3 Management of natural woodland

The broad objective of policy interventions in this area should be to secure the sustainability and equitability of the use of resources in the communal woodlands. Woodlands are areas of multiple resources, and management projects must embrace the whole range of them. Fuelwood alone is not a sufficient incentive for implementing a management programme. It is important to understand and build on local and traditional practices which regulate the utilisation of natural resources. However, in South Africa, we lack a comprehensive picture of the systems of control, access and tenure, particularly tree tenure. Traditional practices are changing under new and external influences: they are either adapting positively to new circumstances, or being eroded. The local resource management regime would have to be investigated for each project. The management of resources entails local political and institutional issues.

It is not recommended that detailed policy guidelines on the management of indigenous woodland be formulated at this stage. Instead, innovative initiatives for the sustainable use of resources in communal woodland should be actively encouraged and supported.

Projects should be initiated within integrated rural development programmes. The basic principles of natural resource management should be included in the training curricula of agricultural and development extension staff. At a later stage of project planning and implementation, specialist expertise would be needed. Nature conservation agencies should be equipped to provide this.

The formation of Resource Management Areas (communal areas which are set aside specifically for conservation and controlled resource utilisation) should be supported where appropriate by conservation authorities. Imaginative combinations of land-use need to be explored for RMAs, particularly for areas in which ecotourism and hunting are not viable options. An ongoing programme for monitoring and evaluating all existing RMAs should be set up.

14.4 Development of a national social forestry programme

14.4.1 The scope of social forestry

It is recommended that a national social forestry programme be set up as a priority. Apart from the sustainable management of natural woodland, the programme would have the broad objective of promoting the planting of trees in and by rural communities. A social forestry programme should be diverse and include (where appropriate):

- agroforestry;
- homesite planting by individuals;
- community woodlots;
- school projects, village greening projects and the like;
- reclamation forestry;
- village nurseries for tree production; and
- commercial small-grower schemes.

It is also recommended that the programme include the establishment of woodlots under some form of institutional or departmental control. This is not social forestry in the true sense. Nevertheless, from an administrative and planning standpoint, these belong in social forestry.

14.4.2 Linkages

Social forestry must be truly multisectoral. Firm and formal links between sectors are required within an overall coordinating structure. Of particular interest to the subject of this paper is the role of the energy sector. There is very limited opportunity for the direct involvement of this sector in the practical implementation of social forestry despite the very significant bearing it has on rural energy supplies. It is suggested that the energy sector has a role in the initiation of the programme and its coordination, in planning and policy formulation, and in research insofar as it relates to fuelwood.

14.4.3 Extension

It is recommended that the existing disparate branches of extension be brought within a coordinated structure. This might be a precursor of a single integrated rural extension network. Social forestry will have to rely heavily on extension workers in related disciplines, most notably agriculture, but there will still be need for a specialist extension service in social forestry. It is recommended that the social forestry extension service should be streamlined and professional, with well-trained staff.

Social forestry extension requires that extensionists have a degree of technical knowledge not covered in the existing curricula. They will also need to be familiar with participatory methods of extension. Therefore it is recommended that appropriate training modules be developed for the further training of existing extension staff, and that social forestry be included in the basic training of new agricultural extension workers.

14.4.4 Training

Training in social forestry is needed at all levels from the rural village level to tertiary professional training. It is recommended that a body be established for the planning and coordination of training in social forestry and that this body should consist of three units: training, media, and curriculum development.

It is further recommended that a southern African network for training in social forestry be established to rationalise facilities in the region as a whole.

14.4.5 Support services

Provision must be made to provide support for social forestry initiatives on the ground. Local service organisations which give support to rural communities need support services themselves. These will include:

- access to information;
- technical advice;
- basic infrastructure (for example water supplies);
- extension personnel;
- access to supplies;
- a network of practitioners in social forestry;
- finance;
- local and regional coordination of development; and
- research, monitoring and evaluation.

The broad objective should be to enable NGOs and service organisations to be effective agents in promoting social forestry.

14.5 Transport and distribution of fuelwood

The broad objective is to make fuller use of under-utilised fuelwood resources. This involves promoting and facilitating the distribution of wood from the commercial agricultural and forestry sector to the homelands, and to a lesser extent the distritution of localised surpluses within the homelands.

A campaign to encourage farmers and foresters to allow easy access to fuelwood should be conducted through the media, the agricultural unions and the extension services to the commercial sector. The integration of fuelwood harvesting into farm management plans should be encouraged.

Assistance might be given to the wood merchants in the form of finance, advice, and in the formation of associations to negotiate directly with land-owners.

These interventions offer the potential for relatively large increases in the available fuelwood per rand of public money spent.

14.6 Commercial forestry

It is recommended that the principle of convergence should be a fundamental principle of policy formulation. By this is meant the bringing together of commercial forestry and social forestry in a single coherent policy framework to replace the old 'dual economy' paradigms of the past.

Clearly there are large differences between the two, but there are also important areas of overlap. These include:

- small-grower schemes;
- the use of plantation residues for fuelwood;
- mixed fuel, pole and timber plantations;
- the sharing of nursery facilities; and
- support for small-scale primary processing.

From the point of view of social forestry, including small-grower schemes, it is recommended that aspects of existing forestry policy and the commercial forestry industry be reviewed. These include:

- afforestation permits in relation to mini-plantations;
- the wattle bark quota system;
- timber price structures; and
- the isolation of small-growers from the commercial sector.

14.7 Institutional structure

Many of the earlier recommendations deal with the need for links and coordination of one kind or another. This points to the need for an institutional structure for social forestry.

14.7.1 Levels of institutional capacity

An institutional capacity is needed at three levels:

The national level: policy-making, overall coordination, resource allocation and macrobudgeting, international linkages and cooperation and other aspects.

The regional level: programmes operationalised, integration into other regional initiatives such as rural development programmes and integrated energy plans.

The local level: project implementation, accessing, coordination and timing of a range of inputs and support services, local planning and decision-making, organisational and institutional development.

14.7.2 Recommendations

1. The Forestry Branch of the Department of Water Affairs and Forestry (DWAF) is the best positioned to provide an institutional base for a national programme of social forestry and woodlot development.
2. It is debatable whether the position of Forestry as a directorate within DWAF is an ideal arrangement. It is recommended that a committee be appointed to review the institutional location and status of forestry.
3. It is also recommended that a national advisory and coordinating forum for social forestry be convened. The forum should set up working groups as necessary. These might include:
   - policy;
   - education and training;
   - extension and support services; and
   - research.
4. An institutional framework will need a clear entry point for funds and demonstrably effective mechanisms for the delivery of these funds to where they are needed. This must include mechanisms for directing funds to NGOs and CBOs.

   Details of the proposed framework appear in Chapter 13.

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PAPER No 9

Afforestation and woodland management in South Africa

Mark Gandar

SOUTH AFRICAN ENERGY POLICY RESEARCH AND TRAINING PROJECT

widening access to basic energy services for the urban and rural poor

ENERGY FOR DEVELOPMENT RESEARCH CENTRE
University of Cape Town

PROJECT DESCRIPTION

A major two year research project was launched by the Energy for Development Research Centre in April 1992. It aims to investigate policy options for widening access to basic energy services for the urban and rural poor in South Africa. Research papers are being produced in the following areas:

Background papers
Research outline
Integrated energy planning: a methodology for policy analysis and research
Development context for energy planning in South Africa
Background on South African energy system

Energy demand analysis
Energy demand in underdeveloped urban and rural areas

Rural areas
Energy for rural development: an introduction and overview
Energy and small-scale agriculture
Rural household energy supply options
Afforestation and woodland management
Remote area power generation options

Urban areas
Household energy supply in formal and informal urban settlements
Energy and informal sector production

Ancillary sector
Energy and mass transportation*

Key supply sector
Electricity distribution sector*

Cross-sectorial studies
Energy efficiency and conservation*
Energy and environment*
Southern Africa linkages*
Investment requirements and financing mechanisms*
Pricing policy*
Institutional analysis*

Policy options
A concluding document will draw together key policy conclusions
** The scope of these studies is restricted to energy issues concerning the urban and rural poor.*

EDRC

The Energy for Development Research Centre is located at the University of Cape Town. Its objectives are to study energy related problems of developing areas in Southern Africa, and possible ways to address them.

EDRC seeks to achieve its objectives by:

- undertaking research projects;
- running a specialist postgraduate programme to support research projects and to train personnel to contribute to this field;
- transferring relevant information to user groups by offering consulting services and running workshops, and through publishing books, journal papers, reports, leaflets and design and user manuals.

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