

**MANAGING THE MIOMBO WOODLANDS
OF SOUTHERN AFRICA**

POLICIES, INCENTIVES, AND OPTIONS FOR THE RURAL POOR

Public Disclosure Authorized

Public Disclosure Authorized

Public Disclosure Authorized

Public Disclosure Authorized



PROFOR
PROGRAM ON FORESTS

Disclaimer

This work was originally prepared for the World Bank Africa Region's Environment and Natural Resources Management Unit in 2008 to inform its regional work on forests. Extracts were subsequently published in the Journal of Natural Resources Policy Research (Vol.2, No. 1, 57-73) in January 2010. This volume was subsequently peer reviewed, revised, and has been modestly updated. The technical annexes, available online at <http://www.profor.info/profor/content/miombo-annexes>, have also been revised and updated, on the basis of peer review.

All omissions and inaccuracies in this document are the responsibility of the authors. The views expressed do not necessarily represent those of the institutions involved, nor do they necessarily represent official policies of PROFOR or the World Bank.

Suggested citation: Dewees, P., B. Campbell, Y. Katerere, A. Siteo, A.B. Cunningham, A. Angelsen and S. Wunder. 2011. *Managing the Miombo Woodlands of Southern Africa: Policies, incentives, and options for the rural poor*. Washington DC: Program on Forests (PROFOR).

Published in November 2011

Printed on 100% Recycled paper

Material in this book can be copied and quoted freely provided acknowledgement is given

For a full list of publications please contact:

Program on Forests (PROFOR)

1818 H Street, NW

Washington, DC 20433, USA

profor@worldbank.org

www.profor.info/knowledge

**MANAGING THE MIOMBO WOODLANDS
OF SOUTHERN AFRICA**

POLICIES, INCENTIVES, AND OPTIONS FOR THE RURAL POOR

Authors: **Peter A. Dewees**
Bruce M. Campbell
Yemi Katerere
Almeida Siteo
Anthony B. Cunningham
Arild Angelsen
and **Sven Wunder**



PROFOR
PROGRAM ON FORESTS

TABLE OF CONTENTS

EXECUTIVE SUMMARY	5
ACKNOWLEDGMENTS	9
ABOUT THE AUTHORS	10
1. INTRODUCTION	11
2. CONTEXT: EMERGING OPPORTUNITIES FOR PEOPLE LIVING IN MIOMBO REGIONS	19
2.1 Impacts of ecology, biogeography, and history	19
2.2 Woodlands are a valuable resource	22
2.3 Resource rights are shifting to local people	24
2.4 New integrated conservation-development approaches are emerging	26
2.5 Markets are developing and expanding	28
2.6 Summary	33
3. DIAGNOSIS: WHY IS MIOMBO NOT BETTER MANAGED?	35
3.1 Biophysical barriers to sustainable management of miombo	35
3.2 Policy barriers to sustainable management of miombo	37
3.3 Economic barriers to sustainable management of miombo	42
3.4 Organizational barriers to sustainable management of miombo	44
3.5 Summary	48
4. SOLUTIONS: HOW CAN THE MANAGEMENT OF MIOMBO BE IMPROVED?	51
4.1 Tackling poverty traps and enhancing safety nets	51
4.2 Deforestation and its discontents	52
4.3 Expanding management opportunities in miombo regions	54
4.4 Four immediate entry points for improving policies and incentives for management	57
5. REFERENCES	63
TECHNICAL ANNEXES	74
Available online at http://www.profor.info/profor/content/miombo-annexes	

EXECUTIVE SUMMARY

Miombo woodlands stretch across Southern Africa in a belt from Angola and the Democratic Republic of Congo in the west to Mozambique in the east. The miombo region covers an area of around 2.4 million km². In some areas, miombo has been highly degraded as a result of human use (southern Malawi and parts of Zimbabwe), while in others, it remains relatively intact (such as in parts of northern Mozambique, and in isolated areas of Angola and the Democratic Republic of Congo).

From a conventional forester's perspective, miombo is fundamentally uninteresting. It supports relatively few good commercial timber species, and the management of these species has been problematic. The best areas were logged over long ago. Except in a few areas, the remaining commercially viable stocks are relatively small and difficult to access. Public forestry institutions have, for the most part, failed to establish effective management systems for forests, preferring instead to limit their role to regulation and revenue collection, rather than to management *per se*.

Despite the failure of public institutions to set up good forest management practices, miombo's global environmental values are not trivial. They have between 10 and 30 percent of the above-ground carbon found in an equivalent area of tropical moist forests (Keith et al. 2009; Munishi et al. 2010), but because they are so extensive, they account for a large proportion of the carbon sequestered in southern Africa. Compared with tropical moist forests, miombo has low faunal biodiversity and species endemism, though it does provide the habitat for a number of large herbivores—elephant, rhino, and various ungulates. These mega-herbivores have been central to some successful community-based wildlife management schemes. Plant biodiversity is significant. Around 8,500 plant species are found in the miombo region. More than 300 are trees, and around 54 percent are endemic. Mittermeier et al. (2003) suggest that the miombo-mopane woodlands are one of the five global ecozones that need to be prioritized for biodiversity conservation because they are irreplaceable in terms of species endemism.

Miombo woodland actually regenerates fairly easily and prolifically, provided that regeneration is not inhibited by late dry season fires or by cultivation. Permanent forest loss is an issue when woodlands are cleared for agricultural production. Reasonably good miombo can produce about the same increment of timber as the coniferous boreal forests of Russia or the deciduous temperate forests of middle-Europe. What is different between the temperate and boreal forests of Europe and the miombo of southern Africa is that the former produce commodities that are immensely valuable on domestically and internationally traded markets, and can be managed with these outcomes in mind, while the latter produces limited high-value products for which management is extremely difficult.

In fact, local value-added comes from miombo's multiple uses, which may not involve harvesting large-dimensional industrial roundwood at all. Indeed, it has proven to be of immense value to rural people, providing sources of firewood and building material, as well as extensive supplies of wild foods and medicinal plants. It plays a critical role in the management of livestock throughout

the region, and grassy patches within the woodlands are sometimes heavily used for grazing. The miombo woodland comes into its own during the late dry season, when new leafy foliage is often the only available source of browse for livestock. The relationship between woodland use, livestock management, and crop production is highly synergistic: livestock depend on miombo resources for grazing and browse; they process and transfer nutrients, from woodlands, via manure, to cropped fields; and soils are often supplemented by composted leaf litter collected from woodlands. Miombo is also heavily used for beekeeping. Somewhere around 100 million people live in the miombo region, and to some extent, depend on it for income and consumption goods.

Household studies have documented the importance of miombo to rural households. The studies show that poor rural households are vitally dependent on miombo woodlands because of their role as a safety net, not that poor rural households are becoming rich by tapping into markets for miombo products (or have much potential for doing so). Among these households, miombo is providing for a very substantial proportion of total household consumption. This proportion increases significantly in households that encounter serious income shocks because of illness or environmental stress. The household studies show that miombo woodland resources are a critical element of the rural household economy and contribute significantly to mitigating the impacts of poverty. If these resources are lost as a result of deforestation or other proximate causes, the need for alternative safety nets is likely to place further large burdens on public service delivery institutions, already poorly equipped to handle the problem of rural poverty. Spatial analysis (for example, in Malawi and Mozambique) confirms the statistical correlation between areas with extensive miombo cover and areas with high poverty rates.

In light of the role miombo plays in poverty mitigation, we examine the question of why these woodlands are not better managed. The fact that miombo produces relatively few high-value timber products means that it has not supported the development of much of a forest industry (or related public institutions). The forest institutions that are in place have become largely irrelevant for management, as commercially viable timber stocks have been logged over and management of high-value species has been problematic. At least for the rural poor, miombo needs to be managed for multiple outputs. This is not easy, both because the silviculture of managing for multiple outputs is poorly understood and because the complexity of the management system is vastly increased when multiple stakeholders have interests in managing for different outcomes.

Forest policies, institutions, and legislation are often disabling, and are seldom aligned with management objectives that favor the rural poor. Mostly, this has meant that rights to use and access miombo resources have been retained by the state (even in the face of trends toward decentralization). The policy framework may prohibit the harvesting of woodland products for commercial purposes, except under limited circumstances. Even when there is potential for working with local producers to improve management by, for example, improving their extractive techniques or conversion efficiencies (e.g., from roundwood to charcoal), the legal framework may not allow it. A burdensome regulatory framework has meant that it is easy to be illegal. The regulatory framework often does little more than improve the ability of petty officials to extract informal payments. Devolution of control over natural resources to local forest users, while offering good potential, has seldom been undertaken wholeheartedly. It is this lack of effort that has undermined what are ostensibly promising policies for improving woodland management.

Low margins and shallow markets for miombo products have also limited the potential for improving incomes from better managed woodlands. Even when promising new products are identified, it takes a great deal of investment to develop markets for these products. What may seem to be an obvious market may be neither easily accessible nor well developed. Without mechanisms for developing these markets, miombo products offer few easy paths out of poverty.

It is a wonder then, that with this combination of factors—the complexity of managing woodlands for multiple products, low margins and weak markets, irrelevant institutions, and poorly informed policies—there are any miombo woodlands left at all in southern Africa. These factors also help to identify the points of entry for improving policies, incentives, and options for the rural poor. We identify four specific points of entry.

First, policies and institutions need to be reoriented to ensure that forestry is addressed in the decentralization agenda. The devolution of full control to local institutions and organizations is increasingly seen to be a basic requirement for bringing about better management. While decentralization is not a guarantee of success (and in this paper we document many problems with decentralization), it probably increases the chances that local control increases benefits and improves management (Sunderlin et al. 2005). The challenges of devolution come from the need to enhance the legitimacy of local management organizations, from ensuring these organizations can put in place effective management mechanisms, and from seeing that local organizations have the capacity to limit elite capture. In the miombo region, Tanzania has led the way in decentralizing forest management to communities.

Second, the potential of markets for woodland products and services to improve local value-added can increase the incentive for better management of woodlands, and this potential can be enhanced through various policy and regulatory mechanisms. These include simplification of the regulatory regime to reduce transactions costs for poor producers, and developing a framework for providing greater support for producer organizations and user groups. Forest regulatory regimes have acted, in many respects, as a trade barrier, limiting competition, restricting market entry, and keeping producer margins low and consumer prices high. A simplified regulatory regime that favors the capacity of producers to manage woodlands (instead of depending on the whim of officialdom to license the right to extract) could contribute to expanding markets. Trade associations have shown they can play a role in promoting market diversification, in improving the prospects for niche market entry, and in establishing product standards.

Markets for environmental services from miombo woodlands are potentially quite important—for carbon sequestration, for biodiversity conservation, for tourism, and for watershed management. These markets could be more fully developed in line with the emergence of new financing instruments and international commitments. Experience suggests that these types of initiatives are most successful when they are integrated with other rural development activities. Payments for environmental services (PES) may provide the necessary incentives for local people to manage woodlands. Wildlife management schemes that display many features of PES have been relatively successful in the region.

Third, forestry organizations need to be revitalized. Forestry organizations are generally underfunded and not aligned with the major thrusts of rural development efforts. There is also much resistance to change, even though a failure to adapt further marginalizes these groups. Perhaps the

biggest challenge for the region's forest organizations is the need to move from their earlier roles, which were largely regulatory, to roles that have a much stronger service-delivery orientation, aligned with the poverty mitigation agenda. The skill set that currently characterizes forest organizations in the miombo region, and the budget processes that allocate public resources for forest management, is largely not relevant for meeting the challenges of management. Similarly, with only a few exceptions, forest research institutions have demonstrated a limited understanding of the complexities of management to meet local needs. It may be that the current roles of forest organizations need to be greatly reduced to focus on a few strategic themes, and that wider responsibilities for service delivery should shift to other institutions with greater capacity for engaging local stakeholders in improving natural resource management.

Finally, because of the miombo's critical role in mitigating the impacts of poverty, *the impacts of deforestation and degradation need to be more fully incorporated into development planning* in a manner that accounts for the costs of providing the alternative safety nets. Conversely, by improving the capacity for local woodland management through changes in the policy framework, the role of safety nets for mitigating the impacts of rural poverty can be greatly enhanced. The management of dry woodlands is unlikely ever to be a path out of poverty, but it can do a great deal for reducing its negative impacts.

ACKNOWLEDGMENTS

This report was prepared by a team led by Peter Dewees, with the Agriculture and Rural Development Department of the World Bank. The team comprised staff from the Center for International Forestry Research (CIFOR) and its partner institutions, including Bruce Campbell, Yemi Katerere, Almeida Siteo, Tony Cunningham, Arild Angleson, and Sven Wunder, with additional inputs from Alan Ogle and Paddy Abbott. Comprehensive peer review comments were provided by Grant Milne, Marjory Anne Bromhead, and Stephen Mink of the World Bank and were greatly appreciated.

A second volume of technical annexes, which provided much of the background material for this report, was prepared by a team of researchers composed of Charles Jumbe, Sam Bwalya, Madeleen Husselman, Manyewu Mutamba, Almeida Salomão, Frank Matose, Ravi Hegde, Gary Bull, Will Cavendish, Bruce Campbell, Charlie Shackleton, Jeanette Clarke, Paddy Abbot, and Alan Ogle. Their institutional affiliations are noted in the technical annexes. Peter Frost provided the map on miombo distribution and Fiona Paumgarten, Emmanuel Luoga, and Mutemwe Kavallo assisted in compiling information on national budgets and decentralization. In addition to the feedback provided by extensive review and discussion among members of the research team, the technical annexes have been independently peer reviewed. The review process has immensely enriched and improved the technical annexes, and the authors express their appreciation for the feedback.

This work was funded primarily by the World Bank-administered Trust Fund for Environmentally and Socially Sustainable Development (financed by the Governments of Finland and Norway) and by the multi-donor Program on Forests (PROFOR). Additional staff time was contributed by CIFOR through the SIDA-funded dry forests project.

ABOUT THE AUTHORS

Peter A. Dewees

Peter Dewees is Lead Forests Specialist at the World Bank and Manager of the Program on Forests (PROFOR) in Washington DC.

Bruce M. Campbell

Bruce Campbell is Director of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), based at the University of Copenhagen.

Yemi Katerere

Yemi Katerere is Head of the Geneva-based UN-REDD Programme Secretariat.

Almeida Siteo

Almeida Siteo is a Professor in the Department of Forestry at Eduardo Mondlane University, in Maputo, Mozambique.

Anthony B. Cunningham

Anthony (Tony) Cunningham is an Ethno-ecologist working for the Center for International Forestry Research (CIFOR), Bogor, Indonesia.

Arild Angelsen

Arild Angelsen is a Professor of Economics at the Norwegian University of Life Sciences (UMB) in Aas, Norway, and a Senior Associate of CIFOR.

Sven Wunder

Sven Wunder is a Senior Economist in the Livelihoods Program at CIFOR.

1

INTRODUCTION

Miombo woodlands are the most extensive tropical seasonal woodland and dry forest formation in Africa. The miombo region¹ covers somewhere around 2.4 million km². Above-ground biomass stocking densities vary from 20 m³ per ha to as much as 150 m³. Miombo is generally found in areas that receive more than 700 mm mean annual rainfall. Soils tend to be nutrient-poor (Campbell et al. 1996; Frost 1996). Miombo woodlands cover substantial portions of southern Africa: Angola, Malawi, Mozambique, Tanzania, Zimbabwe, Zambia, and most of the southern part of the Democratic Republic of Congo (DRC) (figure 1.1). It is dominated by a few species, mostly from the genera *Brachystegia*, *Julbernardia*, and *Isoberlinia*. Miombo is named after the Swahili word for a *Brachystegia* species.

Miombo woodlands lack the visual appeal of tropical moist forests. They offer little for commercial logging interests. From an ecological perspective, most miombo has been heavily disturbed. There is very little 'old growth' woodland remaining.

Why then should miombo be of any interest at all?

Biodiversity is significant. Although the richness and diversity of faunal species is low, the miombo region has an estimated 8,500 species of higher plants, more than 54 percent of which are endemic. Of these, 334 are trees (compared with 171 in the extensive and similar Sudanian woodlands). Zambia has perhaps the highest diversity of trees and is the center of endemism for

FIGURE 1.1: THE DISTRIBUTION OF MIOMBO WOODLAND



Source: Based on White (1983).

Note: The mapped area is the botanical region in which miombo woodland dominates. It is now largely a mixture of miombo woodland, degraded miombo woodland, and smallholder cropland. Miombo and other forest types are not distinguished in the data.

¹ White (1983) puts the figure for the "Zambezian phytochorological region" (of which miombo is the dominant element) at 3.8 million km². Millington et al. (1994), based on remote sensing, suggested the more generally cited 2.7 million km², but it is not exactly clear what they include in their estimate. Frost et al. (2003) suggest 2.4 million km² for the miombo region, of which 466,000 km² has been transformed. The miombo region is a mixture of woodland, degraded woodland, and cropland.

Brachystegia, with 17 species. Species diversity and localized endemism is high in many herbaceous plant genera, such as *Crotalaria* (over 200 miombo species) and *Indigofera*. Areas of serpentine soils in Zimbabwe provide localized sites of speciation and endemism (Rodgers et al. 1996). Mittermeier et al. (2003), focusing on a slightly larger area than the pure miombo discussed here, recorded the miombo-mopane woodlands as one of the five ecozones (together with Amazonia, Congo, New Guinea, and the North American deserts) that need to be prioritized for biodiversity conservation because of their irreplaceability in terms of species endemism.

Miombo is also important for livelihoods. Especially in regions where population pressures are high and arable land resources are limited, miombo woodlands play an increasingly important role in complex systems of rural land use. These systems integrate woodland management with crop and livestock production and contribute significantly to mitigating the impacts of rural poverty. At least 75 million people inhabit miombo regions, and an additional 25 million urban dwellers rely on miombo wood or charcoal as a source of energy.² Similar dry forest formations stretch across northern Africa, south of the Sahelian zone (Mayaux et al. 2004).

Most miombo in southern Africa has been heavily disturbed precisely because it has great local value. It provides dry-season fodder for large livestock populations and fuelwood for domestic and rural industry uses. It offers construction material for farm structures and homes for millions. It is a rich source of wild foods and fruits, reducing the vulnerability of poor rural households from the risks of crop failure. At the same time, dry woodlands help conserve water and soil resources for agriculture. They may not yield much in terms of high-quality timber, but their other life-support roles have vast importance—and are also being exposed to great pressures. In the face of limited alternative economic opportunity, up to a third of household consumption among poor rural households in the miombo zone can come from dry woodlands. Despite these varied and significant roles, policy interventions that focus on the linkages between woodland management, the environment, and poverty alleviation are seldom clearly articulated.

Deforestation rates and poverty estimates in the miombo region are disturbing. Statistics on forest cover in the miombo countries continue to show a decline in cover (table 1.1). Forest loss is driven largely by two major processes: land clearing for agriculture and wood extraction for energy. In many cases these forces work in tandem, for example, wood extraction is followed by use of the land for agriculture. However, data are poor and generalizations are neither easy nor accurate: there is much variation in the levels and causes of deforestation across the region, and a poor understanding of cause and effect (Abbot and Homewood 1999; Chidumayo 2005a; Dewees 1995; Fisher and Shively 2007; Luoga et al. 2000; Mwampamba 2007; Sprague and Oyama 1999). None of the available statistics distinguish between miombo areas and other forest types, so we can only speak in generalities about forest cover loss.

2 Population estimates are derived from 2007 estimates for the UN Population Fund. Estimates of the population in dry forest areas (in contrast to, e.g., humid forest areas) and for urban use of wood energy are from Campbell et al. (2003), Kambewa et al. (2007), and Stockholm Environment Institute (2002). Population numbers for DRC miombo area were derived from figures provided by the African Forests Observatory project (FORAF).

TABLE 1.1. DEFORESTATION RATES IN COUNTRIES WHERE MIOMBO WOODLAND PREDOMINATES

COUNTRY	FOREST AREA (2010) 1000 ha	ANNUAL CHANGE RATE			
		1990–2000		2000–2010	
	1000 ha/yr	%	1000 ha/yr	%	
Angola	58,480	-125	-0.2	-125	-0.2
Malawi	3,237	-33	-0.9	-33	-1.0
Mozambique	39,022	-219	-0.5	-217	-0.5
Tanzania	33,428	-403	-1.0	-403	-1.1
Zambia	49,468	-167	-0.3	-167	-0.3
Zimbabwe	15,624	-327	-1.6	-327	-1.9

Source: FAO 2011.

Note: The similarity of the data between the two periods points to the lack of reliability of such estimates. Miombo and other forest types are not distinguished in the data.

Indeed, if we consider what happened to agricultural land use across the region between 1990 and 2005, and compare this with what we know about forest loss over the same period, we cannot necessarily conclude that agricultural expansion has been the sole or strongest driver of deforestation (table 1.2). In DRC, for example, agricultural land was abandoned over large areas. At the same time, extensive deforestation took place (perhaps as a result of the timber trade and because of other demands).

TABLE 1.2. CHANGES IN AGRICULTURAL LAND COMPARED TO CHANGES IN FOREST COVER, 1990 TO 2005

COUNTRY	PERCENT CHANGES 1990 TO 2005		CHANGES IN AREA (SQ KM) 1990 TO 2005		RATIO OF THE CHANGE IN FOREST AREA TO CHANGE IN AGRICULTURAL AREA
	Agricultural land area	Forest area	Net change in agricultural land area	Net change in forest area	
Angola	0.3	-3.1	1,860	-18,720	-10.1
Congo, DR of	-1.8	-2.9	-4,100	-46,710	11.4
Malawi	17.8	-12.7	7,520	-4,940	-0.7
Mozambique	2.2	-7.6	10,700	-32,990	-3.1
Tanzania	2.2	-14.6	7,500	-60,500	-8.1
Zambia	9.8	-4.7	19,720	-24,990	-1.3
Zimbabwe	20.7	-22.1	26,900	-49,050	-1.8

Source: World Bank 2011.

In Malawi, Zambia, and Zimbabwe, the deforested area was roughly equivalent to the area of new agricultural land brought in to production. In Tanzania, the area that was deforested over the period was much greater than the area of new agricultural land. While agricultural expansion is clearly part of the process in these countries, other significant drivers also come into play.

If we take the analysis one step further (figure 1.2) and look only at the areas from which harvests were cropped, the picture suggests other complexities. In Tanzania, for example, the areas from which harvests were cropped increased from 1990 to 2009, from around 6 million ha to 10 million

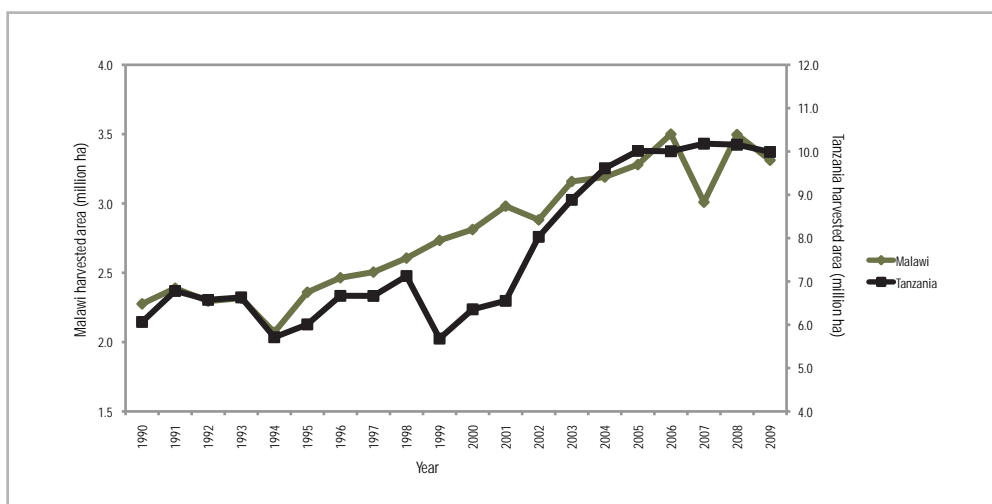
ha (around 210,000 ha per year). But the area that was reportedly deforested during the period was supposed to have been around 400,000 ha per year, suggesting that either deforestation estimates are simply wrong (quite possible) or that there are other significant drivers of the process and large areas that have been deforested are being left fallow. In contrast, in Malawi, the areas from which harvests were cropped increased from around 2.2 million ha to 3.3 million ha (around 60,000 ha per year) over the period. By comparison, the area deforested was only around 32,000 ha per year.

Deforestation trends have been exacerbated by growing demands for land for large-scale agriculture in response to rising cereal and grain prices. In Mozambique, for example, Deininger and Byerlee (2011) found that between 2004 and 2009, use rights to around 2.7 million ha of land had been granted to investors and entrepreneurs with the objective of developing large-scale farming schemes. (A 2009 audit suggested that around half of this land wasn't being used or fully used.)

Economic development and growth to reduce poverty in miombo countries remain problematic. Life expectancies are low, partly as a result of the HIV/AIDS epidemic, and secondary school enrollments and literacy rates remain generally low. In Africa, the HIV/AIDS prevalence rate is highest in southern Africa. It exceeds 30 percent in Botswana, Lesotho, Swaziland, and Zimbabwe, and 20 percent in Malawi, Namibia, South Africa, and Zambia (UNAIDS/WHO 2002). Per capita gross national incomes (GNI) are low, except in the case of oil-rich Angola. While most countries³ have significantly increased their GNI over time, and some countries have demonstrated impressive economic growth rates (e.g., Angola, Mozambique, and Tanzania), poverty headcounts remain high (table 1.3). The lengthy civil wars in Angola and Mozambique devastated the economies, and thus growth in these economies is from a low level. In Angola growth is now driven by the expanding oil economy, but poverty is widespread (Anderson 2006; Le Billon 2005). Digging deeper, Tanzanian data indicate that rural poverty remains highly problematic (Ellis and Mdoe 2003).

3 With the exception of Zimbabwe, which currently has the highest level of economic decline in the region (outside a war zone) because of poor governance.

FIGURE 1.2. CHANGES IN HARVESTED AREAS IN MALAWI AND TANZANIA



Source: FAO Statistics.

TABLE 1.3. INDICATORS OF POVERTY FOR SELECTED YEARS FROM COUNTRIES WHERE MIOMBO WOODLAND PREDOMINATES

COUNTRY	GROSS NATIONAL INCOME PER CAPITA (CURRENT US\$)		POVERTY HEADCOUNT RATIO AT NATIONAL POVERTY LINE	GNI ANNUAL GROWTH RATE			LIFE EXPECTANCY AT BIRTH (YEARS)	INFANT MORTALITY RATE (PER '000 LIVE BIRTHS)	SECONDARY SCHOOL ENROLLMENTS, GROSS (PERCENT)	
	2001	2010		As noted	2001	2005			2010	2009
Angola	450	3960	..	3	21	2.3	47.6	98.1	16.1	15.2(2006)
Malawi	140	330	52.4(2004)	-5	3	7.1	53.8	68.8	32.1	29.5
Mozambique	230	440	54.7(2008)	13	8	7.2	48.1	95.9	6.8	23.4
Tanzania	310	530	33.4(2007)	6	7	7	56.3	68.4	6.8	27.4
Zambia	320	1070	59.3(2006)	5	5	7.6	46.3	86.3	25.6	48.7
Zimbabwe	510	460	72.0(2003)	-3	-6	9	45.4	56.3	43.4	41(2006)

Source: World Bank indicators data set (<http://ddp-ext.worldbank.org>).

Climate change is likely to intensify poverty. Much of the miombo is already characterized by strong seasonality of rain, limiting options during the dry season (Scholes and Biggs 2004). In drier areas, farmers and foresters will face further limits to agricultural and miombo productivity, potentially undermining existing livelihood options and exacerbating vulnerability, especially of the poorer sectors of rural society (Müller et al. 2011).

As in many forested areas, it is this nexus of concerns—the prevalence of poverty on the one hand, and high rates of deforestation in the miombo region on the other—that helps to shape how one looks at the problem at the household level and also helps to define policy possibilities. A few instances in the miombo region give room for optimism, notably cases of where miombo woodland products have found high-valued market niches (CIFOR 2004; Mander and le Breton 2006; Odera 2004), and instances where the policy and institutional framework has supported community action to bring about better woodland management (Blomley and Ramadhani 2006; Wily and Dewees 2001). More generally, Chhatre and Agrawal (2008) as well as Coleman (2009) note the global importance of collective action in developing locally derived forest management strategies.

Many studies of the prevalence of rural poverty give little attention to the use of environmental resources and assets within the household economy. Cavendish (2000) and Sunderlin et al. (2003, 2005) articulate a framework for considering poverty in relation to forest and woodland resource availability, and Cavendish (2000) was a pioneer for his detailed household study of miombo use. Sunderlin et al. distinguish between the use of forest resources to meet household subsistence needs (fulfilling a safety net function in times of emergency, or serving as a “gap filler” in seasonal periods of low income) and the use of forest resources to help lift households out of poverty. In the latter circumstances, forest resources can provide a source of savings, investment, wealth accumulation, and asset building, and can bring about lasting increases in income and well-being.

We have chosen to add an additional dimension to this discussion to describe how rural communities in miombo regions fall into various poverty traps, and then to describe how policies, institutions, and governments can work with those most dependent on miombo woodland resources to break out of these traps. At the macro level, poor countries are sometimes locked into poverty traps resulting from

conflict, poor governance, natural resource abundance (paradoxically), and being landlocked (Collier 2007). These traps have particular resonance in the miombo zone, both at the macro level and also when the paradigm is extended to miombo-dependent communities at the local level (box 1.1).

This report is structured around three objectives. Section 2 describes some opportunities for improving the use and management of miombo woodlands. In section 3, we outline some of the barriers that are preventing households, communities, and countries from adopting better and more sustainable woodland management practices. Section 4 explores some of the policy opportunities for removing these barriers, with the objective of strengthening miombo's contribution to reducing risk and vulnerability of poor rural households through sustainable forest management.

This report is based on seven background papers comprising household studies, national level analyses, and technical assessments. These technical annexes are available online at <http://www.profor.info/profor/content/miombo-annexes> and are referred to throughout the text of this paper. Household studies were undertaken in Mozambique and Zambia to develop a clearer picture of the role of miombo woodlands in household consumption. These studies were an outcome of intensive, seasonal structured household surveys, which have formed the core of the original work supported by this project (technical annexes 1, 2, and 3). Two national level assessments were carried out, the first in Zambia on the contribution of dry forests to economic development. This assessment was derived from a synthesis of empirical household studies, policy research, silvicultural and ecological studies, and other primary sources (technical annex 4). The second country case study reviewed community-based woodland management opportunities in Mozambique and synthesized the results of other primary studies (technical annex 5). We also reviewed what is known about miombo silviculture and how management systems could be improved or otherwise put in place to increase productivity (technical annex 6). Technical annex 7 focuses on policy options for improving management.

There are obvious geographic gaps in coverage in this paper. Angola and DRC were not covered to any significant extent. This is partly because the available body of miombo research largely excludes these miombo-rich countries. It was also not our intention to provide a comprehensive country-by-country overview of the status of miombo woodlands and the policies, institutions, and legislation that are affecting their use. This shortcoming notwithstanding, our efforts focused on teasing out some of the complexities of miombo use and management in the individual technical annexes.

BOX 1.1. POVERTY TRAPS AND THE MIOMBO REGION

Over the past 20 years, around 80 percent of the world's poorest people have become better off. This is an enormous advancement, driven by broad-based growth. But the other 20 percent—almost a billion people, 70 percent of whom are in Africa—live in countries that are economically stagnating or otherwise stuck in various poverty traps. Paul Collier (2007), in his book *The Bottom Billion*, describes four traps that inhibit growth in these countries: a legacy of conflict, the curse of natural resources, poor governance in a small country, and the problem of being landlocked in a bad neighborhood.

At the macro level, most of these traps affect several countries in the miombo region. Angola, Mozambique, and the Democratic Republic of Congo (DRC) are all emerging from a period of long conflict. All countries in the miombo region suffer from poor governance, falling in the bottom half of Transparency International's 2010 Corruption Perceptions Index. Zimbabwe has been particularly problematic in recent years, with repercussions on poverty status and miombo management. The country has seen a high level of unregulated land clearance and a large increase in the use of fuelwood in response to problems with electricity supply and prices. The DRC and Angola suffer, to some extent, from the curse of natural resources with their timber and mineral wealth, with Zimbabwe also playing a role in resource extraction in the DRC (which fueled its military presence in the DRC). Malawi, Zambia, and Zimbabwe are all landlocked (albeit in a "mixed income" neighborhood, given the presence of South Africa).

At the micro level in the miombo region, each of these poverty traps plays out in particular ways. For example, when good markets develop for miombo products (the so-called "natural resource trap"), one of several things often happens. Elites may capture the resource and either over-exploit it or keep the benefits themselves, rather than equitably sharing returns from miombo management with their communities. Wild resources may be domesticated so that supplies become easily available and outstrip demand, and markets collapse. Also, nascent local democratic institutions that have been tapped to help develop strategies for better managing miombo are often undermined when good markets for miombo products develop.

Many communities in miombo regions are "landlocked" to the extent that poor physical and transportation infrastructure make it difficult to tap into external markets for miombo products (when these exist). Even when there are good markets for miombo products (such as firewood and charcoal), the widespread participation of the poor in these markets may be only a symptom of the fact that they are locked into cycles of poverty, and provide products for these markets only because they are important safety nets, rather than genuine pathways out of poverty. The fact is, the poor don't get rich from selling firewood.

While conflict itself has had profoundly positive impacts on miombo ecology in some countries where woodlands have been heavily mined (such as in Angola and Mozambique), other forms of local conflict pose huge challenges for improving local management. Layers of customary tenure and rights of use, and access to miombo resources often compete with contemporary regulatory systems. The poor may lose to those best able to "game" the system to their own advantage. Project-level donor resources sometimes create confusion over which assets are most valuable: natural resources or donor-financed benefits. Conflict over rights to use and access miombo resources—whether these are grazing resources, tree

continued on page 18

continued from page 17

products, or other wild foods—are not uncommon, and careful mediation and conflict management is sometimes critical to prevent the complete loss of miombo resources to fire and theft.

The legacy of poor local governance has also had profound impacts on miombo. Many government forest reserves in the miombo region were established at a time when population pressures were low, and there was no real need to create management systems. Simply “reserving” these areas was enough to maintain them. But as population pressures increased, forest departments throughout the region found themselves unable to set up effective forest management systems because miombo silviculture was either poorly understood, it was biased toward the production of small supplies of high-value industrial wood, or forest institutions were simply not organized to respond to new needs for management. The management vacuum was easily filled by those best able to exploit what was perceived to be a free resource. Where regulatory systems sought to ensure that revenues were to be collected from miombo harvests, poorly paid and equipped local officials were easily able to use their positions for their own gain.

At the same time, miombo woodlands in some countries are also proving to be victims of what we call the “myth of the commons”—the assumption that decentralization and local management and “returning” control over woodlands to communities is the answer to all problems of management. While decentralization of authority and resource control probably increases the possibility of greater local access to forest rents and more local control and management, it does not guarantee this (Sunderlin et al. 2005). There is a presupposition that earlier community controls over woodland use existed and were effective, when this may not have been the case. Governments may give customary authorities control over natural resources that far exceeds their capacity for management. In other cases, it may mean transferring control over resources to a local elite, who may use woodlands principally for immediate political or economic gain.

This decidedly gloomy picture of how poverty traps play out in the miombo region also provides a clearer understanding of how policies and institutions can be better shaped to enable miombo users to break out of these traps. We return to this subject in section 4 of this paper.

2

CONTEXT: EMERGING OPPORTUNITIES FOR PEOPLE LIVING IN MIOMBO REGIONS

This section outlines some of the key linkages between miombo ecology and human impacts and uses, and then describes various opportunities arising from markets, policies, and legislation, and patterns of land use and settlement that are enhancing the prospects for miombo management.

2.1 IMPACTS OF ECOLOGY, BIOGEOGRAPHY AND HISTORY

Resource availability and opportunities for improving the management of miombo woodlands are strongly determined by biogeography, evolutionary history, and geomorphological and climatic factors, which in turn influence miombo soil-fertility and biomass production. It is important to understand and articulate these links because they have a profound impact on the suite of policy, institutional, and legal opportunities for improving miombo management. It would be short-sighted, for example, to focus on policies for increasing the production of commercial timber species from miombo, because the prevalence of these species is actually quite low. Underlying biophysical conditions have led to distinctive uses of miombo, with economic and management implications. These characteristics were perhaps first highlighted by Wilson (1990), who demonstrated the marked differences in land-use that occurred between miombo and adjacent vegetation types in terms of food plants, grazing resources, and ultimately human well-being.

Miombo woodlands are characterized by the three Caesalpinoid genera: *Brachystegia*, *Julbernardia*, and *Isoberlinia*. The species of these genera all produce hard timber, and many have fibrous, tannin-rich bark. In contrast to the low diversity of canopy tree species, a high diversity of shrubs, trees, vines, and perennial herbs in the legume subfamily Papilionaceae dominate the herbaceous layer.⁴ In addition, grass genera useful for thatch⁵ and for grazing are abundant. The third legume subfamily, the Mimosaceae, represented by fine- (rather than broad-) leaved trees (*Acacia*, *Faidherbia*) is concentrated on more fertile sites, such as alluvial soils of river systems and the Rift Valley. Patchy occurrences of dense and resource-rich woodlands, *Terminalia* patches on deep sands, and edible orchid patches along wetlands (“dambos”) are important centers of species diversity within the miombo woodland matrix. Resource-rich woodland patches, with their characteristic vegetation, result partly from human influence (e.g., dung accumulations at old homestead sites or 19th century iron-smelting sites).

4 This includes a high diversity of *Crotalaria* (300 species) and *Indigofera* species (Rodgers et al. 1996) as well as the genera *Tephrosia*, *Eriosema* and *Aeshynomene*. Wild relatives of the cowpea, an important crop, also have their center of diversity in the miombo woodland region.

5 Such as *Eragrostis*, *Loudetia*, *Hyparrhenia*, and *Hyperthelia*.

Ecology, biogeography, and history have interacted in important ways and with significant consequences for value-adding and sustainable use of miombo woodlands. A number of key features of miombo help to inform our understanding of the opportunities for better management.

Perhaps most important, miombo can be enormously productive and can remain so over time, even when highly degraded (at least from a conventional forester's perspective). Many woody species found in miombo reproduce vegetatively. So, to some extent, miombo recovers well from harvesting because of its ability to easily regenerate (Chidumayo 2004). This capacity is quite important throughout the region. Heavy demands for fuel, charcoal, and housing timber have capitalized on miombo's regenerative capacity (Kambewa et al. 2007). In some areas, these products seem to be available in some abundance—a matter of great importance to the 100 million or so people who live in the region. In other areas, though, for example in large parts of Malawi, miombo is no longer abundant, because extensive areas have been converted to agricultural land. This is a critical point, to which we will return in section 3.

Another key characteristic of miombo is that it supports a relatively low proportion of high-quality commercial timber species.⁶ The national forest inventory of Mozambique—a miombo-rich country—indicated that only 7 percent of the total standing wood volume is commercially valuable as timber (Marzoli 2007). This has obvious implications for establishing miombo management practices and suggests that returns to managing miombo for commercial timber production are likely to be quite low (though one-off illegal logging operations can be lucrative—see section 2.5).

The predominance of the unpalatable and toxic Papilionaceae has led to the discovery of many different uses, of enormous utilitarian value to local people and for which there are few substitutes. For example, miombo is a rich source of potent fish poisons (tubers of *Dolichos kilimandscharicus* and all *Neorautanenia* species). Some species are widely harvested and used as dyes for fabrics, textiles, and baskets (*Indigofera arrecta*, *I. tinctoria*). Miombo is also an important source of traditional medicines.

Another characteristic of miombo is that some of the dominant miombo genera, *Brachystegia*, has a particularly fibrous bark. The bark of *Brachystegia boehmii* is especially favored for weaving, fishnet, and rope making, and bark fiber is commonly used in construction. Bark is easily peeled from a number of species (*Brachystegia spiciformis* and others) and is used for fabricating beehives. During the civil war in Mozambique, populations in very remote areas used *Brachystegia* bark to weave clothes.

In contrast to the high availability of wood and bark products, there is a relatively low diversity and availability of species that produce edible fruit in miombo woodland. Most Caesalpinoid trees in the miombo produce small, hard, explosively dispersed seeds, none of which are edible.⁷ A higher diversity of gathered plant foods comes from domesticated miombo fruit species⁸ and from plants

6 Most of these are in the Leguminosae. Genera include: *Azelia*, *Baikiaea*, *Dalbergia*, *Guibourtia*, *Milletia*, *Pterocarpus*, and *Pericopsis*. There is also *Faurea saligna* in Proteaceae.

7 Exceptions are the arils of *Guibourtia coleosperma* and seeds of the understory shrub *Bauhinia petersiana*, both of which provide important food sources to !Khwe San people in the Angolan and Central miombo woodlands.

8 *Sclerocarya*, *Strychnos*, *Adansonia*, *Berchemia*.

growing on scarce, clay-rich soils (termitaria and riverine areas).⁹ However, two major fruit producing species occur naturally in large stands in miombo, namely *Uapaca kirkiana* and *Schinziophyton rautanenii*, both of which have significant economic importance. Additional plant foods comprise tubers and bulbs from woodland (Cucurbitaceae, Asclepiadeceae). The roots of *Boscia salicifolia*, found growing on termite mounds within miombo woodlands, are widely eaten during hunger periods in Central Mozambique (FAO 2005). Edible leafy vegetables are found growing as “weeds” on land cleared for farming (particularly Amaranthaceae, Capparaceae, and Tiliaceae). These are more abundant on densely settled sites with eutrophic soils.

Another characteristic of miombo ecology, with significant implications for human well-being, is that the Caesalpinoid tree species, as well as *Uapaca kirkiana*, support common and extensive fungal associations with their roots¹⁰ (Frost 1996; Lowore and Boa 2001). This evolutionary association has resulted in a remarkable diversity of associated macrofungi, many of which are edible. In Malawi, for example, 362 species of macrofungi are recorded, 14 percent of which are edible (Morris 1994). (In contrast, temperate forests typically have perhaps a quarter of this diversity.) Significant differences between vegetation types within the miombo region, and their impact on the growth of mushrooms, are also important.¹¹

Particularly because of its pattern of seasonal flowering and the heavy prevalence of blossoms among the dominant miombo species—*Brachystegia*, *Julbernardia* and *Isoberlinia*—beekeeping is an extremely common form of miombo land-use. Beekeeping has highly significant cultural, social, and economic dimensions throughout the region.

Miombo woodlands also play a critical role in livestock management throughout the region. During wetter times of the year, open grassy patches within the miombo are sometimes heavily used for grazing, but miombo itself becomes quite important as these grass patches are burnt over or are fully grazed late in the season. Miombo is seasonal and loses much of its leaf cover during the winter, dry season. In the early spring, the so-called late dry season flush sees the miombo coming back to life, with vast swathes of the woodland covered in bright red, orange, and yellow foliage. It is during this time of year, when seasonal grazing resources are otherwise highly constrained, that miombo comes into its own as a critical source of fodder for livestock.

The relationship between livestock production, grass regeneration, crop production and the tendency for people to light fires in miombo woodlands is highly synergistic. There is a widely held perception among rural cattle owners in miombo regions, confirmed by range science, that the burning of grasslands encourages the regeneration of favored grass species. Burning also plays a critical role in rotational *chitemene* systems of crop production, sterilizing the soil and releasing nutrients for farming (though this rotational system is not dependent on the extensive rangeland burns necessary for good grass regeneration). The effects of burning on structure and morphology of miombo woodlands depend on both intensity and timing. Some miombo species—evergreens

9 *Berchemia*, *Carissa*, *Ficus*, *Garcinia*, *Diospyros*, *Pappea*, *Syzygium*, *Parinari*.

10 Ectomycorrhizae.

11 For example, macrofungi genera, a major source of edible species in miombo and *Uapaca* woodlands, are conspicuously lacking in *Baikiaea* dry forest (Pierce and Chitempa 1984).

such as *Parinari excelsa*, *Entandophragma delevoiyi*, and *Syzygium guineense*—are fire intolerant. Others are semi or completely tolerant. Bush fires tend to be most severe in the late dry season, and when miombo has been exposed to these types of fires, the species composition can change dramatically. Miombo exposed to repeated, intense late dry season fires is eventually fully converted to grassland, with a few fire tolerant tree species. Early burning, though, is far less damaging to miombo, and can yield good grass regeneration on the one hand, while limiting damage to newly sprouted trees on the other.

There are strong associated links with agricultural production as well. Cattle are usually kept in enclosures at night, and the manure that accumulates in these enclosures is composted and spread on fields. These inputs are sometimes supplemented with leaf litter, which is collected in great quantities from miombo woodlands and used instead of expensive, chemical fertilizers. Studies have shown that, depending on the availability of leaf litter, this can be a highly valuable soil supplement that yields good returns (Bradley and Dewees 1993).

Finally, the limited tree species diversity in miombo has encouraged a relatively high rate of insect herbivory (consistent with what theory says about insect problems in monocultures). Sometimes, as with many plant pests, this is a real problem. The scale insect *Aspidoproctus glaber*, for example, causes miombo die-back. Other insects are less problematic for woodland growth and have become a culturally important food resource. The best known are *masonja*, in the Saturniidae family of giant silk moths, whose caterpillars are an important source of protein and cash to local people. They rely heavily on dry woodlands at lower altitudes, which are dominated by *Colophospermum mopane*.

Miombo use, then, has evolved across the region in a way that reflects its own growth dynamics and the peculiarities of the various species associations found in dry woodland habitats. These in turn, are an outcome of miombo woodland ecology and biogeography. The economic, social, and cultural value of miombo, is derived from the close links that people have developed over many generations in learning to exploit miombo assets in an otherwise constrained rural environment. We turn now to the question of how these various values play out in the rural economy.

2.2 WOODLANDS ARE A VALUABLE RESOURCE

Over the last 10 years, information on the role of miombo woodlands in rural economies has been increasingly well documented. Cavendish (2000), for example, undertook a pioneering, very detailed, and innovative case study about woodland income in Zimbabwe, and this has been followed by several others (Campbell et al. 2002; Fisher 2004; see also technical annexes 1 and 2 for results from case studies in Mozambique and Zambia).¹² CIFOR's Poverty Environment Network (www.cifor.org/pen), established in 2004, contributed significantly to this body of knowledge by developing a database of comparative, detailed socioeconomic data collected quarterly at the household and village level in a range of forest zones globally, including the Miombo ecoregion.

12 As a measure of overall household welfare, Cavendish (2000) and the subsequent studies used total income, namely the sum of cash income, net gifts/transfers, subsistence production (priced at the market), and environmental income (also priced at the market). Environmental income is defined as the contribution that natural resources, including woodlands, are making to rural household welfare. While consumption is often preferred to income as a welfare measure in household studies (Deaton 1980), in these studies, the distinction between total income and consumption is not large. Because of this, environmental consumption derived from natural resources, is equated with environmental income.

These studies all record high levels of forest dependence in miombo woodland, though the variability within countries can be large. This can be seen in the data presented by Jumbe et al. (technical annex 4), where forest income from the different sites ranges from less than 10 percent to nearly 50 percent. In the Zimbabwe studies, woodlands contributed about 15 percent of total income (Campbell et al. 2002; Cavendish 2002), but this figure was greater than 50 percent in some Zambian sites (Mutamba, technical annex 1).¹³ The Zambian dependency levels are some of the highest so far recorded globally (see Vedeld et al. 2004 for a global overview). The miombo studies also show that it is the poorest of the poor that depend more on woodlands. Campbell et al. (2002) found that in southern Zimbabwe nearly 30 percent of income is woodland-based in the lowest wealth quartile, but is less than 10 percent in the top wealth quartile. Fisher (2004) and Jumbe et al. (technical annex 4) arrived at similar conclusions. For three villages in Malawi, the addition of woodland income to the household accounts leads to a 12 percent reduction in measured income inequality (Fisher 2004). Cavendish and Campbell (technical annex 3) also recorded the inequality-reducing impact of environmental income.

Using seasonal household data for rural Malawi, Fisher and Shively (2005) found that households that experienced an income boost (say, from remittances or from a good harvest) depended less on forest product extraction, compared with those not receiving such a boost. Shackleton (2006), Kayambazinthu et al. (2005), FAO (2005), and Barany et al. (2004) point to the importance of dry forest resources to households afflicted by HIV/AIDS, whereas Tairo (2007) and Ngaga et al. (2006) point to miombo woodland as the provider of “famine foods.” These studies strongly indicate that woodlands have a role to play as natural insurance (e.g., see McSweeney 2002; Pattanayak and Sills 2001; and Takasaki et al. 2004, for insurance values of forests). Hegde and Bull (technical annex 2) document the role that miombo resources play when shocks such as wildfires and illness hit household assets. They show that households with illness shocks increased their consumption of environmental resources by 42 percent. This also demonstrates the likely role that miombo plays in the face of HIV/AIDS.

If we turn to individual products, the importance of forests and dry woodlands is clear. Arnold et al. (2006) point to the continuing importance of woodfuel in Africa, citing the prediction of the International Energy Agency (2002) that biomass energy will still account for an estimated 75 percent of total residential energy in Africa in 2030, and that the absolute number of people using woodfuel and other biomass fuel will rise by more than 40 percent during 2000-30 to about 700 million.

Other products are also of significant value. In Tanzania, for instance, apiculture provides some portion of an income to about two million people (Mwakatobe and Mlingwa 2005). A number of studies (Mander 1998; Mander and le Breton 2006) have emphasized the economic value of medicinal plants. In 2010, the informal trade in medicinal plants in southern Africa in 2010 was valued at US\$75–150 million annually (Shackleton and Gumbo 2010). Large volumes of miombo wood are used in home construction and for livestock enclosures (Grundy et al. 1993). Despite the relatively low availability of commercial timber species in Mozambique’s miombo, recorded timber exports reached a value of around US\$54 million in 2010 (www.faostat.fao.org).¹⁴ Numerous examples of

13 The figures for Cavendish (2000) were recalculated to exclude non-woodland environmental income (e.g., clay, gold).

14 Illegal extraction is not captured in these figures—see section 2.5.

trade in forest products are found in the literature, demonstrating the significant contribution made by miombo woodland products to national and regional economies.

The significant value of miombo woodland products to rural households, both for income and for providing a safety net during times of economic stress, coupled with the high aggregate value of production from miombo for national economies, suggests that the normal and fairly limited set of “forest” policy options that governments usually put in place to deal with what are perceived to be forestry issues are not broad enough for dealing with this much wider scope of product values.

Product values to rural households in miombo regions, though, cannot be imputed simply by considering whether woodlands are physically present or absent. Access and use of woodland products is highly attenuated by sometimes-complex systems of customary tenure, with institutional and tenurial overlays deriving from the body of land and forest law.

2.3 RESOURCE RIGHTS ARE SHIFTING TO LOCAL PEOPLE

In the past few decades, the need for communities to assume more active roles in resource management has come to the fore, and there is a global trend toward devolving responsibility for natural resource management to local stakeholders (White and Martin 2002). A wide range of studies on devolution processes in miombo countries are now emerging, with both positive and negative outcomes (e.g., Balint and Mashinya 2006; Kayambazinthu et al. 2003; Mutimukuru et al. 2006; Nemarundwe 2004; Ribot 2010; Songorwa 1999; Virtanen 2003). Wily (2000, 2003) observes that policy or legal commitments to decentralization in the land and forestry sectors are widespread in southern Africa (see also Anderson et al. 2006). While the intent to decentralize is widespread, experience has not necessarily been positive. Table 2.1 summarizes what is happening with decentralization and devolution in some of the miombo countries, and hints at the high level of diversity among the countries in terms of the processes and outcomes.

Shackleton et al. (2002), drawing on case studies from the miombo region and elsewhere, note that devolution has brought a number of advantages. Devolution gives recognition to local people as legitimate resource users rather than as poachers, criminals, and squatters. It provides new channels for rural dwellers to communicate their priorities to government decision makers, and, in some places, for improving community-government relations. It can enhance villagers’ organizational capacity and political capital by encouraging local people to join new networks and to forge new relationships. In areas where devolution has been in place longer, local people tend to demand greater autonomy, thus bringing about reforms that promote local interests. Devolution can also help address equity issues and make inroads to enhance participation of marginalized groups and women in decision making. Working in Tanzania, Lund (2007) found that, by decentralizing taxation to the lowest local government tier, revenue collection from the use of relatively low value natural resources could be enhanced, which could increase the likelihood that a share of the collected revenue was used to finance public services.

Many observers agree that Tanzania has an especially progressive community forestry regime (Blomley 2006). Participatory forest management has become a central strategy of the country’s forest policy, laws, and programs. The introduction of participatory forest management was originally

project-driven, and interest was catalyzed by small pilot operations that partnered local governments and nongovernmental organizations and focused on particular forest resources. Government then decided to mainstream the approach through national and local government institutions, supported by direct block grants to local governments, and in the late 1990s, formalized this in policy and in law. By the end of 2000, 500 villages in Tanzania had declared new village forest reserves, and 318,000 ha of forests were devoted to community-based forestry.

TABLE 2.1. TRENDS IN DECENTRALIZATION AND DEVOLUTION IN SOME OF THE MIOMBO COUNTRIES

TREND	MALAWI	MOZAMBIQUE	TANZANIA	ZAMBIA	ZIMBABWE
Decentralization policy	Decentralization policy in place since 1998.	Decentralization implemented (Nielsen et al. 2006; Salomao and Matose, Annex 5)	Decentralization implemented and considerable progress in most sectors.	Decentralization launched in 2004 but no enabling laws.	Decentralization in place.
Forestry and decentralization	Decentralization not adequately addressed in the forest policy.	Forestry policy (1998) and act (2002) call for delegation of responsibility to the lowest level. Land and wildlife/forestry laws contradictory with respect to tenure.	Forestry policy (1998) and forest act (2002) indicate clear commitment to decentralization. Forest and land policy closely aligned.	Forestry policy (1998) and forest act (1999) allow for community involvement only in local forests (not national). Policy disabling (Gibbon et al. 2005).	Policies for local control in place for wildlife but not forestry.
Commitment to implementation	Few practical results (Blaikie 2006). Devolution in forestry less successful than other sectors. Forestry slow to approve local forest management plans.	Commitment at policy level, but many implementation problems. Devolution fragmented and limited by sector-related barriers and lack of procedural guidelines. More successes for wildlife than forestry.	Implementation extremely impressive with large numbers of villages and large forest areas already covered (Blomley and Ramadhani 2006).	Implementation mechanisms vague.	Decentralization to district councils only. Committees often collapse when projects end. More successes for wildlife than forestry.
Benefit sharing	Government retains powers to define the type and location of resources that communities may manage.	Very restricted benefits from concessions, and often benefits do not reach communities.	Village Forest Reserves are fully devolved; communities receiving full revenue rights (Wily and Dewees 2001).	Limited benefits to local communities. Elite capture by traditional leaders.	Benefits end with the district council. Elite capture by traditional leaders.
Main streaming	Projects the norm.	Projects the norm.	Forestry devolution mainstreamed.	Projects the norm.	Projects the norm, though wildlife was mainstreamed.

Source: Based on information compiled by Fiona Paumgarten.

management. Around 70,000 ha were under joint management (Masayanyika and Mgoo 2001; Wily and Dewees 2001). More recent estimates show the trend has continued rapidly, with community and jointly managed areas now covering more than 3 million ha and involving over 2,500 villages (Blomley and Ramadhani 2006). Most efforts have taken place in nongazetted, nonreserved forests,

that is, outside of central or local government forest reserves. There is good evidence that the management and protection of woodlands has improved considerably, but there is also scope for more rigorous evaluation of the impact of community forestry programs, and particularly of some of the local political dynamics behind the devolution process (Brockington 2007).

Despite these successes with decentralization, woodlands in some countries are also proving in some respects to be victims of the “myth of the commons.” In the face of shrinking publicly-funded budgets for sectors that do not yield immediate financial benefits to the public sector, governments seek to “return” control over woodland resources to communities. In many instances, there is a presupposition that earlier community controls over woodland use existed and were effective, when this may not have been the case. Governments may give customary authorities control over natural resources that far exceeds their capacity for management. In other cases, it may mean transferring control over resources to a local elite, which may use woodlands principally for immediate political or economic gain. Finally, policies favoring devolution may be poorly aligned with the legal and institutional mechanisms for delivering this particular outcome. Experience has shown that devolution of control over forest resources, while having much to offer, is not a panacea.

2.4 NEW INTEGRATED CONSERVATION-DEVELOPMENT APPROACHES ARE EMERGING

The miombo region is in some respects at the center of a range of innovative attempts at integrating conservation and development. The conservancy model in Namibia (just on the edge of the miombo region), where community institutions have become deeply engaged in habitat conservation, is a prime example of where win-win outcomes for local people and nature have been fostered (Anderson et al. 2006; Bandyopadhyay et al. 2004). Interest in poverty-conservation relationships has taken on global significance (Naughton-Treves et al. 2005), so there is much critical thought on what works and what does not. There is also an expanding range of studies emerging from miombo countries (Frost and Bond in press; Gulinck et al. 2001; Songorwa 1999; Virtanen 2003; Wolmer et al. 2004).

Interest is also growing in the idea of organizing schemes through which individuals and communities receive “payments for environment services” (PES) (Wunder 2007). As tropical deforestation progresses, forest environmental services—formerly provided for free as a “subsidy from nature”—also become scarcer. More generally, PES schemes focus on outcomes resulting from payments for four types of services: carbon sequestration, watershed protection, biodiversity maintenance, and aesthetic qualities of the landscape related to tourism. The underlying principle of such PES schemes is that forests provide valuable positive externalities to off-site beneficiaries, but that these may not be taken into account by on-site landowners or users unless the beneficiaries pay for them. If potential gains from forest conservation or restoration are large enough, the winners should be able to afford to compensate those on the land who might be losing something, because they are being asked to adopt a nonpreferred land-use practice. Likewise, those wishing to use land in a way that diminishes environmental services elsewhere should be prepared to compensate those who depend on those services.

Beyond achieving one of the four types of outcomes noted above, PES schemes can potentially provide important additional and regular income flows, or other material benefits, for cash-poor

forest-dwelling communities. PES schemes thus do have the potential to create win-win situations for people and the environment.

PES schemes, though, are seldom straightforward and pose their own special challenges, especially when it comes to focusing on poverty reduction (Pagiola et al. 2005; Wunder, forthcoming). The poorest of the poor may not be able to get involved in PES because they may lack control over the land and therefore may not be in a position to enter into a contract for environmental service delivery. Poor households may lack the necessary capital, skills, or labor, as well as access to credit or technical assistance, to implement the changes required by the PES scheme. Transaction costs of PES schemes with numerous smallholders may be high relative to PES schemes that deal with a few large landowners. Thus PES schemes, because of the nature of how rights of resource use and ownership are distributed in the first place, may not necessarily be pro-poor. Wunder (forthcoming) argues that PES schemes should be based primarily on deals that make sense in terms of the main goal—environmental service delivery—rather than on subsidiary goals such as poverty reduction. This is primarily because carbon markets (for example) operate in restrictive ways and with single objectives, and are less conducive to supporting multi-objective development operations. Given the overlapping nature of rights, resources, and their allocation among multiple user and income groups, and interests in environmental outcomes, single-PES types of objectives can be especially difficult to focus on. Bond et al (2010) explored the scope for developing pro-poor REDD+ schemes in miombo regions.

A key question emerging in this study is whether there are buyers for environmental services in the miombo region in the first place. A regional review identified several nascent schemes (e.g., for tourism and carbon sequestration), but these appear to be the current exceptions. Tourism, centered around wildlife, offers some good opportunities for communities that live close to wildlife-rich areas, though poor governance can have disastrous impacts on the tourism industry (as evidenced by Zimbabwe and the demise of many community-based wildlife schemes). With the current focus on climate change, carbon markets may emerge as an important driver in future plans (Chomitz 2007). Miombo woodlands have lower wood carbon storage levels per hectare than tropical forests, but because they cover such extensive areas, their aggregate contribution is large. Provided that effective delivery mechanisms can be devised, the woodlands might be included in so-called avoided deforestation schemes.

Good PES schemes have five basic features. They are *voluntary*. They involve a *conditional* transaction between at least one *buyer* (such as tourism operators) and one *seller* (for example, communities or local governments) for a *well-defined environmental service* (such as the conservation of wildlife areas important for hunting and aesthetic landscape values). These features were a key characteristic of the CAMPFIRE (Communal Areas Management Programme for Indigenous Resources) in Zimbabwe. Under this program, communities and local governments have marketed hunting and wildlife-viewing rights to safari operators. In turn, communities have set aside large areas of communal land, under their jurisdiction, for wildlife conservation. From 1989 to 2001, CAMPFIRE generated more than US\$20 million for participating communities, 89 percent of which came from sport hunting (Frost and Bond, forthcoming).

It is worth noting, however, that external donors provided substantial additional finance that exceeded the revenues gained from sport hunting for local conservation activities associated with CAMPFIRE. Donors saw CAMPFIRE as an entry point for broader rural development investments and governance initiatives, and they used the institutional structures, financial management systems, and service

delivery mechanisms set up by CAMPFIRE to channel donor resources. Delivery mechanisms for integrated conservation and rural development activities were superimposed on CAMPFIRE's PES-like structures. As financial benefits often ended up with district councils rather than with participating communities, the incentives to participate were weakened.

In Mozambique, a similar effort has been launched in Sofala Province that seeks to link PES with local community conservation and rural development efforts (Hegde and Bull, technical annex 2). Participating communities receive conditional payments for carbon sequestration if they adopt various tree-planting measures and agree to limit woodland clearance activities. In the medium run this is likely to raise incomes and diversify livelihoods, but in the short run households have been reluctant to adopt these measures owing to liquidity shortages and risk aversion. The bulk of payments to farmers are front-loaded—disbursed in the first years after planting. Therefore carbon buyers (represented by the company Envirotrade, which is handling the deal) have relatively little leverage on carbon outcomes because they are unable to determine what the farmers do with the trees at a later stage. To improve the incentives for participation in the PES scheme, the project also provides support for various activities that add local value to woodland management through, for example, carpentry.

The miombo region has yet to see the development of a “pure,” fully commercially-oriented PES initiative. Particular preconditions, weak local governance structures, and poor prospects for developing environmental service markets suggest that mixed PES/rural development initiatives stand the best chance of success in terms of both conservation and poverty-alleviation impacts. While PES activities can be implemented in a community context, sustainability will be limited if the preconditions and governance structures are not enabling. More pure PES arrangements should be tested, as these may be more attractive to commercial partners in future carbon markets. More conventional markets offer perhaps a greater opportunity to people living in miombo regions.

2.5 MARKETS ARE DEVELOPING AND EXPANDING

Indeed, in addition to emerging markets for environmental services, there are new niche markets for forest products, rapidly expanding urban markets, new buyers of old products, and new communication technologies that can help to improve market access for the poor. These emerging market trends offer promising opportunities. However, growing markets are not necessarily going to enhance sustainable extraction—indeed, market opportunities may result in the demise of resources (see section 3.1.2).

New niche markets

Globalization is creating niche markets for miombo woodland products. Consumer demand for “green” and “fair trade” products can improve the competitiveness of small-scale producers (Shackleton 2007). Export markets for wild natural product derivatives such as fruit oils (e.g., marula oil and melon seed oil), which are also often tied to fair trade initiatives, are increasingly demonstrated high potential. PhytoTrade, a natural products trade organization based in southern Africa (box 2.1), has estimated that the potential regional market for eight oil-producing wild fruit species is on the order of around US\$3 billion, provided, of course, that reliable markets can be established. The opportunities presented by potential markets for these and other products, such as organic teas and food additives, are believed to be nowhere near fully exploited (Mander and Le Breton 2006). An increasingly aware market for green, clean products is emerging for art products (such as carvings

BOX 2.1. TAPPING NEW MARKETS: PHYTOTRADE AFRICA'S APPROACH TO NATURAL PRODUCT COMMERCIALIZATION

PhytoTrade Africa (www.phytotradeafrica.com) is a trade association, set up in 2001, to develop markets for sustainably produced natural products. PhytoTrade works with more than 50 members in southern Africa (Botswana, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, and Zimbabwe), which in turn work with tens of thousands of rural producers of natural products.

One of PhytoTrade Africa's objectives is to develop supply chains for natural cosmetic and food ingredients that are wild harvested from indigenous plant species and meet clear objectives with respect to environmental sustainability. The association is currently researching the development of markets for products from more than 300 plant species. Focal species include manketti/mongongo (*Schinziophyton rautanenii*), baobab (*Adansonia digitata*), sausage tree (*Kigelia africana*), Kalahari melon (*Citrullus lanatus*), marula (*Sclerocarya birrea*), mobola plum (*Parinari spp*), and sour plum (*Ximenia spp*). Categories of products produced include herbal teas, essential oils, gums and resins, lipid oils, and fruit pulps.

PhytoTrade provides training and capacity building to its members in order to provide assurance to buyers that the supply chain is reliable and that producers adhere to strict quality control measures. PhytoTrade's members are currently supplying products for the nutraceutical, phytomedicinal, botanical, flavor and fragrance, herbal remedy, dietary supplement, functional food, cosmeceutical, and personal care industries. The association develops commercial opportunities on behalf of its members based on partnerships with companies in key natural products markets. This involves developing long-term partnerships with international companies, as well as ensuring that strong legal and technical agreements, which provide for equitable benefit sharing, are in place. Commercial partnerships are based on an approach to both market and product development that reflects financial and technical commitment by both parties. PhytoTrade Africa works in four key areas: institutional development, product development, market development, and supply chain development.

from miombo hardwoods), honey, and edible mushrooms. Certification of commercial timber production in the miombo region has been somewhat problematic,¹⁵ though organic certification for miombo products has some promise. In Zambia, for example, wild mushrooms harvested and exported by Mpongwe Coffee and Organic Stallholder Cooperative are certified as organic (de Boer 2003), as is honey and beeswax exported to the United Kingdom and Germany by North Western Bee Products. Market development is not always easy, nor do woodland products always yield the expected financial benefits (see box 2.2).

15 There was an FSC certificate for the management of Zambezi teak in Zimbabwe, covering 41,574 ha, but this has now expired. There are two FSC certificates in Mozambique for the management of unspecified natural forest covering around 71,000 ha, but these are the only certified forest management schemes in the miombo region. Roundwood exports in Mozambique are dominated by the Chinese market, which prefers unprocessed logs and does not currently seem to consider working with certification systems. Illegal logging is a significant problem in Mozambique (Mackenzie 2006).

BOX 2.2. NEW PRODUCTS AND NEW MARKETS: THE CASE OF MARULA

Fruit from the Marula tree (*Sclerocarya birrea*), which is widely distributed in the miombo region, has formed the basis for a new global industry for the alcoholic cream liqueur Amarula. Marula ripens between January and mid-March, and, when allowed to ferment, can create a potent traditional beer. Its high sugar content and mild flavor made it a good candidate for further commercialization and market development. Starting in 1989, the South African company Distell began commercial production of Amarula cream in South Africa. Fruit is harvested from the wild by communities, sorted, purchased by the company, and then pulped. About 2,200 tons of fruit are purchased annually for pulping. The pulp is fermented, then distilled and blended into the final product, which is now sold globally in around 150 countries. Amarula is currently the second-best selling cream liqueur globally (after Bailey's Irish Crème).

Despite the quite rapid rise in Amarula's popularity and the vast expansion of its markets, the relative value of the market for fruit is quite small. In 2002, the total value of the commercial marula trade was estimated to be around R 1.1 million a year in South Africa (around US\$125,000 at the time). This is relatively small in comparison with other traded natural plant products. For example, the trade in medicinal plants in the Mpumalanga region of South Africa alone is valued at between R 62 million to R 92 million per annum (currently between US\$8.7 and US\$13 million).

Even so, the trade and processing of marula fruits and by-products (i.e., nuts and oil) produce significant financial benefits to a relatively small number of households through the generation of cash incomes in an area of South Africa where poverty and unemployment levels are high. A number of constraints limit further market development.

- There are significant inefficiencies in the marula trade, with the greatest losses incurred as a result of poor coordination of transport with the fruit buying companies.
- Volumes traded are relatively small given the numbers of people involved in the trade. This limits the significance of cash benefits.
- At an industry level, the supply of marula fruit exceeds demand with the result that the suppliers of fruit and kernels are price takers and have no ability to increase prices.
- There are few barriers to selling marula fruit and kernels to the processing firms; access to global markets is a greater constraint.
- There is no significant current consumer demand for other domestically traded marula products, such as jams and juices. The market has to be developed despite widespread knowledge about the fruit and its qualities.

Source: Institute of Natural Resources (2002).

Expanding domestic markets

Growing urban populations have greatly increased the demand for charcoal, medicinal plants, wild meat, and construction wood, among other products (Lowore 2006; Shackleton et al. 2008).

Urbanization rates are high for most miombo countries. In 2009, for example, rates were: Angola 4.2 percent per annum; DRC 4.5 percent; Malawi 5.4 percent; Mozambique 4.4 percent; and Tanzania 4.6 percent. The rates are low only for Zambia (2.9 percent) and Zimbabwe (1.4 percent), in the latter because of the current economic meltdown in the country, and in the former because Zambia is already one of the most urbanized countries in the region. Urban woodfuel demands are vast (see the case study in Zambia—Mutamba, technical annex 1). Arnold et al. (2006) concluded that persistently low incomes in Africa are reflected in continued strong growth in urban consumption of woodfuels, and refer to surveys demonstrating positive income elasticity for woodfuel at low income levels. The Stockholm Environment Institute (SEI) (2002) estimated that the consumption of charcoal increased by around 80 percent between 1990 and 2000 in both Lusaka and Dar es Salaam. The proportion of households in Dar that reported charcoal as their principal fuel increased from about 50 to 70 percent over the same period. The estimated annual value of the charcoal industry in the four largest urban areas of Malawi is about US\$41.3 million (Kambewa et al. 2007), slightly less than the value of Malawi's tea industry, and is equivalent to about 0.5 percent of the country's recorded GDP. Around 76 percent of households in the towns of Maputo and Matola in Mozambique (with a combined population of about 1,400,000 people in 2001) were reported to rely partially or exclusively on woodfuels for cooking (Pereira 2002). Per capita woodfuel consumption ranged from 0.92 to 1.00 m³ (Brouwer and Falcao 2004) and can be even higher when supplies are physically abundant.

The rapid growth in urban demand for charcoal has enabled large numbers of people to engage in its trade (Arnold et al. 2006). The charcoal industry for the largest urban areas in Malawi provides significant employment. It is estimated that 92,800 people owe at least some portion of their livelihoods to the charcoal trade: 46,500 producers, 12,500 bicycle transporters, 300 other transporters, and 33,500 traders (Kambewa et al. 2007). Households in the Licuati forest region, in Southern Maputo, have been earning more than 65 percent of their income from charcoal making (Pereira 2002). Woodfuel markets, however, are not any clear pathway out of poverty. The number of players in the trade and the way markets are organized mean that these markets are likely to remain the domain of the poorest. The likeliest winners in the trade are those who are best positioned to vertically integrate and to capture margins at each level of the value chain.

Charcoal markets clearly offer an important opportunity for both generating employment and for bringing woodlands under longer term management. The sustainability of these systems, however, requires careful policy support as well as an effective institutional and legal framework. In Tanzania, for example, it has been posited that a range of policy measures could stimulate both job creation and forest conservation in the energy sector (World Bank 2009).

There has also been a massive expansion of medicinal plant trade (Botha et al. 2004; Williams et al. 2000). Krog et al. (2005) found 198 medicinal plant traders in three markets in Maputo, up from 10 in 1980. Traders were selling medicines derived from more than 100 plant species and some animals, all of them obtained from native forests and fallow land. *Hypoxis hemerocallidea* (the African potato), one of the more important species sold in these markets, is used in treatment of several ailments including those related to HIV/AIDS.

New buyers of old products

The economic growth of China has already had significant repercussions for forest product markets in miombo countries. This trade is likely to rise dramatically in the future. It is likelier still that

other Asian countries will also enter these markets as their economies grow. China has formed strong links throughout the miombo woodland region. In a repeat of the 1960s, when Tanzanian hardwoods were exported in huge quantities to China after construction of the TanZam railway, hardwoods are a major focus today. The fast-growing market for Mozambique log exports to China has fueled a debate on the sustainability of the forest operations and highlighted extensive illegal operations involving Chinese firms connected with Mozambican politicians (Mackenzie 2006). There is also an upsurge of illegal logging in southern Tanzania, with hardwoods also being exported to China (Milledge et al. 2007).

Even within Africa, new trade links are being developed. South Africa is proving to be a particular engine of growth, importing timber from other countries in the miombo region, as well as finished products for domestic sale and export. One notable example is the woodcraft market, where markets in South Africa are now selling large quantities of tree-based products from other countries (Shackleton 2005a). This kind of regional trade integration is partly an outcome of improved communication technologies.

New technologies and institutions are opening up market possibilities

Considerable advances in communication technology, in particular mobile phones and the Internet, are creating new opportunities for improving the flow of information and strengthening links between small-scale entrepreneurs and the markets (Duncombe and Heeks 2002; *The Economist* 2005; Souter et al. 2005). The mobile telecommunications sector has grown in Africa by an average of 78 percent per annum over the last 10 years, which has had far-reaching economic and societal impacts. The positive benefits of this technology for small-scale entrepreneurs have been well demonstrated. A study from Ghana, for example, concluded that access to cellular phones had decreased informal traders' transaction and transport costs, creating higher profit margins, increasing their efficiency, and enhancing trust within trade networks (Overa 2006). An International Fund for Agricultural Development (IFAD) project in Tanzania has shown the effect of mobile telecommunications on the bargaining power of smallholder farmers. In the past they had been hood-winked by truck drivers about the market price of their products, but with the arrival of mobile phones they can now independently verify this information. Additionally, small farmers have been able to link up directly with buyers in Dar es Salaam and secure more favorable prices (IFAD 2006).

But what does this mean for forest product trade in the miombo region? Anecdotal evidence suggests that poor producers are using mobile phones to expand market opportunities. One such example comes from Zambia, where rural honey producers have been able to quickly access market information from urban areas and thereby plan more efficient production.

Technologies are not the only thing behind expanding market opportunities. New marketing institutions, such as clusters of common interest groups or small producers, and community managed federations have also been helpful. Among other things, the federations link with major buyers to provide increased scale of production and to act as a channel for applied research and value addition training. These institutions offer great potential for strengthening the market position of communities (see section 4.4.4).

2.6 SUMMARY

We have attempted to show that miombo woodlands products are enormously valuable to rural households and that local woodland management has strong links with livestock management and with crop production. Miombo produces “products of first resort” of great importance to rural households. Woodlands are a pharmacy, a supermarket, a building supply store, and a grazing resource, providing consumption goods that are not otherwise easily available, particularly in subsistence economies. Increasingly, rights to use and manage woodland resources are being shifted to the local level. Management initiatives are being introduced through integrated rural development initiatives, and new and niche markets are developing for miombo products as well as for environmental services. All of these pose important opportunities for improving miombo management.

The many opportunities for expanding the use and management of miombo to meet specific market demands and reduce rural poverty pose a compelling question: Why is miombo so poorly managed? What is causing its degradation, and why have institutions and organizations not been able to effectively respond to the pressures being placed on it?

The barriers that are preventing miombo from being better managed can be characterized in four ways:

- First, *biophysical barriers*, which can simply reflect the limits posed by ecology for improving productivity;
- Second, there are clear *policy barriers* which can be tackled by governments, but which are preventing better management of miombo;
- Third, *economic barriers* can limit the incentives for improving management; and
- Last, the capacity for managing miombo is sometimes hobbled by both *organizational and institutional barriers*.

3.1 BIOPHYSICAL BARRIERS TO SUSTAINABLE MANAGEMENT OF MIOMBO

The inherently low productivity of miombo and the problem of managing it for the production of multiple products pose some of the most important biophysical barriers to its sustainable management.

Low inherent productivity

Limited research has been done on miombo productivity, but the available data suggest that productivity is low. This is because miombo woodlands are located on some of the poorest soils in some of the driest regions Africa.

Frost (1996) has compiled available yield data. Dry miombo coppice plots in Zambia had yields of about 2 m³ per ha per year. In some of the best remaining miombo in Africa, Marzoli (2007) estimated yields (in Mozambique) ranged from 2.0 to 4.8 m³ per ha per year for all species. Lower yields were found in open woodlands in drier regions, while higher yields came from wet miombo woodlands of northern Mozambique. In Tanzania, Misana et al. (2005) estimated yields of 2.3 m³ per ha per year from regrowth of miombo woodland, suggesting that it takes 8 to 15 years for degraded woodlands to recover for charcoal production.¹⁶ Although growth is slow, strong coppicing occurs, so coppice management is possible (Luoga et al. 2004). Indeed, miombo regenerates relatively easily. Provided that miombo is not permanently converted to farmland, regeneration can be robust and requires relatively few silvicultural interventions. Caro et al. (2005), however,

¹⁶ Providing that trees are allowed to grow to a minimum size of greater than 10 cm dbh (diameter at breast height) before burning to charcoal.

suggested that the prospects for sustainable management of *individual species* look bleak (their focus was on *Pterocarpus angolensis*).

Indeed, most efforts to manage specific valuable species in logged-over miombo have failed. Despite a fairly large body of literature calling for the introduction of conventional silvicultural systems for miombo management (Hofstad 1993; Werren et al. 1995), backed up by technical recommendations from silvicultural systems trials, there are no recent reports of the successful implementation of such practices outside of a few gazetted forest reserves, and even then, on no significant scale.

Two factors are at the crux of the problem. First, it is difficult to encourage the regeneration of specific valuable miombo species, and second, the inherent value of miombo comes from a wide range of products and uses, rather than from individual species. Mean annual growth rates of 2 to 5 m³ per year sound low, but in fact, these are not much lower than growth rates for mixed hardwood forests in the temperate and boreal forests of Europe. In Romania, for example, the mean annual growth for oak forests is around 3.5 m³ per ha. According to the Swedish National Forest Inventory, 43 percent of Sweden's forests yields 3 m³ per ha or less per year (Yrjölä 2002). So, the point is not that productivity itself is the constraint. What is different between the temperate forests of northern Europe and the dry woodlands of southern Africa is that the former produce commodities that are immensely valuable on domestically and internationally traded markets, and can be managed with these outcomes in mind. The latter, however, produce limited high-value products for which management is extremely difficult. Indeed, local value-added comes from miombo's multiple uses and may not involve harvesting roundwood at all.

Managing for multiple products

Although growth rates are low, miombo woodlands are valuable because of their diversity and the species mix. Miombo woodlands are one of the prime "mushroom kingdoms" of the world. They have given rise to a culture of mushroom gathering, widespread among people in miombo woodlands but largely absent in other tropical African dry woodlands. The widespread presence of large-bodied, charismatic mammals found in miombo supports significant tourist and sport hunting industries (WWF-SARPO 2001). Miombo also has a large volume of edible insects, making the woodlands an important source of insect protein (Cunningham 1996). Miombo is excellent for beekeeping and honey production (Cunningham 1996; Fischer 1993; Mickels-Kokwe 2006), and this has resulted in the creation of ministries of forestry and beekeeping to oversee their management. From a household perspective, miombo has diverse uses as well. Cavendish (2002) recorded more than 100 types of resources used in a single study area, with many types of resource use involving multiple species (e.g., 47 wild fruits, more than 40 medicinal species, and 40 wild vegetables).

The problem is that it is not easy to manage multiple, productive resources, and in many cases, the current incentives and institutional arrangements lead to overharvesting (Chidumayo et al. 1996). There are trade-offs that come from managing with particular objectives in mind. Most current woodland management models limit their focus to the production of a narrow range of wood products. There is still very little known about multiple systems of harvesting, and the trade-offs and complementarities this can involve. National forest research organizations (with a couple of exceptions) seem to be stuck in a narrow technical paradigm that focuses on production of

a few, high-value resources. They have generally failed to contextualize resource use within an understanding of how local people actually use and rely on the miombo.

The main technical dimensions to management that have been explored largely relate to timber harvesting, regeneration, coppice management, fire management, and grazing management. Because of the diversity of uses of miombo woodland, the intensification of any one particular management strategy is likely to affect the production of other woodland products. For example, in Zambia's Eastern Province, there is a well-known case where beekeepers hung their hives in the forest at around the time a timber concession license was issued to a prominent businessman. A significant number of big, flowering trees were cut, leading to lower honey production (Mickels-Kokwe 2006). There are also numerous examples of conflicts between charcoal producers and those wanting other resources from the woodlands. Managing the seasonal cycle of fire, and the livestock populations that depend on grass regeneration and dry season browsing, is also critical. More attention should be given to what constitutes sustainable extraction of the multiple non-timber forest products.

How miombo areas are managed is often a reflection of specific features of government policy—or the lack thereof. We turn now to the range of policies that can act as a constraint on improved woodland management.

3.2 POLICY BARRIERS TO SUSTAINABLE MANAGEMENT OF MIOMBO

A number of policies, both within and external to the forestry sector, act as barriers to miombo use and management. We consider two particular barriers: (a) forest policies that are disabling, either because they are highly restrictive or because they do not tackle the issues that would provide incentives to small-scale producers and to community initiatives; and (b) the lack of a comprehensive or credible policy framework that supports the forestry sector within government planning and budget allocation processes. Policy credibility is a significant problem. Sometimes highly aspirational forest policies bear no relationship to the budgets or staff requirements needed for their implementation.

Disabling forest policy

Regulatory instruments

A range of regulatory instruments—designed to prevent the over-exploitation of forest resources and to raise government revenues, ostensibly for natural resource management (Kowero et al. 2003)—inadvertently undercut livelihood opportunities for local producers and traders. For example, many policies prohibit the harvesting of forest products for commercial purposes from state-owned forests. Ironically, these restrictive institutions have not been very successful in preventing resource degradation; in many cases they have had the opposite effect by removing the responsibility for management from the actual users. In addition, revenue generation has been limited (Jumbe et al., technical annex 4, for Zambia), and the nature of public budget allocation processes has favored disconnecting revenue collection from spending on natural resource management.

In Malawi, the government put in place measures that, from a policy perspective, were intended to control the charcoal market and to reduce deforestation (Deweese 1995; Openshaw 1997).

Charcoal became more costly to produce and to get to the market, which reduced demand, but created good opportunities for intermediaries to capture extra revenues, usually from bribes (box 3.1). With production pushed out of the legal domain, the forestry department had less control over the process. It became problematic for the forest department to collect stumpage fees even if charcoal was made in forest reserves, nor was it able to advise or train charcoal producers on woodland management and charcoal production because this would have been illegal. More recently, Kambewa et al. (2007) also conclude that current efforts in Malawi to discourage charcoal making are expensive and ineffective.

Much of the recent literature on forest governance confirms that a plethora of national-level regulations does little more than improve the ability of petty officials to extract informal payments. Such informal taxation results in lower profit margins to producers and traders. In an impassioned report on the Mozambique timber market, Mackenzie (2006) concluded that official agencies were presiding over and colluding with abuses that makes a “mockery of the notion of governance: taking bribes for issuing licenses, approving management plans, concessions and export permits,

BOX 3.1. ISSUES RELATED TO REVENUE GENERATION FROM THE FORESTRY SECTOR

Informal payments to officials

In Malawi, it was estimated that “private taxation” of charcoal traders diverted US\$700,000 per year from public revenues (Kambewa et al. 2007). In Tanzania, marketing studies routinely showed that forestry tax compliance was on the order of 1 percent to 20 percent, and that the forgery of key documents (with the evident complicity of local government agents) was common (Kobb 2001).

Low levels of official revenue collection

In Mozambique it is estimated that in the Maputo area, a mere 1 percent of the potential fees and licenses were actually collected (SEI 2002). In Zambia the estimate is about 10 percent. In Tanzania, royalties from natural forests totaled about US\$1.2 million per annum 1999. Since Tanzania has roughly 34 million hectares of forests, revenues are equivalent to around US\$0.04 per hectare of forest (Kobb 2001).

Incentives for local governments not to devolve revenue collection

Devolution often begins by giving local governments the right to collect a greater share of forest revenues. These revenues can become an important source of “untied” income for local governments (Blomley 2006). This causes a potential conflict of interest as the same bodies hold the key to further devolving rights of forest management and use (and revenue collection responsibilities) to local communities.

Rights to revenue collection

At the national level, the connection between the right to collect revenues (by forest departments) and the responsibility for management (again, by forest departments) is seldom made. The question, then, is why the public sector has the right to extract rents from what are essentially unmanaged woodlands (but which are held in trust by government). Forestry, then, becomes a mining operation, where outside interests are granted the rights to exploit a resource on payment of royalties, but have no responsibility to encourage sustainable production. Few other productive sectors operate in this way. Government’s only rights to forest product revenue were based on a colonial designation of an area as a forest reserve, not on any legitimate right derived from protection or use.

and getting timber through checkpoints.” Salomão and Matose (technical annex 5) also indicate how communities are limited from participating in market initiatives because of the complex set of conditions and regulations for such participation.

The problem of devolution

Section 2 of this paper points out that the devolution of rights of tenure, use, and access is an important trend across southern Africa, and poses good opportunities for improving miombo management. This trend also poses special challenges, and, when poorly implemented, can even undermine efforts to improve management.

Problems arise when devolution is incomplete, or otherwise reduces clarity with respect to who has local rights to use and management. Wily (1999) convincingly argues that full power (rights of access, use, control, and ownership), not just rights of use, needs to be devolved to local communities. Experience has increasingly shown that pilot schemes which don't give meaningful power to local actors are unlikely to be successful (Matose 2006; Wily 1999). Schafer and Bell (2002), based on experience in Mozambique, suggest that the state's reluctance (regardless of what “policy” says—see also Salomão and Matose in technical annex 5) to take measures to devolve control over natural resources stems from the desire of forestry personnel to protect the forests above all else, the economic interests of state agents in valuable natural resources, and the unwillingness of politicians to allow local control in areas that are politically sympathetic to the opposition.

In a number of countries, the wider policy framework is simply not conducive to local control (e.g., Blaikie 2006; Campbell et al. 2001). Progress with participatory forest management has been slow in Zambia because of the lack of a sound policy and legal framework (Gibbon et al. 2005). In some cases there are good policies in place (e.g., Tanzania) and decentralized management has been mainstreamed throughout the forestry sector. But even here there are critics. For example, Petersen and Sandhövel (2001) point to lack of clear rights and adverse incentives, while Meshack et al. (2006) have recorded the high transaction costs of local control, and suggest that these are highest for the poorest of the poor. They conclude that policies and legislation need to be simplified in order to reduce transactions costs. In many places initiatives are still at the planning and experimental stage, and often are of top-down design (Wily 2003). System design is often awkward, unrealistic, expensive, and overly complex, and thus lacks the simplicity essential for widespread adoption and real involvement of local communities in woodlands management. Goldman (2003), working in community-based conservation in Tanzania, also suggests that planning remains a top-down affair, despite the rhetoric.

One manifestation of the lack of commitment to devolution is the focus for devolution efforts on degraded resources rather than on high-quality woodlands. Another manifestation is the limited benefits that local producers are allocated. In Mozambique, the national forest regulation establishes that only 20 percent of the taxes resulting from the extraction and use of forests and wildlife should be returned to the communities living within or close to the forest areas. As a result of that measure, only US\$422,000 (in 2006) was returned to the 956 communities living in the area (Sitoe et al., unpublished manuscript).

Marginalization of the forestry sector

Forest resources play a crucial role in improving livelihood security. There is good evidence that, for many households, they contribute as much as dryland crop production to household consumption. In some cases forest resources contribute significantly to the national economy as well (for an example, see box 3.2). Even so, within the overall national policy and budgeting framework, forestry is commonly marginalized, and few resources are provided through the budget process to support sustainable management, to develop appropriate technical information about management, or to enforce realistic and constructive regulations (Barany et al. 2004; Mlay et al. 2003).

It is certainly true that forestry spending has to be mobilized in the face of many competing priorities, for example health, education, transport, and agriculture. But agriculture appears to do relatively well compared with forestry. For example, in Malawi the agriculture sector receives 30 times the budget of the forestry sector, and even more if irrigation is included (table 3.1). In Tanzania, agriculture receives some 40 times more than forestry.¹⁷ All countries in the region have agricultural extension services, but forest extension services are either missing or extremely limited. Forestry does not feature to any significant extent in regional development initiatives such as NEPAD (Fakir 2003).

TABLE 3.1. BUDGET ALLOCATION TO DIFFERENT SECTORS: THE CASE OF MALAWI AND TANZANIA, 2007–08

SECTORAL BUDGET LINE	MALAWI		TANZANIA	
	Total recurrent and capital budget (US\$ million)	Spending as a percent of total budget	Total recurrent and capital budget (US\$ million)	Spending as a percent of total budget
Forestry	4.7	0.4	7.2	0.2
Agriculture	149.8	13.5	291.9	6.3
Education	125.5	11.3		
Health	130.7	11.8	453.8	10.0
Irrigation and water development	36.7	3.3	835.5	18.0
Lands and natural resources	23.2	2.1		
Tourism, wildlife, and culture	5.3	0.5		
Local government and rural development	12.0	1.1		
Other	487.9	56		
Total budget	1108.6	100		

The lack of public spending has meant that forestry departments are unable effectively to implement forest policies, have limited capacity for regulation where it is needed, and provide limited services to smallholders and communities (though part of the problem also relates to their lack of service orientation—both a cause and effect of low budget allocations). While, in theory, budget rationalization (an outcome of public expenditure reviews) should close the gap between what policies say and what budgets deliver, in practice, the lofty goals outlined in forest policies (and increasingly in

¹⁷ Comparisons of public expenditure across sectors ought to be based on a common numeraire that is sector specific, e.g., sector expenditure as a share of sector GDP. However, forestry GDP estimates are exceptionally poor. Nonetheless, for Tanzania, at the very most, the GDP of agriculture is 11 times that of forestry, and yet budget allocations differ by a factor of 40.

environmental policies) are seldom matched with real cash. The lack of policy credibility contributes strongly to the sense of institutional ineffectiveness.

Forestry micro-enterprises have demonstrated some good development potential for increasing local value-added from miombo management. The public sector, though, is seldom able to deliver the technical, financial, and marketing services that might improve the viability of forest-based micro-enterprises (though the lack of attention to micro-enterprises is widespread and not limited to the forestry sector). Shackleton (2007) argues that much of the locally initiated trade in natural resource products is invisible, neglected, and unsupported and, consequently, poorly recognized by important stakeholders such as traditional authorities, municipal authorities, landowners, and managers.

As a result of under-investment in comprehensive, household-based, and relevant silvicultural research, technical information regarding the management of miombo is limited and mostly out-of-date. From a narrow timber production perspective, forest growth and yield data are scarce. Values used to estimate cutting cycles and the annual allowable cut are partly guesswork. Because of the low value of potential industrial timber production, there is limited investment in developing timber inventories.¹⁸ In Zambia, for example, there are no up-to-date national forest inventories to determine or to assess the quantity and quality of the country's forest resources. Estimates of remaining woodland cover, growing stock, and stocking rates are based on limited local level inventories. Under-investment (and corruption) also results in poor enforcement of national forestry regulations (box 3.2). In many cases, lack of attention to appropriate forestry regulations or poor management (e.g., no fire control) leads to resource destruction (Chidumayo 2002).

BOX 3.2. THE DECLINE OF TIMBER STOCKS IN TANZANIA: WHEN MULTIPLE BARRIERS COME INTO PLAY

Miombo woodlands have a relatively low proportion of high quality commercial timber species, yet some are of extremely high value. *Dalbergia melanoxylon* (African blackwood or mpingo) is one of the world's most expensive timbers, with sawn billets selling for up to US\$ 18,000 per cubic meter when they are used to produce the world's finest woodwind instruments such as clarinets, oboes, and bagpipes (Ball 2004; Jenkins et al. 2002). *Dalbergia melanoxylon* is the third highest foreign exchange earning species for Tanzanian forestry, bringing in an estimated US\$ 1.5 million per year from exports (Beale 1995). This only represents the legal trade—the illegal trade is likely many-fold more.

Considering that *Dalbergia melanoxylon* often co-occurs with other valuable timber species, such as *Pterocarpus angolensis*, closer examination of how forestry national regulations are implemented in practice in the case of *Dalbergia melanoxylon* is therefore instructive. Given its status as a national icon, the Tanzanian National Tree, and a valuable source of foreign exchange, is this species managed sustainably?

In Tanzania, in the late 1980s, it was estimated that close to half of the harvested *Dalbergia melanoxylon* was felled illegally (Moore and Hall 1987). Minimum diameter size classes were commonly disregarded. Around 54 percent of the logs in a sawmill inspected by Ball (2004) were smaller than the minimum allowed diameter. Official statistics for *Dalbergia melanoxylon* also rarely reflect real harvest levels. Backéus et al. (2006) have recently suggested that selective logging of *Dalbergia melanoxylon* is likely to result in its local extinction.

continued on page 42

continued from page 41

Sustainable management is not possible if neither forest management area boundaries nor well-founded rules for resource management are respected. Despite these high timber values, fire management is also sometimes poor, and fire-sensitive timber species such as *Guibourtia* and *Baikiaea* are in decline in many areas.

Having been marginalized within the budget process, forestry personnel seldom have an adequate platform for ensuring that forestry issues are considered by other branches of government, be they in the energy sector, agricultural sector, or local government. Solutions to the charcoal problem may well lie with the national energy policies (Deweese 1995; Kambewa et al. 2007). Agricultural policies that favor the expansion of crop production into fragile miombo areas can be a driver of deforestation (Kowero et al. 2003). Examples of such policies include fertilizer subsidies, promotion of export crops, and some types of land tenure reform. While forestry policies may declare production illegal (as in the case of charcoal in Malawi), another ministry (local government) allows sales and collects revenue from the trade (Kambewa et al. 2007). Forestry officers in the field have low salaries, almost no equipment, no current maps, no transport, and tiny operational budgets, yet are supposed to be covering huge geographic areas.

3.3 ECONOMIC BARRIERS TO SUSTAINABLE MANAGEMENT OF MIOMBO

We have repeatedly made the point that miombo offers limited economic returns to management because the complexities of managing woodlands for multiple outputs are seldom well understood, the difficulty of managing miombo for the production of single high-valued products, and the challenge of devolving resource use and ownership to the local level. In this section, we examine barriers to achieving sustainable management, which we broadly characterize as economic barriers. These reflect high rates of time preference and thus the lack of investment in longer term initiatives, and the problem of low margins and what this means for market development and adding local value.

Cash constraints and preferences for rapid exploitation

The absolute income of most rural households in miombo regions is very low. Even the wealthiest quartile in the Zimbabwe field study sites of Mutangi and Romwe had a mean income of less than US\$1 per person per day (Campbell et al. 2002). While woodlands are quite important for subsistence products, they are generally less important for cash income, especially for the wealthier households. In Cavendish's study in Shindi (Zimbabwe), 9 percent of the total cash income came from woodlands, and the top quintile showed the least reliance on cash from woodlands (about 4 percent of total cash income) (Cavendish 2000). In one of the few experimental studies of rates of time preference in the region, conducted in Zimbabwe, rates were very high, indicating the strong tendency to discount the future (Kundhlande 2000). Luoga et al. (2000) calculated that charcoal production is profitable only if resource stock decline is discounted. If households want to secure cash, will they choose to overuse and, if necessary, deforest? Or will their desire to secure subsistence products ensure conservative use? And will wealthier households be less likely to liquidate the woodland assets than poorer households because they are less reliant on woodlands? These are some key questions that need to be explored, and placed in the context of the institutions that govern resource use.

Moving beyond the level of households, most countries in the miombo region have changed their economic direction, from centralized socialist approaches to more market-driven approaches. With governments relinquishing control over many industries, privatization of forest-based industries has occurred, but rarely with a view to long-term, sustainable management (box 3.2). Instead, resource mining is more common, shifting short-term profits to urban, commercial sectors or other natural resources.

Low margins for miombo management

Active management of miombo can improve resource productivity. For example, productivity can be enhanced by reducing the numbers of coppice shoots after extraction of poles (Frost 1996). A number of studies of the constraints to improved forest management have focused on the need to raise the value of the product, in order to generate larger margins to finance more intensive and effective mechanisms of control and management (for woodfuel, Arnold et al. 2006; World Bank 2002; for woodcarving, Standa-Gunda et al. 2007).

Margins in miombo regions, however, may simply be too low to generate significant resources that could be used for sustainable forest management. Particularly when there are low-cost alternatives, and when the prices of alternatives are not rising, it is really difficult to raise margins (Arnold et al. 2006). Higher margins could have negative impacts on consumers, many of whom are poor urban dwellers. Additionally, higher margins could attract better funded and skilled participants, undermining the comparative advantage poor people have in many forest-based enterprises. After examining the margins achieved by woodcarvers in southern Zimbabwe, Standa-Gunda et al. (2007) concluded that there was very little room for adding a resource management tax. Any additional taxes could drive producers out of business, as margins and returns to labor were already low.

The transactions costs of control and management mechanisms by regulators are likely to be high relative to the low value of many resources (Arnold et al. 2006). For many forest products, markets are transient and dispersed, making regulation and enforcement difficult (Hofstad 1997; Shackleton 2005b, 2007). Questions have been raised as to whether the benefits of control and management mechanisms outweigh the costs of enforcing such regulations. Existing natural resource policies in all the countries include fees for removal, transportation, or trade in forest resources. SEI (2002) argues that the collection of these fees for woodfuel would result in substantial amounts that could be used for management. They note, however, that fiscal management systems are inadequate, and revenue collection (whether by central or local governments, or by communities) is a fraction of what it might be.

Although there are economic barriers to getting communities involved in miombo management, it is also true that the costs of management associated with using traditional forest department operations would be much higher, and thus communities can manage these forests much better and more efficiently than the state.

Shallow markets and what domestication means for managing the miombo

Even when promising new miombo products are identified, it takes a great deal of investment to develop markets for these products. Various oils extracted from miombo trees and plants, wild food products, and craft products don't easily fall into the shopping cart, and what may seem to be an obvious market, may be neither easily accessible or well developed. Without mechanisms

for developing these markets, miombo products offer few easy paths out of poverty. Even when there appear to be good markets for tree products, they may be easily available, and oversupply can depress producer prices, limiting the incentive for management.

One outcome of the development of markets for miombo tree products is domestication. While this trend may be appropriate and desirable from a market and livelihood perspective, it has the effect of reducing interest in the natural miombo woodland. When forest products are commercialized, many end up being domesticated, cultivated, and subject to more intensified production (Arnold et al. 2006; Arnold and Dewees 1997; Ruiz-Perez et al. 2004). Taking woodfuel as the example, Arnold et al. (2006) noted that the potential for increasing supplies from farmer-grown trees is likely to continue to grow, and that changes in land tenure and labor availability, and increased scarcity of wild resources will favor the expansion of low-input tree crops. This is very much what has happened in higher rainfall areas, but whether it is as likely in the drier miombo woodland areas is open to question.

An enormous amount of attention has focused on the potential for the development of markets for environmental services (Chomitz 2007). The fact is, in the miombo region, these markets are nearly nonexistent and are largely aspirational, except for tourism-related payment schemes. Limited experience with these markets has shown the importance and potential for integrating these types of schemes with more comprehensive rural development initiatives. This tends to increase their complexity, and the costs of their development and implementation. To some extent, the priority on catalyzing markets for environmental services becomes subordinated to the challenging themes of local participation, benefit sharing, and community-based management. These themes are not incompatible, but they do represent a very specific market niche for highly specialized delivery mechanisms for payments for environmental services. Carbon markets are especially problematic because of the focus on the value of a single service. The challenge for the forestry sector more generally (and not just in the miombo region) is to figure out how the range of important objectives for putting in place sustainable forest management systems can be reconciled with priorities for establishing and operating carbon markets.

3.4 ORGANIZATIONAL BARRIERS TO SUSTAINABLE MANAGEMENT OF MIOMBO

In this section we examine organizational weakness at the local and national levels.

Weak local organizations

Section 2 outlined some of the policy issues surrounding devolution. Independent of the policy framework, at the local level, devolution requires the presence of competent and capable local organizations. There is great diversity across the region in terms of local organizational capacity, even within countries. So, for example, traditional authorities are strong and have legitimacy in some parts of Zimbabwe whereas in others they are all but absent. Conversely, modern local organizations have no legitimacy in some parts and are functioning and well respected in others. But, to generalize across the region, local organizations are often weak, be they local community organizations, traditional authorities, or local government. The fact that local organizations are weak

has a number of negative consequences, specifically resulting in the lack of clear and accepted local rules and regulations, elite capture, and limited market power.

Lack of clear and accepted local rules and regulations

Existing local institutional capacities are often weak, and local actors are unable to enforce control mechanisms to prevent the overuse of resources and effectively intervene in the management arena. The complexity of the commons is well established (e.g., Cavendish 2002). Resource heterogeneity poses special difficulties for the design of common property resource management. Similarly, highly heterogeneous communities pose special challenges for common property management.

The lack of local institutional capacity is a constraint to conflict resolution. Diverse conflicts between traditional and modern institutions are common in miombo areas (Nemarundwe 2004). One outcome is de facto open access. The lack of moral and political legitimacy can undermine the effectiveness of local institutions, and poor leadership can threaten sustainable management. In southern Zimbabwe, failures in local leadership combined with the withdrawal of outside agencies responsible for oversight and assistance were to blame for this demise of community-based wildlife and tourism ventures. There is some evidence that local power struggles are preventing communities from adopting rangeland burning regimes, which would be more environmentally sustainable, with negative impacts on miombo regeneration.

It is difficult to bring about major improvements in sustainable woodland management if local organizations are weak, and if the transfer of rights and responsibilities over the woodland resources is incomplete. Community organizations, the public sector, and the private sector are often encouraged to join efforts for sustainable management of woodlands (Matakala and Mushove 2001), but power imbalances, and the role of the state, reduce clarity about the role of each partner. The result is that local community members tend to become employees, rather than partners.

Elite and external actors capture values

When there are significant economic values for woodland products, resource ownership is often contested or captured by local elites (Campbell et al. 2001; Kajembe and Monela 2000; Nemarundwe 2003). This is a disincentive for local collective action for woodland management. Even in relatively successful community-based schemes in Tanzania, elites have tended to “hijack” processes and forcefully occupy the political space opened by decentralization. A key challenge is to guard against domination by elites in newly created institutions. Brockington (2007) points to the problem of corrupt village government in Tanzania and how their practices of resource grabbing, often in tandem with higher levels of government, could undermine devolved forest management. Logan and Moseley (2002), studying Zimbabwe’s CAMPFIRE, concluded that the program was unlikely to achieve local empowerment without addressing the administrative and legal structures that underlie the nation’s political economy. Elite capture does not always occur. For example, Lund and Treue (2008) found that forest decentralization in Tanzania’s Iringa district had overwhelmingly positive livelihood effects, including in terms of well-functioning local governance and benefit-distribution systems. Improved woodland quality has also been recorded.

Where resources are of high value, external players may become important in terms of capturing resource rents, with the state often supporting the external players. Beekeepers in Zambia lost important flowering trees to a timber concession licensee, a prominent businessman (see section 3.1.2). When comparing similar products in national versus international markets (e.g., honey

sold in Zambia versus honey exported), big (external) players tend to dominate even more when international trade is involved. Domestic, as opposed to export, markets often require only modest investments to develop and expand. Export markets, on the other hand, are much more complex and the numerous legislative barriers, standards, and quality controls effectively restrict local participation (Shackleton 2007; Tieguhong and Ndoye 2006; Wild 2006). In the marula trade of southern Africa, foreign companies have a dominant and growing share of total incomes in the value chains, often due to their monopolistic position in the international market (Wynberg et al. 2003).

There are also examples of the state and its actors dominating resource control. This continues to be the case even in forests subject to shared state-community management. For example, in Mafungabusi State Forest in Zimbabwe, the state has entered into resource sharing agreements with local people but these cover only nontimber forest species (e.g., thatching grass) and not timber (Mapedza and Madondo 2000; Mapedza 2004). Further, in these shared forest management regimes access by communities is often insecure as the state continues to be the land owner and thus the ultimate authority. Nascent conflicts between local people and government officials occur even in relatively successful community-based schemes in Tanzania. In Mozambique, corrupt officials captured much of the rent in the timber trade to the detriment of the forests and local people (Mackenzie 2006).

Devolution has often not yielded the benefits that were expected. In many instances, the state provided benefits as an incentive to encourage people to support activities that met government revenue targets or conservation interests rather than local livelihood needs (Fairhead and Leach 1998). Thus, although access to some subsistence products improved, access to other important local resources such as timber and wildlife often continued to be restricted. There was often a bias toward products and species favored by forestry departments (e.g., timber) rather than those valued by poor people, such as for medicine, fodder, craft materials, and wild foods. In most cases, the lack of local authority to make decisions was a major area of discontent. Income distribution shares were generally decided at the central level, but governments often failed to deliver on these promised shares, and the returns were far less than anticipated by communities. In cases where financial benefits accrued from revenues, licenses, permits, and leases, a disproportionate amount of this income was retained by the state, or it was captured by local and outsider elites. Only in a few cases did communities receive substantial financial benefits. For example, in 2002 Mozambique introduced forest regulations specifying that local communities would accrue 20 percent of the revenues generated from forest and wildlife use or extraction. This rule was not implemented until 2006 (Siteo et al., unpublished manuscript).

Lack of strong local producer associations

Local enterprises in miombo woodlands turn out products, such as honey and edible mushrooms, that have significant national and export markets. To tap into such markets requires sufficient quantities of product, delivered on time, at the right price, and of the appropriate quality. Harvesting from the wild certainly offers opportunities for organic or FairTrade marketing, but harvesting sufficient quantities is labor-intensive and requires hundreds—or even thousands—of rural harvesters to collect these products. Numerous small producers also make brand recognition, quality control, and market growth very challenging. In 2007, it was estimated that, in North West Province of Zambia, around 15,000 beekeepers were managing production from around 73 hives each. In Malawi, around 8,000 beekeepers annually produce 1,000 and 150 tons of honey and beeswax, respectively. In Mozambique, an estimated 20,000 traditional beekeepers produce 360 tons of honey and 60 tons

of beeswax annually (Nhantumbo and Soto 1994). The question is, how can dispersed production by numerous producers be bulked up to meet market standards?

Well-established and effective local organizations to coordinate bulking up of resources, reduce transport costs, maintain quality standards, improve market recognition, and improve supply chain capability can be enormously helpful in ensuring market participation. These organizations can use communications technologies such as mobile phones, e-mail, and the Internet to improve market engagement. In general, such organizations are lacking, but there are some exceptions. For example, in Namibia, the 5,000 members of the Eudafano Women's Cooperative are producing marula seed oil, and the Cooperative is coordinating collection and oil pressing to deliver high-value cosmetic oil to the European market. Similarly, in Zambia, North Western Bee Products (NWBPP) has invested in quality control training along the supply chain as well as honey certification and is coordinating supplies to get them to export markets in Europe, competing favorably with large-volume suppliers from China. In southern Africa, the eight-country network PhytoTrade Africa operates as an umbrella body for smaller member businesses.

Weak national forestry organizations

Many forest institutions in Africa were established at a time when there were other policy priorities and objectives. They were never designed to respond to the needs of local communities. Their original functions were largely regulatory. A few institutions developed good capacities for management, but simply because of the extent of miombo, its robust regenerative capacity, and the lack of human pressure on it in the first half of the twentieth century, most management largely consisted of designating areas as forest reserves and then simply leaving them alone. Fire management was probably the most significant silvicultural intervention, consisting of controlling late season fires and managing low-intensity early burning to favor grass regeneration and to limit damage to fire sensitive species. Today these agencies are underbudgeted, with staff that are generally underpaid and demoralized.

The idea of forest institutions as organizations with serious service delivery responsibilities is uncommon in most parts of the world—not least in southern Africa. Other parts of the public sector, supported by organizations such as schools and health centers, have a strong rationale for meeting service delivery objectives. Forest organizations in southern Africa continue, largely, to see themselves as relevant simply because of their regulatory functions, rather than because they are supposed to manage forests per se. If forest organizations exist solely to provide regulatory functions, the question for policy is whether other institutions may be better suited to this role, say within the range of functions provided by tax administration services.

When forest organizations do turn their attention to management, their lack of service orientation is again evident. By and large, they remain locked into old-style forestry focused on timber, plantations, silviculture, and on-station work. Miombo woodlands, though, are about honey production, mushroom collection and marketing, wildlife management, and the use and management of a diverse range of other natural products. And miombo woodlands are about poverty mitigation. Forestry agencies have been slow in coming to grips with this reality. Inventories and management plans, if they are ever done, seldom look beyond timber and fail to take local livelihood activities into account. Forest departments have also been misguided at times, relying on systems that don't work for miombo. For example, "high grading" of valuable timber species is very common, where only mature trees are felled. Beale (1995) suggests that this could reduce future regeneration

(for example, of *Dalbergia melanoxylon*) owing to the lack of reproductively active trees. A similar conclusion was reached by Desmet et al. (1996), who studied *Pterocarpus angolensis*. In this case, the most important requirement for the survival of *Pterocarpus angolensis* populations was the continued presence of mature, reproductive trees in the population, the very size classes being felled because of high grading.'

Technical information also does not take into account the new reality that management is most likely to be undertaken by local people. Forest department perspectives on tree scarcity and abundance often do not mesh with local people's perspectives (Walker and Peters 2007). There are few innovative schemes in miombo woodland for linking forest inventory data to local people's knowledge and values (Cunningham 2001). Access to GIS data and satellite imagery is limited and hardly ever fed into participatory land management planning. Very little is done and developed in terms of participatory fire management (Banda et al. 2006). Rural development forestry needs to provide local solutions to local problems and to recognize the influence of diversity within the rural community (Abbot 1997).

Until relatively recently, forestry in many parts of the world largely took the form of top-down government approaches that centered on the introduction of new technologies (Roda et al. 2005). Frequently, especially in developing countries, this involved establishing village woodlots, planting fast-growing species, and demarcating protected forest areas from which local people were excluded. Indigenous species management, local agroforestry systems, and traditional natural resource management practices, as well as institutions for communal forest stewardship, were often ignored. Decisions about forest management were made in centralized government offices, far from the people affected by the policies, or more typically, decisions were not made at all. In Tanzania, for example, huge areas of miombo had been gazetted as forest reserves by the mid-1900s, but no institutions were established or developed to actively manage these areas, because management was largely not needed. Woodlands were abundant and could be harvested (high graded) at will. The long-term institutional ramifications were serious, because no tradition of management per se ever developed around these areas, only regulation and a narrow focus on revenue generation. It is not surprising that a commitment to devolution (Salomão and Matose, technical annex 5) has been weak even in the face of appropriate policy. For example, forest policy in Malawi is not generally the problem, but rather its interpretation and implementation (Kambewa et al. 2007). Frameworks for forest management such the Forest Act, the National Forest Policy, and Standards and Guidelines for Participatory Forestry Management are in place, all of which are intended to promote good forest practice throughout Malawi, but implementation is slow and devolution is resisted. There has been reluctance to take responsibility for new ideas and ways of engaging with multiple stakeholders (Gibbon et al. 2005).

3.5 SUMMARY

Despite the fact that there are good opportunities for improving the management of dry woodlands in southern Africa, forest degradation and deforestation are still problems. The productivity of high-value products is very low and difficult to improve through better management. Value-added is based largely on the large number of multiple products (albeit of low value). It is difficult to manage multiple, productive resources, partly because the silviculture is poorly understood and partly because of the complexity in meeting the interests of a diverse group of stakeholders.

Forest policies have not been conducive to improving local management. Mostly, this has meant that rights to use and access miombo resources have been retained by the state, even in the face of trends toward decentralization. The policy framework may prohibit the harvesting of woodland products for commercial purposes. Even when there is potential for working with local producers to improve management by, for example, improving their extractive techniques or conversion efficiencies (e.g., from roundwood to charcoal), the legal framework may not allow it. A burdensome regulatory framework has meant that it is easy to be illegal, doing little more than improving the ability of petty officials to extract informal payments. Devolution of control over natural resources to local forest users, while offering good potential, has seldom been undertaken wholeheartedly. It is this problem of incompleteness that has undermined what are ostensibly promising policies for improving woodland management.

Low margins and shallow markets for miombo products have also limited the potential for improving incomes from better managing woodlands. Even when promising new products are identified, it takes a great deal of investment to develop markets for these products. What may seem to be an obvious market may be neither easily accessible nor well developed. Without mechanisms for developing these markets, miombo products offer few easy paths out of poverty.

Finally, forest institutions have shown little capacity for rising to the challenge of working with rural people to improve the management of miombo woodlands. Their role has largely been regulatory, and when they have turned their attention to management, they have been decidedly biased toward production of commercially viable timber species (of which there are a highly constrained number) and plantation development. Neither of these uses has great utility to the large numbers of rural households who depend on miombo for its production of consumption goods.

4

SOLUTIONS: HOW CAN THE MANAGEMENT OF MIOMBO BE IMPROVED?

4.1 TACKLING POVERTY TRAPS AND ENHANCING SAFETY NETS

Before moving to solutions, we examine a fundamental problem in the miombo region: widespread and persistent poverty. In Section 1 of this paper, we considered Collier's (2007) formulation of how various poverty traps can sometimes make it really difficult for poor people to improve their condition, particularly in areas affected by armed conflict, weak governance, and mismanaged dependencies on natural resources, and when facts of geography (in particular being landlocked, and surrounded by poor neighbors) limit access to external markets. Most miombo countries are caught in at least one of these traps: (a) armed conflict, at least in the recent past, in Angola, DRC, and Mozambique;¹⁹ (b) mismanaged dependencies on natural resources in Angola and DRC, with Zimbabwe also participating in resource extraction in the DRC; (c) weak governance throughout the region, with particular problems in, Angola, DRC, and Zimbabwe; and (d) Malawi, Zambia, and Zimbabwe all landlocked, as is much of the DRC.

Two trends are likely to intensify the problem of poverty in the region: HIV/AIDS and climate change. The former is already afflicting millions of households, while the latter is likely to significantly affect agricultural production and water availability.

At the micro-level, poverty traps like these have particular relevance for people living in and around miombo woodlands: local conflict can make it difficult to resolve rights of use and ownership over woodland resources; elite capture and local corruption limit the extent to which households and communities can benefit from improved management; a bias toward timber production can undermine local and more important local management strategies; and miombo-dependent communities often live far from markets and have limited access to transport and communication infrastructure (Mutamba, technical annex 1). Under these circumstances, it is tough to add value to miombo products locally and to increase incomes.

One thing that has come out of the household studies described in technical annexes 2, 4, and 5 has been not that poor rural households are becoming rich by tapping into markets for miombo products (or have much potential for doing so), but that poor rural households are vitally dependent on miombo woodlands because of their role as a safety net. Among these households, miombo is providing a substantial proportion of total household consumption. This proportion increases significantly among households that encounter serious income shocks because of illness or environmental stress. These studies show, perhaps for the first time in a rigorous and statistically

¹⁹ Collier's (2007) discussion explores the long-term problem of growth in post-conflict economies. The conflict may be over, but the trap created as a result of the conflict tends to persist. Civil war reduces growth by around 2.3 percent per year, so a seven-year war leaves a country about 15 percent poorer than it would have been. DRC will need 50 years of peace, at its current growth rate, to achieve 1960s income levels. The chances that a poor country that has had a conflict will have another conflict are much greater among the "bottom billion" countries than among others.

robust way, that miombo woodland resources are a critical element of the rural household economy and contribute significantly to mitigating the impacts of poverty. If these resources are lost as a result of deforestation or other proximate causes, the need for alternative safety nets will pose a significant economic and financial burden on governments.

Miombo has a crucial role in poverty mitigation in spite of the fact that it has low productivity and is not well-endowed with high-value timber resources. This makes miombo less interesting to commercial concerns, but what matters is their high local value to tens of millions of poor households. Miombo woodlands can sustain livelihoods, act as safety nets in times of emergency, and serve as gap fillers in times of seasonal shortages. They also shore up livelihoods in the face of HIV/AIDS,²⁰ and we would hypothesize that miombo resources may become even more important as a source of consumption goods in the face of climate change.²¹

These perspectives are bolstered by spatial analyses of the distribution of poor households in miombo countries (figure 4.1). In Malawi, for example, there is a statistical correlation between areas with high forest cover and areas with high poverty rates. We are not implying causality, but the correlation does indicate that miombo has the ability to act as a safety net in the very areas where poverty rates are high. Malawi has one of the highest rates of deforestation in southern Africa, resulting from a combination of high population density, forest reliance, agricultural expansion, and high demand for wood, especially fuelwood. The loss of woodlands to deforestation is going to remove a vital safety net. Mozambique shows a similar correlation between high forest cover and high poverty rates, though the correlation extends to less than half the forested area, suggesting the problems of deforestation are less immediate (Sunderlin et al. 2007).

4.2 DEFORESTATION AND ITS DISCONTENTS

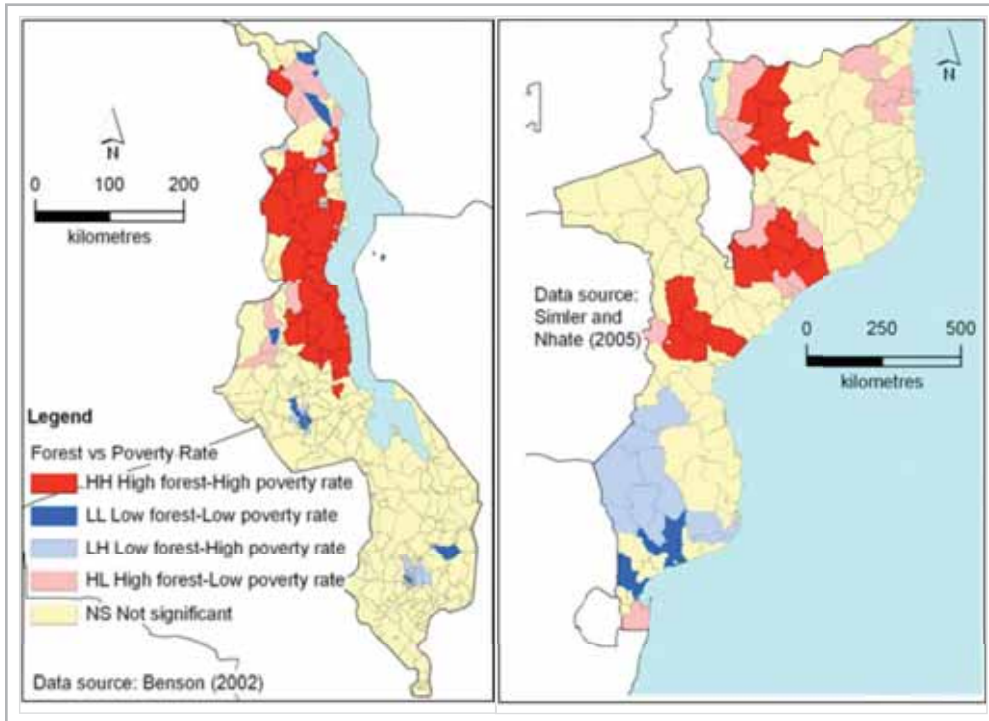
Even in the face of this type of analysis, there is a compelling argument that one of the best ways for getting people out of poverty is by forest land conversion, including road development. Certainly, economic growth in the United States and Canada was fueled by this during the mid-1800s, and forest colonization in the Brazilian Amazon has shown clear economic benefits. Sunderlin et al. (2007) argue that there is a clear overall relationship between the conversion of forest cover for agriculture and increased per capita income. Does this argument hold for the miombo region?

Mostly not. Miombo soils are generally sandy and nutrient-poor. Where agriculture would do best, in the higher rainfall areas, the dominant soils are orthic, rhodic, and xanthic ferralsols. When clearing land in ferralsols, which were under natural vegetation for long periods, the challenge for soil management is not to create a suitable soil structure for cultivated plants, but rather to preserve it against deterioration. This is especially difficult in miombo soils because organic matter in the top soil layers tends to degrade quickly in tropical climates. Additional nutrient inputs, once the original ones are depleted, are seldom freely available. Clay soils, which can help improve soil quality because of their capacity for retaining water, are scarce. Farming households, recognizing that termite mounds are an important source of accumulated clay soils, often collect these and

20 The role that miombo plays in shoring up households in the face of illness was convincingly shown by Hegde and Bull (technical annex 2), where environmental income increased by 42 percent as a result of illness shocks.

21 There are few good estimates of the impact of climate change on miombo ecology. Some speculate that miombo is also likely to be negatively affected by climate change (Chidumayo 2005b; Trouet et al. 2006).

FIGURE 4.1. FORESTRY AND POVERTY RELATIONSHIPS IN MALAWI AND MOZAMBIQUE



Source: Sunderlin et al (2007).

incorporate them into their fields in miombo farming systems. In fact, when forest land conversion has taken place in miombo regions, the most productive land management approaches are those that continue to integrate some aspect of woodland management into the farming system, such as the composting and deposition of leaf litter on depleted fields. On balance, the most productive farming in miombo regions requires integration of miombo into the farming landscape in a fractured mosaic, rather than total land clearance.

In addition to the problem of how nutrient poor soils can be managed in converted miombo woodlands, two other global themes argue against conversion of miombo. The first is a release of carbon from the soil and biomass into the atmosphere. As Scholes (1996) points out, if half of the carbon in the top 30 cm of soil and all the carbon in woody biomass were released in half of the existing miombo in the next 30 years, the mean rate of release would be around 0.2 Pg C yr⁻¹. Total carbon released from land-use change around the world is estimated at around 1 Pg C yr⁻¹. There would also likely be a decrease in the formation of rain-generating convective storms (because of increased reflection of solar radiation and decreased surface roughness, increasing atmospheric stability) (Xue and Shukla 1993).

The second issue has to do with biodiversity loss. Biodiversity endemism is significant in the miombo region. While many miombo countries are well covered by national parks, there is no analysis as to how effective these are in terms of biodiversity conservation; and there is no analysis of the effectiveness of protected areas vis-à-vis sustainable miombo management outside protected

areas. The importance of both externalities suggests that careful thought needs to be given to how a regulatory framework can best be responsive to these, on the one hand, while acknowledging the vital interest local communities have in ensuring that they have the ability to use and manage miombo resources.

So, there are really no very strong arguments in favor of clearing miombo for agricultural expansion, at least on any scale, and a strong case can be made for the integrated types of land uses that are emerging as population pressures increase. Land-use intensification in mosaic-like patterns, where fields and woodlands are found side-by-side, may offer the best and least costly solution to the problem of how to go about expanding agricultural production opportunities at woodland frontiers.²²

4.3 EXPANDING MANAGEMENT OPPORTUNITIES IN MIOMBO REGIONS

If agricultural expansion and miombo woodland clearance is not considered to be viable either because it is not sustainable or because the global costs are too high, what are the other options? Three particular intervention areas are resonant in southern Africa.²³

Our first intervention area concerns *devolution of rights and responsibilities* for woodland management to the local level. The experience has been mixed, but devolution is decidedly more effective when rights of use and access are completely—rather than partially devolved, when these rights are locally well-understood, and when they are supported by an enabling policy and legal framework. Devolution has been more effective than regulatory efforts stemming from national policy and legislation. While an enabling policy and legal framework is an important signaling mechanism, without strong and effective measures at the local level, policy and legislation, by itself, is insufficient. A long process of acculturation to the idea of devolution and what it means for local government can contribute to success. The social sectors have, perhaps, greater experience in achieving measured positive outcomes with devolution,²⁴ and offer good experience from which the forestry sector might draw. The experience with the devolution of forest rights and responsibilities to communities in Tanzania, regardless of its admitted shortcomings, is among the most promising in the miombo region. Shifting forest management responsibilities to communities requires significant and sustained investments in social mobilization, institution building, and capacity building. The community also needs to see benefits from the forest to build an incentive to protect the resource and to manage it sustainably. Success in forest management devolution may also need to be coupled with creating broader rural livelihood opportunities.

Devolved rights and responsibilities may not always deliver on management that secures global environmental values (e.g., carbon and biodiversity). This leads to our second intervention area. There may be good opportunities in the future for *exploiting opportunities for transfer payments to achieve environmental objectives*, such as from payment for environment services schemes,

22 We don't believe there are any detailed analyses comparing different scenarios of intensification, ranging from clear felling large areas for numerous individual smallholders to mosaics of agricultural land and woodland. However, detailed household studies do indicate that considerable income is derived from woodlands, and much of this would be lost if with wholesale clearance (section 2.2).

23 See also the global perspective on these themes in Sunderlin et al. (2007).

24 Experience in the education sector in Uganda, for example, has been widely cited for what can be achieved when transparency is increased with respect to how public funds are allocated to schools.

particularly if carbon markets develop more extensively. The challenge will be to figure out how to incorporate these types of objectives into multi-dimensional rural development initiatives, in order to increase the incentive for poor rural households to participate. Existing markets for environmental services, however, are quite shallow.

Third, not only do these markets need to be further developed, there are also important opportunities for *increasing the value of woodland production*. This will involve two particular and concurrent approaches: first, enhancing forest-based markets by, for example, removing restrictive legislation (e.g., by allowing communities to harvest resources previously harvested by state monopolies; freeing up transport regulations) and by strengthening local producers and forest enterprises (e.g., by strengthening local marketing federations of producers to provide economies of scale); and second, by ensuring that production of woodland products can be made sustainable so that markets can be assured of future supplies. Key barriers to overcome are related to the regulatory and devolution frameworks, and to weak national institutions.

These challenges are easier to handle for some products. For example, honey production and sustainable woodland management are entirely consistent, and contribute both to raising local incomes and conserving woodlands. In fact, beekeeping and use of products such as edible insects and mushrooms have significant potential to support environmental conservation by making habitat destruction more costly strategies. But the ease with which sustainable production can be achieved is offset by the tradeoffs they also entail. Beekeepers, for example, are one set of stakeholders among many (e.g., pit-sawyers, charcoal makers, and the local elite who may benefit from timber production).

The various intervention areas toward improving miombo management, with their potential impacts and constraints are outlined in table 4.1.

TABLE 4.1. OPPORTUNITIES AND CONSTRAINTS FOR IMPROVEMENT IN MIOMBO MANAGEMENT

APPROACH	POTENTIAL IMPACTS	CONSTRAINTS AND DRAWBACKS
<p>Devolving rights and responsibilities for woodland management to the local level</p>	<p>When devolution is complete, the first outcome is often, effectively, closure and woodland regeneration. There can be strong local redistributive impacts.</p>	<p>Closure creates winners and losers; objections of other stakeholders may limit potential; strong need for conflict management mechanisms in socially and economically heterogeneous communities.</p> <p>Policy and legislation may not be conducive to devolution; forestry may not have a high enough profile to bring about policy change or the budgets needed to accomplish devolution.</p> <p>Local capacity for woodland management may be weak.</p> <p>National institutions may have limited ability to work with communities to provide guidance.</p> <p>Incomplete devolution can create opportunities for elite capture and political interference.</p> <p>Low margins and few markets for woodland products may give limited incentives to improve management</p>
<p>Organizing transfer payments to individuals and communities in exchange for providing environmental services</p>	<p>Well-designed schemes reduce the incentive for land clearance and overexploitation of miombo resources, and can encourage regeneration. Can contribute to household income and reduce impact of shocks from ill-health and environment stress.</p>	<p>Markets for environmental services are poorly developed.</p> <p>Leakage: reduced exploitation in one area may simply shift exploitation to another area.</p> <p>Need to integrate PES schemes with a range of other service-delivery investments.</p> <p>Weak local and national capacity for working with communities in meeting these particular objectives.</p> <p>Policies and legislation may not support these types of interventions.</p>
<p>Increasing the value of woodland production through market development can create increased value-addition and new products.</p>	<p>Generates higher incomes for poor rural households, and increases the incentive to better manage woodlands for multiple outputs.</p>	<p>Significant market development requires investment capital.</p> <p>When lucrative markets are developed for miombo products, raw material oversupply can limit household revenue potential</p> <p>When rights to resources are unclear, elite capture can threaten the viability of value-added schemes</p> <p>Government is poorly placed to aid in product-specific market development, but can focus on wider policy and legal framework to encourage forest-based SMEs.</p> <p>Private sector with the capacity for market development is thin.</p> <p>Limited local marketing channels for new products require institutional investments that may be beyond the capacity of the private sector.</p> <p>Forest policy and legislation may prohibit the sale of forest products outside of the conventional regulatory regime.</p> <p>Trade-offs between extractive and consumption management options are likely, which will require mediation and conflict management.</p>

4.4 FOUR IMMEDIATE ENTRY POINTS FOR IMPROVING POLICIES AND INCENTIVES FOR MANAGEMENT

Many problems related to miombo woodland are governance related. Improved relevance of forestry institutions, policy and legal reforms, and building capacity in local organizations will be crucial but will take time. While miombo woodlands cannot be expected to be a major part of the poverty elimination agenda, they can and should form part of the agenda of improving national and local governance, and of enhancing poverty mitigation efforts.

In line with the above analysis we suggest four entry points for improving policies and incentives for miombo management. Given the diversity in the miombo region, these points will need to be tailored and prioritized according to local conditions. In many cases it is unlikely that a single entry point will be sufficient—a portfolio of entry points may be necessary.

The first two action points (“revitalizing forestry organizations”; “getting forestry onto the poverty reduction agenda”) are cross-cutting and will stimulate support and recognition of all the intervention areas mentioned in the previous section. The third action point, “redistributing woodlands,” will address the intervention area for devolving rights and responsibilities for woodland management to the local level. The fourth action point on “enhancing forest-based markets for products and services” is aimed at the intervention area on increasing the value of woodland production through market development. While this fourth action point has some relevance to the intervention area concerning environmental services, we have not designed a specific action point for this area given that these markets are shallow.

While the first-mentioned entry point is forestry-centric, many of the others are likely to be successful if they can be integrated into ongoing policy processes in other sectors: miombo use and management is not necessarily about forestry and its institutions, but rather about how other institutions relate to the use of natural resources by the poor.

Revitalizing forestry organizations

The very fact that miombo provides significant amounts of so many goods and services—for local people is also the primary management challenge for both local and government institutions. The lack of responsiveness on the part of forest institutions and other external agencies to the realities of local users, and a lack of appreciation of indigenous resource use and management practices, is a widespread constraint throughout the region. Emphasis is still placed on commercially oriented forest production and management systems, on regulation and enforcement, and on revenue generation for the state (and sometimes for personal gain). Forestry organizations lack an orientation toward service delivery and, indeed, have no clear set of roles in providing services to rural people. Frameworks for more participatory management and more local control may be in place but are resisted by those implementing forestry interventions.

Perhaps the biggest challenge for forest institutions in the region is a reorientation from their earlier roles, which were largely regulatory, to roles that have a much stronger service orientation, aligned with the poverty mitigation agenda. The poor must be a major client for them. This will equip them to take a credible lead in the reform of legislation and policy, in the mainstreaming of miombo use into the public welfare agenda, in the incorporation of miombo use into decentralization

processes and into decentralized regulation, in providing technical advice that is relevant to poor rural households dependent on miombo, and in devising a more effective and realistic national-level regulatory framework.

The call for forest institutional reform raises questions about what makes for “good” forest institutions in the first place. Drawing on some of the lessons of the 2004 World Development Report *Making Services Work for Poor People* (World Bank 2004), five principles help to define institutional performance (and good performers). These are:

- **Delegating.** There is an explicit or implicit understanding between multiple stakeholders that a service (or goods embodying the service) will be supplied.
- **Financing.** Financial resources are provided that enable the service to be provided, or there is a mechanism in place to ensure that the service is otherwise paid for.
- **Performing.** The service is actually supplied.
- **Using information.** Mechanisms are in place for obtaining relevant information and performance against expectations and formal or informal norms.
- **Enforcement.** Institutions are able to impose sanctions for inappropriate performance or to provide rewards for good performance.

These principles suggest quite radically different ways for forest organizations to operate in the region and would require a process of institutional introspection, as well as national leadership, to see them through a process of credible reform. It is unlikely that forest departments will ever be able to engage with communities sufficiently to facilitate local organizational and producer group development. Rather, forestry departments should ensure that other service providers with more strength at the community level are armed with the necessary forestry perspectives and tools. Forestry departments are better placed to review and approve locally meaningful management plans, provide support for serious fire or insect outbreaks where necessary, and provide technical advice.

Getting forestry onto the poverty reduction agenda

Over the past five years, two instruments have helped to catalyze a focus on poverty reduction. These are Poverty Reduction Strategies, ostensibly government-driven initiatives to articulate the key priorities for achieving poverty reduction targets; and the Millennium Development Goals (MDGs), which have helped to identify progress in achieving poverty reduction.

A key outcome of both of these instruments has been that national planning processes have been much more strongly linked to budget allocation processes, in particular because spending priorities to meet poverty reduction objectives are more clearly targeted as a result in most countries' Medium Term Expenditure Frameworks. These, in turn, provide a framework for general budget support targeted at particular sectors through donor-financed instruments. This has had a variable effect on rural productive sectors such as forestry and forests that are multi-sectoral, and in general forestry has been marginalized in the process. There are certainly cases where forestry has benefited from targeted public spending financed by instruments such as Development Policy Loans (DPLs) from the World Bank, such as in DRC. Some reviews have suggested, however, that DPLs are perhaps not

the right instrument for achieving sweeping stroke-of-the-pen reforms in the forestry sector, with its many social, economic, and environmental complexities.

Miombo woodlands are crucial for poverty mitigation for tens of millions of households. There is a need for greater emphasis on forestry in development planning at both local and national levels, and a need to safeguard the safety net value of the miombo for the poorest. Getting forestry into PRSPs isn't necessarily about getting forest policies and strategies into macro-planning but making sure that the policies and processes that are in the PRSPs work together to eliminate the barriers for forestry to work for the poor. We need to make sure miombo is recognized as a safety net and managed as such and incorporated into risk and vulnerability planning through social welfare departments and economic planning departments. Health departments should be fully aware of the safety net value of miombo medicinal plant use, and should support local management and use. It is more about mainstreaming forestry than keeping forestry in the forestry department. PRSP monitoring should include benchmarks/ indicators that monitor key drivers of the vulnerability-forestry relationship.

Redistributing woodlands

Local woodland users facilitate the production of essential products both actively and passively through selective clearing; highly selective harvesting practices; seasonal, cultural, and spiritual harvesting controls; and a wide range of demand management measures. Studies have shown that woodland use and management practices can be highly attenuated to respond to resource constraints, suggesting that in many areas at least, there is still considerable scope to stay within sustainable harvesting limits. Modest support for these types of practices, often achieved simply by making small changes in the ways communities' local rights and responsibilities are acknowledged and perceived, can have powerful outcomes.

The advantages of such an approach are that minimal changes in local practices are required and are therefore more likely to succeed. They can potentially strengthen local capacity for management through building on existing practices and institutions. A growing body of evidence from success stories throughout the region shows that communities have been assisted in improving the management and productivity of their woodlands through small but effective changes to the status quo. Underlying such an approach is the need to ensure that property rights are clear, and that the capacity and role of local organizations for woodland management are strengthened.

Reforming land and forest policy

Many countries have made progress in reforming land and forestry policies, but in only a few (e.g., Tanzania) are both the land and forest policies in place to support full local control and management of resources. Land and forest policies have to support each other. In some countries, a progressive land policy fails in the forestry sector because of disabling forestry policies—and vice versa. While national forest policy and legislation may need attention, as important in the context of decentralization will be the need to support the creation and enforcement of management rules at more local levels.

Getting forestry onto the decentralization agenda

Decentralization—the transfer of authority and responsibility for public functions from the central government to intermediate and local governments or organizations—is increasingly a theme of rural development in southern Africa. It has immediate relevance for forest organizations and for

miombo woodland management, but forestry is seldom clearly on the national decentralization agenda. A growing body of experience with decentralization has shown that at least five conditions are important to its success, and these have direct relevance for the effectiveness of efforts to engage communities in local woodland management.

- The decentralization framework must link fiscal authority with service provision responsibilities so that local politicians can bear the costs of their decisions and deliver on their promises. Decentralized woodland management is one thing, but if it comes with fiscal strings attached that compel the community to finance these investments on their own, it will likely fail.
- Communities must be fully informed about the costs of various service delivery options and the resource envelope and its sources so that the decisions they make are meaningful. Managing stakeholder expectations viz. woodland management possibilities is critical.
- The community must have a mechanism to express its preferences in a way that is binding so that there is a credible incentive for people to participate. Locally established forest by-laws and rules offer some scope for doing this.
- There must be a system of accountability that relies on transparent information flows, which enables communities effectively to monitor what is happening with their woodlands.
- The instruments of decentralization—the legal and institutional framework, the structure of service delivery responsibilities, and the intergovernmental fiscal system—are designed to support the political objectives.

The idea of building stronger decentralized local organizations does not necessarily mean that this has to be done through local “forestry” organizations. In fact, supporting and establishing local forestry organizations may be part of the structural problem because forestry is out of the mainstream development agenda. Rather, attention should be focused on the lowest level of government (e.g., down to village development committees), on producer organizations, and on civil society organizations. The challenges include enhancing the legitimacy of such organizations; ensuring such organizations are a conduit for appropriate information to the poor; making such organizations effective watchdogs against local elite control and corruption by petty officials; and ensuring that local organizations have the capacity and resources to deal with powerful external agents that misappropriate miombo resources. Significant efforts will be needed around social mobilization, institutional development, and capacity building to strengthen local community groups.

Enhancing forest-based markets for products and services

Attempts to develop novel products and new markets have not always been successful, while at the other end of the spectrum, many local markets and products show low returns and limited potential for value addition and growth (Shackleton 2007). Numerous factors, both within and outside of the natural resource sector, constrain the development of viable and sustainable small-scale enterprises. De facto open access resource regimes, unsustainable harvesting and management practices, and policy environments that implicitly or explicitly disadvantage local resource management have hindered the supply side.

On the marketing side, sometimes the context and external environment is not supportive of market-based activities, for example infrastructure to remote communities may be inadequate (Mutamba, technical annex 1). Severe limitations in human capacity caused by poor education and

health services and weak political power, have undermined the bargaining positions of producers and hampered the development of successful enterprises. In many instances, significant regulatory and other barriers either prohibit the entry of small-scale entrepreneurs or prevent them from moving beyond the informal sector. Frequently, development, and business support to assist small-scale entrepreneurs with the skills, technologies, organizational capacity, and financial capital to exploit market opportunities or expand their activities in any meaningful way is nonexistent, woefully inadequate, or inappropriately targeted.

Establish simple regulatory frameworks or requirements

In some instances, the forest regulatory framework has not been aligned with the value of the resource, making transaction costs too high for poor producers. In other cases the regulatory framework has done little more than act as a means for officials to extract resources for personal gain. More externally imposed forest rules provide more opportunities for undermining local governance. Regulatory simplification would be an obvious strategy for helping increase value-added to local forest users.

Support producer organizations

To ensure market participation, well-established and effective local organizations are needed to coordinate 'bulking up' of resources, benefit from economies of scale in reducing transport costs, maintain quality standards, improve market recognition and supply chain capability, and act as a watchdog against corrupt practices of regulators. These organizations can help to improve market engagement, but, in general such organizations are lacking.

There are some exceptions. For example, in Namibia, the Eudafano Women's Cooperative, which produces marula seed oil and has more than 5,000 members, coordinates seed collection and oil pressing to deliver high-value oils to the European cosmetic market. Similarly in Zambia, North Western Bee Products (NWBPs) has invested in quality control training along the supply chain, as well as in organic honey certification, and is able to coordinate supplies to get them to export markets in Europe.²⁵ In southern Africa, the eight-country network PhytoTrade Africa operates as an umbrella body for smaller member businesses (box 2.1).

²⁵ The honey competes with the large volume suppliers such as China by being high quality and organic.

- Abbot, J.I.O. and K.A. Homewood. 1999. "The History of Change: Causes of Miombo Woodland Decline in a Protected Area in Malawi." *Journal of Applied Ecology* 36: 422–33.
- Abbot, P.G. 1997. "The Supply and Demand Dynamics of Miombo: An Analysis of Household Responses." LTS International, Penicuik, UK.
- Anderson, J., C. Benjamin, B. Campbell, and D. Tiveau. 2006. "Forests, Poverty and Equity in Africa: New Perspectives on Policy and Practice." *International Forestry Review* 8:44–53.
- Andersen, K.H. 2006. "Resources and Conflict in Angola: An Economic Conflict Analysis." Department of Economics, University of Oslo.
- Arnold, J.E.M. and P.A. Dewees, eds. 1997. *Farms, Trees and Farmers: Responses to Agricultural Intensification*. London: Earthscan Publications.
- Arnold, J.E.M., G. Köhlin, and R. Persson. 2006. "Woodfuels, Livelihoods, and Policy Interventions: Changing perspectives." *World Development* 34:596–611.
- Backéus, I., B. Pettersson, L. Strömquist, and C. Ruffo. 2006. "Tree Communities and Structural Dynamics in Miombo (Brachystegia–Julbernardia) Woodland, Tanzania." *Forest Ecology and Management* 230:171–8.
- Ball, S.J.M. 2004. "Stocks and Exploitation of East African Blackwood: A Flagship Species for Tanzania's Miombo Woodlands?" *Oryx* 38: 1–7.
- Balint, P. and J. Mashinya. 2006. "The Decline of a Model Community-Based Conservation Project: Governance, Capacity, and Devolution in Mahenye, Zimbabwe." *Geoforum* 37:805–15.
- Banda, T., M.W. Schwartz, and T. Caro. 2006. "Effects of fire on germination of *Pterocarpus angolensis*." *Forest Ecology and Management*, Volume 233, Issue 1, 1 September 2006: 116–120.
- Bandyopadhyay, S., P. Shyamsundar, L. Wang, and M.N. Humavindu. 2004. "Do Households Gain from Community-Based Natural Resource Management? An evaluation of community conservancies in Namibia." DEA Research Discussion Paper 68. Directorate of Environmental Affairs, Ministry of Environment and Tourism, Windhoek, Namibia.
- Barany, M., A.L. Hammett, K. Stadler, and E. Kengni. 2004. "Non-Timber Forest Products in the Food Security and Nutrition of Smallholders Afflicted by HIV/AIDS in Sub-Saharan Africa." *Forests, Trees and Livelihoods* 14: 3–18.
- Beale, D. 1995. "Tree! What Tree? An Ecological Economic Approach to Producing a Sustainable Mpingo Trade" (unpublished Master's thesis, University of Edinburgh).
- Blaikie, P. 2006. "Is Small Really Beautiful? Community-Based Natural Resource Management in Malawi and Botswana." *World Development* 34: 1942–57.
- Blomley, T. 2006. "Mainstreaming Participatory Forestry Within the Local Government Reform Process in Tanzania." Gatekeeper Series 128, London: IIED.

- Blomley, T. and H. Ramadhani. 2006. "Going to Scale with Participatory Forest Management: Early Lessons from Tanzania." *International Forestry Review* 8: 93–100.
- Bond, I., M. Chambwera, B. Jones, M. Chunduma, and I. Nhantumbo. 2010. *REDD+ in Dryland Forests: Issues and prospects for pro-poor REDD in the Miombo Woodlands of Southern Africa*. Natural Resources Issues No. 21. IIED, London.
- Botha, J., E.T.F. Witkowski, and C.M. Shackleton. 2004. "Market Profiles and Trade in Medicinal Plants in the Lowveld, South Africa." *Environmental Conservation* 31: 38–46.
- Bradley, P. and Dewees, P. 1993. Indigenous woodlands, agricultural production and household economy in the communal areas. P. Bradley and K. McNamara, eds. *Living with trees: policies for forestry management in Zimbabwe*. Washington, D.C.: World Bank, 63–138.
- Brockington, D. 2007. "Forests, Community Conservation, and Local Government Performance: The Village Forest Reserves of Tanzania." *Society and Natural Resources* 20: 835–48.
- Brouwer, R. and M.P. Falcao. 2004. "Woodfuel Consumption in Maputo, Mozambique." *Biomass and Bioenergy* 27: 233–45.
- Campbell, B.M., W. de Jong, M. Luckert, A. Mandondo, F. Matose, N. Nemarundwe, and B. Sithole. 2001. "Challenges to Proponents of Common Property Resource Systems: Despairing Voices from the Social Forests of Zimbabwe." *World Development* 29(4):589–600.
- Campbell, B.M., P. Frost, and N. Byron. 2006. "Miombo Woodlands and Their Use: Overview and Key Issues." In *The Miombo in Transition: Woodlands and Welfare in Africa*, ed. B. Campbell, 1–10. Bogor, Indonesia: CIFOR.
- Campbell, B.M., S. Jeffrey, M. Luckert, M. Mutamba, and C. Zindi. 2002. "Household Livelihoods in Semi-Arid Regions: Options and Constraints." Bogor, Indonesia: CIFOR.
- Campbell, B.M., S.J. Vermeulen, J.J. Mangono, and R. Mabugu. 2003. "The Energy Transition in Action: Domestic Fuel Choices in a Changing Zimbabwe." *Energy Policy* 31: 553–62.
- Caro, T.M., M. Sungula, M.W. Schwartz, and E.M. Bella. 2005. "Recruitment of *Pterocarpus angolensis* in the Wild." *Forest Ecology and Management* 219 (2-3): 169–75.
- Cavendish, W. 2000. "Empirical Regularities in the Poverty-Environment Relationship in Rural Households: Evidence from Zimbabwe." *World Development* 28 (11): 1979–2003.
- Cavendish, W. 2002. "Quantitative Methods for Estimating the Economic Value of Resource Use to Rural Households." In *Uncovering the Hidden Harvest: Valuation Methods for Woodland and Forest Resources*, eds. B.M. Campbell and M.K. Luckert, People and Plants Conservation Series. London: Earthscan.
- Chhatre, A. and A. Agrawal. 2008. "Forest Commons and Local Enforcement." *PNAS*. September 9, 2008. 105(36): 13286–91.
- Chidumayo, E.N. 2002. "Changes in Miombo Woodland Structure Under Different Land Tenure and Use Systems in Central Zambia." *Journal of Biogeography* 29: 1619–26.
- Chidumayo, E.N. 2004. "Development of Brachystegia-Julbernardia Woodland After Clear-Felling in Central Zambia: Evidence for High Resilience." *Applied Vegetation Science* 7: 237–42.
- Chidumayo, E.N. 2005a. "Key External Underlying Threats to Dry Forests of Sub-Saharan Africa: A Case Study of Urbanization and Climate Change." Unpublished report. University of Zambia, Lusaka, Zambia.
- Chidumayo, E.N. 2005b. "Effects of Climate on the Growth of Exotic and Indigenous Trees in Central Zambia." *Journal of Biogeography* 32: 111–20.

- Chidumayo, E.N., J. Gambiza, and I. Grundy. 1996. "Managing Miombo Woodlands." In *The Miombo in Transition: Woodlands and Welfare in Africa*, ed. B. Campbell, 59-71. Bogor, Indonesia: CIFOR.
- Chomitz, K.M. 2007. *At Loggerheads: Policies for Development, Poverty Alleviation and Environment in the Worlds' Tropical Forests*. Washington, DC: World Bank.
- CIFOR. 2004. "Making Dry Forests Work for the Poor in Africa: Building on Success." CIFOR Livelihood Brief, No. 3.
- Coleman, E.A. 2009. "Institutional Factors Affecting Biophysical Outcomes in Forest Management." *Journal of Policy Analysis and Management* 28(1):122-46.
- Collier, P. 2007. *The Bottom Billion: Why the Poorest Countries Are Failing and What Can Be Done About It*. Oxford, UK: Oxford University Press.
- Cunningham, A.B. 2001. *Applied Ethnobotany: People, wild plant use and conservation*. London: Earthscan
- Cunningham, A.B. 1996a. "Saturniid Subsidy: Cash and Protein from Edible Caterpillars of Zambesian Woodlands." In *The Miombo in Transition: Woodlands and Welfare in Africa*, ed. B. Campbell. Bogor, Indonesia: CIFOR.
- De Boer, C. 2003. "Certified Organic Mushroom Collection in Zambia." Organic Producers and Processors Association of Zambia.
- Deaton, A. 1980. "The Measurement of Welfare: Theory and Practical Guidelines." LSMS Working Paper No. 7, World Bank, Washington, DC.
- Deininger, K. and D. Byerlee 2011. *Rising Global Interest in Farmland: Can It Yield Sustainable and Equitable Benefits?* Washington DC: World Bank.
- Desmet, P.G., C.M. Shackleton, and, E.R. Robinson. 1996. "The Population Dynamics and Life History Attributes of a *Pterocarpus angolensis* Population in the Northern Province, South Africa." *South African Journal of Botany* 62: 160-66.
- Deweese, P. 1995. "Forest Policy and Woodfuel Markets in Malawi." *Natural Resources Forum* 19: 143-52.
- Duncombe, R., and R. Heeks. 2002. "Enterprise Across the Digital Divide: Information Systems and Rural Microenterprise in Botswana." *Journal of International Development* 14: 61-74.
- Economist. 2005. "Mobile Phones and Developing: Calling an End to Poverty." *The Economist* 376 (July 7): 51-52.
- Ellis, F., M. Kutengule, and A. Nyasulu. 2003. "Livelihoods and Rural Poverty Reduction in Malawi." *World Development* 31: 1495-1510.
- Ellis, F., and N. Mdoe. 2003. "Livelihoods and Rural Poverty Reduction in Tanzania." *World Development* 31: 1367-84.
- Evans, A., L. Cabral, and D. Vadrjal. 2006. *Sector-Wide Approaches in Agriculture and Rural Development: Desk Review of Experience, Issues and Challenges*. London: ODI.
- Fairhead, J. and M. Leach. 1998. *Reframing Deforestation: Global Analysis and Local Realities: Studies in West Africa*. London: Routledge.
- Fakir, S. 2003. "Ensuring a Pro-poor Focus in Agriculture and Rural Development Through NEPAD." IUCN (World Conservation Union)-SA Report <http://www.sarpn.org.za/documents/d0000491/index.php>.
- Fischer, F.U. 1993. "Beekeeping in the Subsistence Economy of the Miombo Savanna Woodlands of South-Central Africa." In *NTFPs: Three Views from Africa*. Rural Development Forestry Network. Network Paper 15c.
- Fisher, M. 2004. "Household Welfare and Forest Dependence in Southern Malawi." *Environment and Development Economics* 9: 135-54.
- Fisher, M., and, G.E. Shively 2005. "Can Income Programs Reduce Tropical Forest Pressure? Income Shocks and Forest Use in Malawi." *World Development* 37(7): 1115-28.

- Fisher, M. and G.E. Shively. 2007. "Agricultural Subsidies and Forest Pressure in Malawi's Miombo Woodlands". *Journal of Agricultural and Resource Economics* 32: 349–62.
- Food and Agriculture Organization of the United Nations (FAO). 2005. "Miombo Woodlands and HIV/AIDS Interactions - Mozambique Country Report." Forestry Policy and Institutions Working Paper 2. FAO, Rome, Italy. <http://www.fao.org/docrep/008/j5251e/j5251e00.htm>.
- FAO. 2011. *State of the World's Forests 2011*. Rome, Italy: Food and Agriculture Organization of the United Nations.
- Frost, P.G.H. 1996. "The Ecology of Miombo Woodlands" In *The Miombo in Transition: Woodlands and Welfare in Africa*, ed. B. Campbell, 11–57. Bogor, Indonesia: CIFOR.
- Frost, P.G.H. and I. Bond. Forthcoming. "The Zimbabwean CAMPFIRE Programme as a Payment for Environmental Services Scheme." Article submitted to special issue of *Ecological Economics*.
- Frost, P.G.H., J. Timberlake, and E. Chidumayo. 2003. "Miombo-Mopane Woodlands and Grasslands." In *Wilderness: Earth's Last Wild Places*, eds. R. Mittermeier, C. Goettsch Mittermeier, P. Robles Gil, G. Fonseca, T. Brooks, J. Pilgrim and W. Konstant, 183–204. Chicago: University of Chicago Press.
- Gibbon, H., D. Mbithi, E.N. Mugo, and M. Phiri. 2005. "Forest and Woodland Management in East and Central Africa: Emerging Models for Improvement in Livelihoods and Natural Resource Management in Kenya and Zambia." *International Forestry Review* 7: 193–207.
- Goldman, M. 2003. "Partitioned Nature, Privileged Knowledge: Community-Based Conservation in Tanzania." *Development and Change* 34: 833–62.
- Grundy, I.M., B.M. Campbell, S. Balebereho, R. Cunliffe, C. Tafangenyasha, R. Fergusson, and D. Parry. 1993. "Availability and Use of Trees in Mutanda Resettlement Area, Zimbabwe." *Forest Ecology and Management* 56: 243–66.
- Gulinck, H., N. Vyverman, K. Van Bouchout, and A. Gobin. 2001. "Landscape as Framework for Integrating Local Subsistence and Ecotourism: A Case Study in Zimbabwe." *Landscape and Urban Planning* 53:173–82.
- Hegde, R. "Contributions of Miombo Woodlands to Household Economy and Socio-Economic Determinants of Woodland Use: The Case of Mozambique" (unpublished manuscript).
- Hofstad, O. 1997. "Woodland Deforestation by Charcoal Supply to Dar es Salaam." *Journal of Environmental Economics and Management* 33:17–32.
- Hofstad, O. 1993. Woodland management practices in Zimbabwe. In: Pierce, G.D. and Gumbo, D.J. (eds) The ecology and management of indigenous forests in Southern Africa, 51-61. Proceedings of an international symposium, Victoria Falls, Zimbabwe, 27-29 July 1992. Zimbabwe Forestry Commission and SAREX, Harare.
- International Energy Agency (IEA). 2002. "Energy and Poverty" (chapter 13). In *World Energy Outlook 2002*. Paris, France: Organisation for Economic Co-operation and Development (OECD).
- International Fund for Agricultural Development (IFAD). 2006. "Bringing Markets Closer in the United Republic of Tanzania." Update Issue 2. IFAD, Rome.
- Jenkins, M., S. Oldfield, and T. Aylett. 2002. *International Trade in African Blackwood*. Cambridge, UK: Fauna and Flora International.
- Kajembe, G. C., and G. C. Monela. 2000. "Empowering Communities to Manage Natural Resources: Where Does the New Power Lie? A Case Study of Duru-Haitemba, Babati, Tanzania." In *Empowering Communities to Manage Natural Resources: Case Studies from Southern Africa*, eds. S. Shackleton and B. M. Campbell, 125–35. Bogor, Indonesia: CIFOR.

- Kambewa, P.S., B.F. Mataya, W.K. Sichinga, and T.R. Johnson. 2007. "Charcoal: The Reality: A Study of Charcoal Consumption, Trade and Production in Malawi." Community Partnerships for Sustainable Resource Management in Malawi.
- Kayambazinthu, D., M. Barany, R. Mumba, and C. Holding Anyonge. 2005. "Miombo Woodlands and HIV/AIDS Interactions: Malawi Country Report." FAO - Forestry Policy and Institutions Working Paper 6. <http://www.fao.org/docrep/008/j6038e/j6038e00.htm>.
- Kayambazinthu, D., F. Matose, G.C. Kajembe, and N. Nemarundwe. 2003. "Institutional Arrangements Governing Natural Resource Management of the Miombo Woodland." In *Policies and Governance Structures in Woodlands of Southern Africa*, eds., G. Kowero, B.M. Campbell, and, U.R. Sumaila, 45–79. Bogor, Indonesia: CIFOR.
- Keith, H., B.G. Mackey, and D.B. Lindenmayer. 2009. "Re-Evaluation of Forest Biomass Carbon Stocks and Lessons from the World's Most Carbon-Dense Forests." *PNAS* 106 (28): 11635–40.
- Kobb, D. 2001. Improving Forestry Revenue Collection in Tanzania. Unpublished Working Paper prepared for the World Bank (February 20, 2001). Dar es Salaam, Tanzania.
- Kowero, G., B.M. Campbell, and U.R. Sumaila, eds. 2003. *Policies and Governance Structures in Woodlands of Southern Africa*. Bogor, Indonesia: CIFOR.
- Krog, M., M. Falcão, and C. Olsen. 2005. "Comercialização de Plantas Mediciniais em Maputo. Departamento de Engenharia Florestal. Faculdade de Agronomia e Engenharia Florestal." Universidade Eduardo Mondlane. Maputo. Boletim Matéria Prima 4:3–12.
- Kumar, S. 2002. "Does 'Participation' in Common Pool Resource Management Help the Poor? A Social Cost–Benefit Analysis of Joint Forest Management in Jharkhand, India." *World Development* 30: 763–82.
- Kundhlande, G. 2000. "Economic Behavior of Developing Country Farm-Households: Measures of Rates of Time Preference, the Use of Cattle as Buffer Stocks, and the Endogenous Evolution of Land Rights." Ph.D. thesis, Department of Rural Economy, University of Alberta).
- Le Billon, P. 2005. "Aid in the Midst of Plenty: Oil Wealth, Misery and Advocacy in Angola." *Disasters* 29: 1-25.
- Logan, B.I., and W.G. Moseley. 2002. "The Political Ecology of Poverty Alleviation in Zimbabwe's Communal Areas Management Programme for Indigenous Resources (CAMPFIRE)." *Geoforum* 33: 1–14.
- Lowore, J. 2006. *Miombo Woodlands and Rural Livelihoods in Malawi*. Bogor, Indonesia: CIFOR.
- Lowore, J. and E. Boa. 2001. "Local Practices and Indigenous Knowledge of Wild Edible Fungi: Bowa Markets in Malawi." Prepared for the Miombo Edible Fungi Project, DFID.
- Lund, J.F. 2007. "Is Small Beautiful? Village Level Taxation of Natural Resources in Tanzania." *Public Administration and Development*.
- Luoga, E.J., E.T.F. Witkowski, and K. Balkwill. 2000. "Economics of Charcoal Production in Miombo Woodlands of Eastern Tanzania: Some Hidden Costs Associated with Commercialization of the Resources." *Ecological Economics* 35: 243–57.
- Lund, J.F. and Treue, T. "Are We Getting There? Evidence of Decentralized Forest Management from the Tanzanian Miombo Woodlands." *World Development*. Volume 36, Issue 12, December 2008: 2780-2800.
- Luoga, E.J., E.T.F. Witkowski, and K. Balkwill. 2004. "Regeneration by Coppicing (Resprouting) of Miombo (African Savanna) Trees in Relation to Land Use." *Forest Ecology and Management* 189: 23–35.
- Mackenzie, C. 2006. *Forest Governance in Zambezia, Mozambique: Chinese Takeaway!* Final report for the Forum of NGOs in Zambezia (FONGZA).

- Mander, M. 1998. *Marketing of Indigenous Medicinal Plants in South Africa: A Case Study in KwaZulu-Natal* Rome, Italy: FAO.
- Mander, M., and G.L. Le Breton. 2006. "Overview of the Medicinal Plant Industry in Southern Africa." In *Commercialising Medicinal Plants: A Southern African Guide*, ed. N. Diederichs, 1–9. Stellenbosch, South Africa: Sun Press.
- Mapedza, E. 2004. "Compromised Co-Management, Compromised Outcomes: Experiences from a Zimbabwean Forest." Paper presented at the IASCP 2004 Biannual Conference, Oaxaca, Mexico.
- Mapedza, E. and A. Mandondo. 2000. *Co-Management in the Mafungautsi State Forest Area of Zimbabwe: What Stakes for Local Communities*. Environmental Governance in Africa. Working Paper Series. World Resources Institute, Washington, DC.
- Marzoli, A. 2007. "Inventário florestal nacional" (Draft Report). Avaliação florestal integrada de Moçambique. Ministério da Agricultura. Maputo, Mozambique.
- Masanyanya, S.W. and J.S. Mgoo. 2001. "Basic Assessment of Benefits and Costs Sharing and Other Issues Affecting Joint Forest Management (JFM) and Community-Based Forest Management (CBFM)." Ministry of Natural Resources and Tourism, Forestry and Beekeeping Division.
- Matakala, P. and P. Mushove. 2001. "Arranjos institucionais para o manejo comunitário dos recursos naturais (MCRN): perfis e análise de 42 iniciativas de MCRN em Moçambique." Ministério da Agricultura e Desenvolvimento Rural, Maputo.
- Matose, F. 2006. "Co-Management Options for Reserved Forests in Zimbabwe and Beyond: Policy Implications of Forest Management Strategies." *Forest Policy and Economics* 8: 363–74.
- Mayaux, P., E. Bartholome, S. Fritz, and A. Belward. 2004. "A New Land-Cover Map of Africa for the Year 2000." *Journal of Biogeography* 31: 861–77.
- McSweeney, K. 2002. "Who Is Forest Dependent? Capturing Local Variation in Forest-Product Sale, Eastern Honduras." *The Professional Geographer* 54: 158–74.
- Meshack, C.K., B. Ahdikari, N. Doggart, and J.C. Lovett. 2006. "Transaction Costs of Community-Based Forest Management: Empirical Evidence from Tanzania." *African Journal of Ecology* 44: 468-477.
- Mickels-Kokwe, G. 2006. *Small-Scale Woodland-Based Enterprises with Outstanding Economic Potential: The Case of Honey in Zambia*. Bogor, Indonesia: CIFOR.
- Milledge, S., I. Gelvas, and A. Ahrends. 2007. *Forestry, Governance, and National Development: Lessons Learned from a Logging Boom in Southern Tanzania*. TRAFFIC, Tanzania Ministry of Forestry and Tourism, and Tanzania Development Partners Group, Dar es Salaam, Tanzania.
- Millington, A.C., R.W. Critchley, T.D. Douglas, and P. Ryan. 1994. *Estimating Woody Biomass in Sub Saharan Africa*. Washington, DC: World Bank.
- Misana, S., G.C. Jambiya, and B. Mchome. 2005. "Charcoal Potential of Miombo Woodlands at Kitulungalo, Tanzania." *Journal of Tropical Forest Science* 17: 197–210.
- Mittermeier, R.A., C.G. Mittermeier, T.M. Brooks, J.D. Pilgrim, W.R. Konstant, G.A.B. da Fonseca, and C. Kormos. 2003. "Wilderness and Biodiversity Conservation." *Proceedings of the National Academy of Science* 100: 10309–13.
- Mlay, G., F. Turuka, G. Kowero, and R. Kachule. 2003. "Agricultural Policies and Forestry Development in Malawi, Mozambique, Tanzania, and Zimbabwe: Complementarities and Conflicts." In *Policies and Governance Structures in Woodlands of Southern Africa*, eds. G. Kowero, B. M. Campbell, and U. R. Sumaila, 138–64. Bogor, Indonesia: CIFOR.

- Moore, K. and J.E. Hall. 1987. "Report of a Mission to Assess the Management and Conservation of *Dalbergia melanoxylon*, or the Mpingo, in Tanzania" (unpublished report). United Nations Environment Programme, Nairobi, Kenya.
- Morris, B. 1994. "Bowa: Ethnomycological Notes on the Macrofungi of Malawi." In *Proceedings of the XII AETFAT Congress*, Malawi, eds. J.H. Seyani and A.C. Chikuni, 635–47.
- Müller, C., W. Cramer, W.L. Hare, and H. Lotze-Campen. 2011. "Climate Change Risks for African Agriculture." *PNAS* 108 (11): 4313–15.
- Munishi, P.K.T., S. Mringi, D. Shirima, and S.K. Linda. 2010. "The Role of the Miombo Woodlands of the Southern Highlands of Tanzania as Carbon Sinks." *Journal of Ecology and the Natural Environment* 2 (12): 261–69.
- Mutumukuru, T., W. Kozanayi, and R. Nyirenda. 2006. "Catalyzing Collaborative Monitoring Processes in Joint Forest Management Situations: The Mafungautsi Forest Case, Zimbabwe." *Society and Natural Resources* 19: 209–24.
- Mwakatobe, A. and C. Mlingwa. 2005. "The Marketing of Bee Products in Tanzania." Paper presented at the "Bees for Development Honey Trade Workshop," Dublin, Ireland, August 2005. http://www.beesfordevelopment.org/info/proceedings_HTW1/tanzania_marketing_bee_products.htm.
- Mwampamba, T.H. 2007. "Has the Woodfuel Crisis Returned? Urban Charcoal Consumption in Tanzania and Its Implications to Present and Future Forest Availability." *Energy Policy* 35: 4221–34.
- Naughton-Treves, L., M. Buck Holland, and K. Brandon. 2005. "The Role of Protected Areas in Conserving Biodiversity and Sustaining Local Livelihoods." *Annual Review Environmental Resources* 2005. 30:219–252.
- Nemarundwe, N. 2003. "Negotiating Resource Access: Institutional Arrangements for Woodlands and Water Use in Southern Zimbabwe." Ph.D. thesis, Swedish University of Agricultural Sciences. Acta Universitatis Agriculturae Sueciae Agraria 408. Uppsala, Sweden.
- Nemarundwe, N. 2004. "Social Charters and Organisation for Access to Woodlands: Institutional Implications for Devolving Responsibilities for Resource Management to the Local Level in Chivi District, Zimbabwe." *Society and Natural Resources* 17: 279–291.
- Ngaga, Y. M., E. Munyanziza, and H. E. Masalu. 2006. "The Role of Wild Mushrooms in the Livelihoods of Rural People in Kiwele Village, Iringa, Tanzania: Implications for Policy." *Discovery and Innovation* 18: 246-251.
- Nhantumbo, I., and J. S. Soto. 1994. "Mercado de produtos madeiros e não-madeiros." FAO: MOZ/92/013. Ministério de Agricultura, Maputo.
- Nielsen, O. J., R. Bandeira, F. Helles, K. Kamelarczyk, A. Macucule, G. Mlay, C.S. Olse, A. Siteo, and M.A. Taquidir. 2006. *Forests and Livelihoods in Mozambique. A Literature Review and Annotated Bibliography*. University Eduardo Mondlane and Danish Centre for Forest Landscapes and Planning, Maputo and Copenhagen.
- Odera, K. 2004. "Community-Based Enterprises: Their Role in Sustainable Natural Resource Management and Rural Livelihoods in Zimbabwe." Paper prepared for the Tenth Biennial Conference of the International Association for the Study of Common Property (IASCP), Oaxaca, México, August 9–13, 2004.
- Openshaw, K. 1997. "Malawi: Biomass Energy Strategy Study." Background paper for World Bank Energy Study of Malawi.
- Overa, R. 2006. "Networks, Distance and Trust: Telecommunications Development and Changing Trading Practices in Ghana." *World Development* 34 (7): 1301–15.

- Pagiola, S., A. Arcenas, and G. Platais. 2005. "Can Payments for Environmental Services Help Reduce Poverty? An Exploration of the Issues and the Evidence to Date from Latin America." *World Development* 33: 237–53.
- Pattanayak, S.K., and E.O. Sills. 2001. "Do Tropical Forests Provide Natural Insurance?: The Microeconomics of Non-Timber Forest Product Collection in the Brazilian Amazon." *Land Economics* 77: 595–612.
- Pereira, C. 2002. *Chaposa: Charcoal Potential in Southern Africa – Mozambique Country Report. Final Report*. Department of Forestry, Eduardo Mondlane University, Maputo, Mozambique.
- Petersen, L. and A. Sandhövel. 2001. "Forestry Policy Reform and the Role of Incentives in Tanzania." *Forest Policy and Economics* 2: 39–55.
- Pearce, G.D., and T.T. Chitempa. 1984. "Records and Collections of Macrofungi in the Teak Forests Region." In *The Zambezi Teak Forests. Proceedings of the First International Conference on the Teak Forests of Southern Africa*. 258–70. Livingstone, Zambia. March 1984. Zambia Forest Department, Ndola.
- Ribot, J. 2010. "Democratic Decentralization in Sub-Saharan Africa: Its Contribution to Forest Management, Livelihoods, and Enfranchisement." *Environmental Conservation* 37 (1): 35.
- Roda, J-M., M. Mutamba, B.M. Campbell, and G.S. Kowero. 2005. Forest-Based Livelihoods and Poverty Reduction: Paths from Local to Global Development. In *Forests in the Global Balance—Changing Paradigms*, eds. G. Mery, R. Alvaro, M. Kanninen, and M. Lobovikov, IUFRO World Series 17:75–96.
- Rodgers, A., J. Salehe, and G. Howard. 1996. "The Biodiversity of Miombo Woodlands." In *The Miombo in Transition: Woodlands and Welfare in Africa*, ed. B. Campbell, 12. Bogor, Indonesia: CIFOR.
- Ruiz Perez, M., B. Belcher, R. Achdiawan, M.N. Alexiades, C. Aubertin, C.J. Caballero, B.M. Campbell, C. Clement, A.B. Cunningham, A.C. Fantini, H. De Foresta, C. Garcia-Fernandez, K.H. Gautam, P.H. Martinez, W. de Jong, K. Kusters, M.G. Kutty, C., Lopez, M.A.M. Maoyi Fu, Alfaro, T.K.R. Nair, O. Ndoye, R. Ocampo, N. Rai, M. Ricker, K. Schreckenberg, S. Shackleton, P. Shanley, T.C.H. Sunderland, and C.Y. Yeo. 2004. "Markets Drive the Specialization Strategies of Forest Peoples." *Ecology and Society* 9(2). <http://www.ecologyandsociety.org/vol9/iss2/art4/>.
- Schafer, J., and R. Bell. 2002. "The State and Community-Based Natural Resource Management: the Case of the Moribane Forest Reserve, Mozambique." *Journal of Southern African Studies* 28: 401–20.
- Scholes, R. J., and R. Biggs, eds. 2004. *Ecosystem Services in Southern Africa: a Regional Assessment*. Pretoria: CSIR.
- Scholes, R.J. 1996. "Miombo woodlands and carbon sequestration." *The Miombo in Transition: Woodlands and Welfare in Africa*, ed. B.Campbell, 28. Bogor, Indonesia: CIFOR.
- Shackleton, S.E. 2005a. "Bowls, Spoons and Other Useful Items: The Kiaat Woodcrafters of Bushbuckridge, South Africa." In *Carving Out a Future: Forests, Livelihoods and the International Woodcarving Trade*, eds. A. Cunningham, B. Campbell, and B. Belcher. People and Plants Conservation Series. London, Earthscan.
- Shackleton, S.E. 2005b. "The Significance of the Local Trade in Natural Resource Products for Livelihoods and Poverty Alleviation in South Africa." Ph.D. thesis, Rhodes University, Grahamstown, South Africa.
- Shackleton, S.E. 2006. *Forests as Safety Nets for Mitigating the Impacts of HIV/AIDS in Southern Africa*. Forest Livelihood Briefs, No. 4. CIFOR, Bogor, Indonesia.
- Shackleton, S. 2007. "Background Paper on Small Scale Forest Based Enterprise Development." Working Paper, CIFOR, Bogor, Indonesia.

- Shackleton, S., B.M. Campbell, H. Lotz-Sisitka, and C.M. Shackleton. 2008. "Links Between the Local Trade in Natural Products, Livelihoods and Poverty Alleviation in a Semi-Arid Region of South Africa." *World Development* 36: 505–526.
- Shackleton, S., B.M. Campbell, E. Wollenberg, and D. Edmunds. 2002. "Devolution and Community-Based Natural Resource Management: Creating Space for Local People to Participate and Benefit?" *Natural Resources Perspectives (ODI)* 76:1-6, <http://www.odi.org.uk/nrp/76.pdf>.
- Shackleton, S., and D. Gumbo. 2010. "The Dry Forests and Woodlands of Africa: Managing for Products and Services." In *The Dry Forests and Woodlands of Africa: Managing for Products and Services*, eds. E. N. Chidumayo, and D. J. Gumbo, 63-91. London: Earthscan.
- Sitoe, A., B. Guedes, and S. Sitoe. "Avaliação dos modelos de manejo comunitário dos recursos naturais em Moçambique" (unpublished manuscript). Faculty of Agronomy and Forestry, Eduardo Mondlane University, Maputo, Mozambique. Draft Report.
- Songorwa, A. 1999. "Community-Based Wildlife (CBW) Management in Tanzania: Are the Communities Interested?" *World Development* 27 (12): 2061–79.
- Souter, D., N. Scott, C. Garforth, R. Jain, O. Mascarenhas, and K. Mc Kerney. 2005. "The Economic Impact of Telecommunications on Rural Livelihoods and Poverty Reduction: A Study of Rural Communities in India (Gujarat), Mozambique, and Tanzania." <http://www.telafrica.org/R8347/3les/pdfs/FinalReport.pdf>.
- Sprague, D.S. and S. Oyama, 1999. Density and Distribution of Chitemene Fields in a Miombo Woodland Environment in Zambia. *Environmental Management* 24: 273–80.
- Standa-Gunda, W., I. Bond, B.M. Campbell, and L. Petheram. 2007. "Exploring Woodcarving Markets to Determine the Potential of Fiscal Instruments for Improving Woodland Management: The Case of Woodcarving in Southern Zimbabwe." *Forests, Trees and Livelihoods* 17: 61–73.
- Stockholm Environment Institute (SEI). 2002. "Charcoal Potential in Southern Africa, CHAPOSA: Final Report." INCO-DEV. SEI, Stockholm, Sweden.
- Sunderlin, W.D., A. Angelsen, B. Belcher, P., Burgers, R. Nasi, L. Santoso, and S. Wunder. 2005. "Livelihoods, Forests, and Conservation in Developing Countries: An Overview." *World Development* 33: 1383–1402.
- Sunderlin, W. D., A. Angelsen, and S. Wunder. 2003. "Forests and Poverty Alleviation." In *State of the World's Forests: 2003*, ed. Food and Agriculture Organization of the United Nations (FAO), 61–73. Rome, Italy: FAO.
- Sunderlin, W. D., S. Dewi, and A. Puntodewo. 2007. "Poverty and Forests: Multi-Country Analysis of Spatial Association and Proposed Policy Solutions." CIFOR Occasional Paper Number 47. CIFOR, Bogor, Indonesia.
- Tairo, V.E. 2007. "The Composition and Regeneration Status of Wild Food Plants in Chenene Miombo Woodland, Dodoma Rural District, Tanzania." *Discovery and Innovation* 19: 107–111.
- Takasaki, Y., B.L. Barham, and O.T. Coomes. 2004. "Risk Coping Strategies in Tropical Forests: Floods, Illnesses, and Resource Extraction." *Environment and Development Economics* 9: 203–224.
- Tieguhong, J.C. and O. Ndoye. 2006. "Transforming Subsistence Products to Propellers of Sustainable Rural Development: Non-Timber Forest Products (NTFPs) Production and Trade in Cameroon." In *African Development Perspectives Yearbook, Vol. 11: Africa: Escaping the Primary Commodities Dilemma*, eds. K. Wohlmuth, P. Burger, A. Gutowski, M. N.Hussain, T.Kneduk, and M. Meyn, 107–38. Berlin, Germany: Lit Verlag.

- Transparency International. 2010. Corruptions Perception Index: http://www.transparency.org/policy_research/surveys_indices/cpi/2010.
- Trouet, V., P. Coppin, and H. Beeckman. 2006. "Annual Growth Ring Patterns in *Brachystegia spiciformis* Reveal Influence of Precipitation on Tree Growth." *Biotropica* 38: 375–82.
- UNAIDS/WHO. 2002. *AIDS Epidemic Update*. Geneva: UNAIDS.
- Vedeld, P., A. Angelsen, G.K. Berg, and E. Sjaastad. 2004. "Counting on the Environment. Forest Incomes and the Rural Poor: A Study for the World Bank." Paper No. 98, Environment Development Papers, World Bank, Washington, DC.
- Virtanen, P. 2003. "Local Management of Global Values: Community-Based Wildlife Management in Zimbabwe and Zambia." *Society and Natural Resources* 16:179–90.
- Walker, P., and P. Peters. 2007. "Making Sense in Time: Remote Sensing and the Challenges of Temporal Heterogeneity in Social Analysis of Environmental Change." *Human Ecology* 35: 69–80.
- Werren, M., J. Lowore, P. Abbot, B. Siddle, and P. Hardcastle. 1995. Management of miombo by local communities. University of Aberdeen and Forestry Research Institute of Malawi, Zomba.
- White, A., and A. Martin. 2002. *Who Owns the World's Forests?* Washington DC: Forest Trends.
- White, F. 1983. "The Vegetation of Africa. A Descriptive Memoir to Accompany the UNESCO/AETFAT/UNSO Vegetation Map of Africa." *Natural Resources Research* (Paris) 20: 1–356.
- Wild, C. P. 2006. "Medicinal Plants Industry: Trends in Durban." Commercial Products from the Wild, Brief 6.
- Williams, V., K. Balkwill, and E.T.E. Witkowski. 2000. "Unravelling the Commercial Market for Medicinal Plants and Plant Parts on the Witwatersrand, South Africa." *Economic Botany* 54 (3): 310–27.
- Wilson, K.B. 1990. "Ecological Dynamics and Human Welfare: A Case Study of Population, Health and Nutrition in Southern Zimbabwe." Ph.D. thesis, University of London, London.
- Wily, L. 1999. "Moving Forward in African Community Forestry: Trading Power, Not Use Rights." *Society and Natural Resources* 12: 49–61.
- Wily, L.A. 2000. "The Democratisation of Forest Management in Eastern and Southern Africa." *International Forestry Review* 2 (4): 287–294.
- Wily, L.A. 2003. *Governance and Land Relations: A Review of Decentralisation of Land Administration and Management in Africa*. London, UK: International Institute for Environment and Development.
- Wily, L.A., and P.A. Dewees. 2001. "From Users to Custodians: Changing Relations Between People and the State in Forest Management in Tanzania." Policy Research Working Paper WPS 2569. Environment and Social Development Unit. World Bank, Washington DC.
- Wolmer, W., J. Chaumba, and I. Scoones. 2004. "Wildlife Management and Land Reform in Southeastern Zimbabwe: A Compatible Pairing or a Contradiction in Terms?" *Geoforum* 35: 87–98.
- World Bank. 2011. *World Development Indicators*. Washington DC: World Bank. <http://data.worldbank.org/data-catalog/world-development-indicators>.
- World Bank. 2004. *Making Services Work for Poor People. World Development Report*. Washington DC: World Bank.
- World Bank. 2009. "Environmental Crisis or Sustainable Development Opportunity? Transforming the Charcoal Sector in Tanzania." World Bank, Washington, DC.
- World Bank. 2002. "Report of the AFTEG/ AFTRS Joint Seminar on Household Energy and Woodland Management." World Bank, Washington DC.
- Wunder, S. 2007. "The Efficiency of Payments for Environmental Services in Tropical Conservation." *Conservation Biology* 21 (1): 48–58.

- Wunder, S. Forthcoming. "Payments for Environmental Services and the Poor: Concepts and Preliminary Evidence." *Environment and Development Economics*.
- WWF Southern Africa Regional Programme Office (WWF-SARPO). 2001. "Conserving the Miombo Ecoregion. Reconnaissance Summary." WWF Southern Africa Regional Programme Office, Harare, Zimbabwe.
- Wynberg, R.P., S.A. Laird, S. Shackleton, M. Mander, C. Shackleton, P. Du Plessis, S. den Adel, R.R.B. Leakey, A. Botelle, C. Lombard, C. Sullivan, T. Cunningham, and D. O'Regan. 2003. "Marula Policy Brief. Marula Commercialisation for Sustainable and Equitable Livelihoods." *Forests, Trees and Livelihoods* 13: 203–15.
- Xue, Y. and J. Shukla. 1993. "A numerical experiment to study the influence of changes in the land surface properties on Sahel climate. Part I: Desertification." *J. Climate* 6: 2232-2245.
- Yrjölä, T. 2002. "Forest Management Guidelines and Practices in Finland, Sweden and Norway." European Forest Institute Internal Report No. 11. European Forest Institute, Joensuu, Finland.

Technical Annexes to Managing the Miombo Woodlands of Southern Africa

Available online at <http://www.profor.info/profor/content/miombo-annexes>

Household Studies

- Annex 1: Supplementing or Sustaining Livelihoods? The Role of Forest Products in Household Livelihoods in Mufulira and Kabompo Districts of Zambia (M. Mutamba)
- Annex 2: Socio-economics of Miombo Woodland Resource Use: A Household Level Study in Mozambique (R. Hegde and G. Bull)
- Annex 3: Poverty, Environmental Income, and Rural Inequality: A Case Study from Zimbabwe. (W. Cavendish and B.M. Campbell)

National-level Assessments

- Annex 4: Contribution of Dry Forests to Rural Livelihoods and the National Economy in Zambia. (C.B.L. Jumbe, S.M. Bwalya, and M. Husselman)
- Annex 5: Toward community-based forest management of miombo woodlands in Mozambique (A. Salomão and F. Matose)

Technical and Policy Options

- Annex 6: Silviculture and Management of Miombo Woodlands for Products in Support of Local Livelihoods (C.M. Shackleton and J.M. Clarke)
- Annex 7: Improving Policy Outcomes for the Management of Miombo Woodlands (P.G. Abbot and A. Ogle)

THE MIOMBO WOODLANDS ARE THE MOST EXTENSIVE TROPICAL SEASONAL WOODLAND AND DRY FOREST FORMATION IN AFRICA. ALTHOUGH THEY ARE LESS RICH IN BIODIVERSITY AND HIGH-VALUE TIMBER THAN MOIST TROPICAL FORESTS, THESE LANDSCAPES PLAY AN INTEGRAL ROLE IN THE LIVES OF MILLIONS OF RURAL PEOPLE WHO DEPEND ON WOODLAND RESOURCES FOR FOOD, ENERGY AND ENVIRONMENTAL SERVICES.

THE ONGOING PUBLIC DEBATE ABOUT THE VALUE OF FORESTS AND WOODLANDS IN THE FACE OF CLIMATE CHANGE PROVIDES AN IMPORTANT OPPORTUNITY TO REVISIT POLICIES, INCENTIVES, AND OPTIONS FOR MANAGING THE MIOMBO WOODLANDS IN WAYS WHICH WOULD BENEFIT THE RURAL POOR IN THE CONTEXT OF A CHANGING CLIMATE, GROWING FOOD INSECURITY, AND INCREASING DEMAND FOR WOODFUEL AND CHARCOAL. THE MAIN VOLUME MAKES RECOMMENDATIONS FOR REVITALIZING FORESTRY ORGANIZATIONS, GETTING FORESTRY ONTO THE POVERTY REDUCTION AGENDA, HAVING ANOTHER LOOK AT FOREST TENURE, AND ENHANCING FOREST-BASED MARKETS FOR PRODUCTS AND SERVICES. THE TECHNICAL ANNEXES, PUBLISHED ONLINE, OFFER A CLOSER LOOK AT SOME OF THE RESEARCH WHICH INFORMED THIS ANALYSIS.



PROFOR

PROGRAM ON FORESTS (PROFOR)

THE WORLD BANK
1818 H ST NW
WASHINGTON DC 20433 USA
TEL: + 1 202 473 5844
FAX: + 1 202 522 1142

EMAIL: PROFOR@WORLDBANK.ORG
WEBSITE: [HTTP://WWW.PROFOR.INFO](http://WWW.PROFOR.INFO)

Profor is a multi-donor partnership supported by:

