DFID Forestry Research Programme

R8305

Developing biometric sampling systems and optimal harvesting methods for medicinal tree bark in southern Africa

FINAL TECHNICAL REPORT

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Executive Summary

The original project concept as envisaged by FRP was to apply forest science principles to the development of inventory and management systems for medicinal plants. This was interpreted by the project team to include all aspects of the design of sustainable harvesting prescriptions for plants collected from the wild for use in traditional medicine practice in southern Africa.

The project built on two preceding projects; one on medicinal bark harvesting in South Africa and a FAO project developing generic inventory techniques for NWFPs. The project was implemented in three countries: Malawi, South Africa and Zambia with FRIM, Forestwood and Copperbelt University as lead collaborators. In each country a number of sub-contractors were engaged and the whole team was supported by academic specialists from the UK and Germany.

Despite a few hiccups the experiments and surveys undertaken by the project were successful and yielded a wealth of new knowledge on the pathology of indigenous trees in montane and miombo forests and the relationship between tree ecophysiology, management and harvesting.

Other outputs of the project are a series of field-practitioner-level publications which will cover everything from inventory techniques to cultivation and processing of herbs. Two of these were adopted from the prior CPWild and FAO projects and would not have otherwise been completed or published. R8305 is contributing a Bark harvesting handbook to this series to cover the design of sustainable bark management plans and harvesting prescriptions.

Over time the project team expanded to include more in-country specialists and culminated in a project completion workshop attended by 85 people from across the SADC region. The 'Trees for Health Forever' workshop established a set of priority action points and a regional NTFP working group to continue the momentum established by the project and to work towards regional co-operation and projects on sustainable NTFP management.

At the end of the project just over 80 outputs had been produced with many more planned. There was considerable media interest in the issues raised by the project in Malawi and it will be interesting to see if this leads to improved management practices. The level of commitment to the project from the whole team has been exemplary and it is hoped that the partnerships developed during the project will lead to continued regional-level collaboration. The prospects for this look good and the exiting activity of the project was to fund a regional expert meeting to prepare proposals for regional project and research on NTFPs and medicinal plants in particular.

Acknowledgements

The author of this final technical report did not undertake the work described herein but acted as a facilitator for a project which was implemented by a committed core group of collaborators. Over the duration of the project the core team were joined by an increasing band of supporters many of whom were incorporated into the project as sub-contractors. The contribution of all of these people to the project outputs is gratefully acknowledged.

Acronyms

BOTR back to the office report
CBU Copperbelt University (Zambia)
CPWild Commercial Products from the Wild (RSA)
DFID Department for International Development (UK)
DIDC Department for International Development Co-operation (Finland)
DWAF Department of Water Affairs and Forestry (RSA)
FAO Food and Agriculture Organisation of the United Nations
PMF project memorandum form
FRIM Forest Research Institute of Malawi
FRP Forest Research Programme
FTR final technical report
GAU Geörg-August University
IK indigenous knowledge
KZN KwaZulu-Natal
NTFP non-timber forest product
NWFP non-wood forest product
PCW project completion workshop
PSP permanent sample plot
RBS randomised branch sampling
RSA Republic of South Africa
SADC Southern African Development Community
THPAZ Traditional Health Practitioners Association of Zambia
UK United Kingdom of Great Britain and Northern Ireland
UWB University of Wales Bangor
WRL Wild Resources Limited (UK)

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5 Diederichs N. (editor) (2006) Commercialising Medicinal Plants: A Southern African Guide. African Sun Media, Matieland, RSA.
6 Distribution list for Commercialising Medicinal Plants book [CPWild distribution.xls]
7 R8305 project dissemination outputs [CD-ROM/Outputs]

Background

At a basic level the project arose as a response to the FRP call for proposals advertised in mid-September 2002. The asked for concept notes to address the following:

> The topic on biometrically-adequate methods for assessment of NTFPs (non-timber forest products) recognises that sustainability of production depends in part on accurate knowledge of productivity and of the effects of harvesting. FRP expects that the research will be medium-term and that results will feed into global and regional efforts to improve the quality of dynamic resource assessment. Connections to CIFOR's studies on NTFPs will also be expected.[1]

However, the identification of this as a topic itself arose from a process which prioritised it for action against other potential topics. Of course it is not possible to fully appreciate what the process was but the project leader responded to the call because it had resonance with their own appreciation of the significance of the topic. It is this understanding that is presented here. It is assumed that FRP identified biometrics and medicinal plants as researchable constraints from pre-projects in these areas; namely ZF0077, ZF0101, ZF0119 and ZF0118. Reports from all of these projects demonstrated the demand for research in the area identified in the FRP call.

The development significance of medicinal plants

Indigenous plants are the mainstay of traditional medicine practice in Africa. Traditional medicine in turn is the main source of health care for the vast majority of people and not just isolated rural communities. It has been estimated that 80% of the populace in Africa uses traditional medicine while a third may not have access to any other form of health care[2]. The majority of these plants are harvested from the wild and many are sourced from forest ecosystems and trees. The most valued and highly demanded medicinal species are increasingly harvested on a commercial scale and there are few management plans that make provision for sustained yield management of the species or plant components (e.g. leaves, bark, roots etc.) that are in demand. Serving an expanding and increasingly urbanised population from dwindling and under-managed forests means that the species are under threat. At the same time the trade networks are expanding and more people, many of whom are poor and vulnerable depend for their livelihood on the medicinal plant trade. Implementation of sustainable management for medicinal plants will therefore make a significant contribution to the maintenance of forest biodiversity as well as income security of collectors and traders and health security in the general populace particularly the poor. Success in this will therefore contribute to Millennium Goal 6 (Combat HIV/AIDS, malaria and other diseases), Goal 7 (Ensure environmental sustainability) and indirectly by recognising the role of women in traditional medicine practice and trade to Goal 3 (Promote gender equality and empower women).

As a contribution to the development of sustainable forest management for traditional medicine the project focussed on two researchable constraints: (a) the need for sustainable harvesting systems for medicinal plants and (b) the lack of statistically rigorous inventory methods for NTFPs (non-timber forest products).

Bark harvesting

The first of these had been identified by forest managers in RSA (Republic of South Africa) based on increased numbers of trees damaged by bark harvesting in indigenous forests particularly in KZN (KwaZulu-Natal) as well as observations of species and quantities of bark passing through the wholesale Durban Herb Market. It transpired that around 60% of medicinal plant material in trade in RSA was composed of indigenous tree bark with several species noted as being in decline.

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1 http://www.frp.uk.com/sub_page.cfm/title/Research%20Topics/section/previous_call/editID/40

2 http://www.who.int/mediacentre/factsheets/fs134/en/

Bark harvesting was therefore included in the RSA Innovation Fund project 3114 'Sustainable utilisation, commercialisation and domestication of products from indigenous forest and woodland ecosystems' (Commercial Products from the Wild - CPWild) which commenced in 1998 with the final report appearing in 2003. This study conducted surveys of bark harvesters trees in Umzimkulu forests (KZN) and bark wound recovery experiments on four species *Ocotea bullata, Curtisia dentata, Prunus africana* and *Rapanea melanophloeos* in Southern Cape (an area where it was possible to experiment on undamaged trees). These four species exhibited different recovery patterns, from rapid recovery in *P. africana* and *O. bullata*, slower recovery in *C. dentata* and no recovery over the period of the experiments (three years) in *R. melanophloeos*. This suggested that the hitherto universal recommendation of periodic strip harvesting of bark (e.g. harvesting rules for *P. africana* in Cameroon) is too simplistic and a range of harvesting strategies are required. The Innovation Fund project also investigated the implementation of sustainable harvesting and facilitated the development of the Sizamimpilo Association which is a formally constituted association of herb traders based in the Durban Herb Market. With the assistance of the project the Sizamimpilo Association has entered into a formal management agreement with DWAF (Department of Water Affairs and Forestry) for sustainable resource use (particularly bark) from the Umzimkulu forests (a General Licence under sections 7, 15 & 23 of National Forests Act no 84 of 1998 issued on 30 May 2002).

Biometrics and non-timber forest product inventory

A previous FRP (Forest Research Programme) project (ZF0077 'Biometric assessment of NTFPs'[3]) was commissioned to review the biometric quality of then current NTFP resource inventory. The results of this review indicated that there were serious deficiencies in the rigour of the inventory data which forms the basis of NTFP resource management plans. This was partly a consequence of a insufficient awareness of the principles and practice of forest inventory but also of the unavailability of methods tailored for the peculiarities of NTFPs, namely their relative rarity in a forest and the morphology of the taxa being exploited. A series of recommendations were made for the development of field-practitioner-level guidelines and inventory protocols suitable for use with NTFPs.

Project identification

In late 2002 the Forestry Research Programme (FRP) issued a call for proposals on the biometrics of non-timber forest product (NTFP) assessment with an emphasis on medicinal plants. A concept note for this call was developed by a small team based around the personal experience of Dr Jenny Wong who undertook the ZF0077 project on NTFP biometrics and Dr Coert Geldenhuys who was a lead partner in the CPWild project on bark harvesting. Mr Gerald Meke of the Forest Research Institute of Malawi (FRIM), Mr Fabian Malambo of Copperbelt University (CBU) in Zambia and FAO non-wood forest product (NWFP) staff were known to Dr Wong as a result of prior collaboration on the FAO project GCP/RAF/354/EC especially the implementation of NTFP inventory case studies. The identification of the researchable constraints therefore arose from existing knowledge and consolidated through existing collaborative networks. This basic team developed the concept note for submission to FRP. On the basis of the concept note a pre-project was agreed with FRP and under ZF0192 'Planning workshop on medicinal bark in South Africa'[4] a project preparation workshop was held in 31st March to the 11th April 2003. This included the initial project team as well as a small group of specialists from CABI Biosciences, University of Wales Bangor (UWB), Georg-August University and the Food and Agriculture Organisation (FAO) Headquarters. The project preparation team undertook an extensive tour of proposed study sites and consulted a wide range of stakeholders in RSA, Zambia and Malawi. As a consequence, understanding of the issues was greatly enhanced, the project proposal significantly improved and the project team acquired several more members. A full project memorandum form (PMF) was developed out of this workshop and the R8305 project commenced in May 2003. In late 2004 FRP management granted a request for the project to be extended until January 2006 and the PMF was revised to take account of additional activities agreed for the extension in June 2005. See Annex 1 for the final version of the PMF.

[3] http://www.frp.uk.com/project_details.cfm/projectID/7097
[4] http://www.frp.uk.com/project_details.cfm/projectID/8104

Project Purpose

In line with the conventions of logframe propagation the project takes as its goal an output of the FRP programme itself; the project goal is therefore: *Strategies developed and promoted to maximize the benefits to forest and tree dependent poor people in the Forest/Agriculture Interface accruing from current global issues or generic tools* (FRP programme output 1). The project also adopts just one of the many FRP programme objectively verifiable indicators (OVIs) for its output which in this case is: *inventory data and techniques compiled and / or developed for timber and non-timber forest products*. This then sets the milieu for the elaboration of the research project outputs. Briefly the project sought to address the whole range of scientific issues attached to the development of sustainable management plans for medicinal tree bark. The technical issues addressed were:

- quantification of the number of trees in the forest;
- estimation of bark volume per tree;
- determination of tree response to bark wounding and the
- identification of suitable bark harvesting strategy for each species.

All of this is to be presented in the form of manuals for use by field foresters backed up by appropriate training. However, as the project progressed it became increasingly apparent that bark use and trade networks are extensive, while the continued engagement of the Sizamimpilo Association suggested that actors other than the conventional 'forest-adjacent' communities could be motivated to engage in sustainable forest management. Furthermore, it became apparent that there are significant differences between the patterns and actors in medicinal plant use and trade in each of the partner countries but all view with apprehension the prospect of a cessation in supply of raw materials. During the latter stages of the project, a fifth output was added to the project to gather data on regional trade in medicinal bark to back up the largely qualitative impression of the markets. This was to be used to (a) raise awareness of the threats to traditional medicine posed by unsustainable forest management and (b) to identify entry points and actors in the trade network who may be most motivated to take responsibility for changing harvesting practices in line with sustainable management plans.

Research Activities

The project activities were designed to achieve four and later five outputs:

1. Protocols for the efficient inventory of medicinal bark resources in natural forest developed and tested
2. Best bark harvesting practices developed for trees with differing bark anatomy and ecophysiological profiles
3. Bark yield models developed for different harvesting systems
4. Preparation, testing and dissemination of project results
5. Analysis of production-to-consumption systems for medicinal bark

The planned activities are listed in the logframe within the PMF (see Annex 1) while Annex 2 presents a report of what was actually achieved by the project up to 21 March 2006, briefly introduces the surveys and other work undertaken by the project and lists the outputs generated for each activity. The detailed protocols used during the project were collated into a single document which is included as Annex 3. The reports that relate to each study elaborate on the purpose, design and execution of the protocols as well as the analysis of the resultant data.

The project got off to a late start, part-way through the first treatment season. Everyone worked very hard to get the experiments established but this inevitably had a knock on effect on other activities in terms of timing. The original proposal had been for a three year project but this was cut back to two years by FRP management because of cost and the impending end of FRP programme funding. The delays compounded the difficulty of achieving the

project outputs within the agreed timeframe and it was fortunate that an extension was agreed to the FRP programme which meant the project could likewise get an extension. Nevertheless, the project still fell two months short of three years.

Only two activities experienced problems more severe than simple slippage in terms of timing. One of these was the census of trees in Mwekera Forest Reserve in Zambia (Activity 1.1). The first of these was a consequence of the inexperience of the CBU and Forest Research staff in the supervision of field inventory crews made up of people from a range of different institutions and variable skill levels including students. Many lessons were learnt as a result of the struggle to resolve problems in the census and skill levels in inventory practice significantly enhanced from collaboration with the project team and especially Coert Geldenhuys, Christoph Kleinn and Jenny Wong who are all experts in forest inventory, although sometimes this was at cross-purposes. Addressing these problems resulted in a delay of at least a year in delivery of data which compromised Activities 1.3 to 1.7. However, prioritisation of these activities within the time and resources left to the project in March 2005 meant that the output itself was not compromised and useful results were obtained although some of the more detailed analyses such as Activity 1.3 had to be omitted.

Project team

February 2003

January 2004

March 2005

November 2005

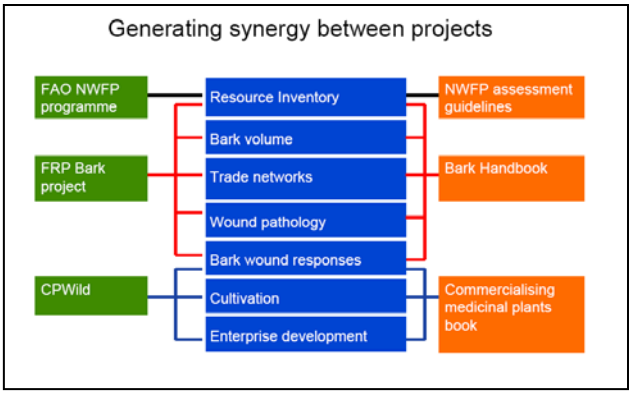
The other activity which experienced problems was the re-enumeration of permanent sample plots (PSPs) in South Africa (Activity 3.3). Here, permission to re-enumerate the plots was required from the Department of Water Affairs and Forestry (DWAF) and this was not granted within the time allocated for the fieldwork so the activity was not undertaken. The consequence of this is that the growth models in the bark yield models were less sophisticated than intended. However, the lack of useful PSP data for miombo woodland meant that growth modelling was probably over-ambitious for this project. The bark yield models therefore concentrate most on the estimation of yield from different harvesting scenarios rather than yield projections into the future.

The project had always intended to create opportunities for capacity building and networking between the collaborators and two workshops including the core team (Coert Geldenhuys, Fabian Malambo, Stephen Syampungani, Felix Chileshe, Gerald Meke, Tembo Chanyenga, Christoph Kleinn and Jenny Wong) were held; one in Zambia (Informal workshop 1) and the other in Malawi (Training course 2). At each of these the opportunity was taken to include other collaborators as well as local forestry officers, lecturers and staff from the forestry colleges. These workshops were very effective for team building to the extent that the project team acquired new collaborators from each event. By the end of the project the 'team' had grown 3-4 fold from the original team and continues to grow as the message is picked up by herbalists, journalists and other countries across the region. This is perhaps the most significant indicator of the potential of traditional medicine to act as a trigger for sustainable forest management.

During the project the core team (Coert Geldenhuys, Fabian Malambo, Gerald Meke and Jenny Wong) were invited to an IMA training workshop on science communication and advocacy in Accra, Ghana. The team and the project benefited greatly from the lessons learnt and ideas generated from this training. As a consequence the promotional strategy of the

project was re-drafted and more prominence and resources was directed towards promotion and dissemination activities within the project logframe.

In order to foster a spirit of co-operation the project itself took advantage of opportunities to network with other projects. These were the previous FAO project on the biometrics of non-wood forest product (NWFP) assessment where R8305 was able to contribute around 70% of a new FAO publication on NTFP inventory. The other was a RSA Innovation Fund project on the commercialisation of medicinal plants (the CPWild project) where R8305 was able to fund the publication of their book which included a chapter on sustainable bark harvesting. The synergy created by these collaborations greatly increased the impact of all three as well as permitting a greater range of issues to be covered.



The project team has demonstrated considerable commitment to the project and has been able to complete all major field activities, many intermediate internal reports and one of three major publications (see below for plans for continuation of project activities beyond the end of the project).

Outputs

The research results and tangible products of the project are listed in Annex 4. The book published by CPWild is provided as Annex 5 with its circulation by R8305 given in Annex 6. Annex 7 is copies of all 'soft' copies of project outputs as at March 2006. Many of these present the 'first look' at the data generated by R8305 and the key synthesis reports are in draft form. This is a consequence of time constraints as explained above which was not eased by the need to respond to opportunities arising from the PCW if the project was going to leave behind a process rather than a presentation.

At present there is no one document which details the results of the project as a whole though there is the intention to produce at least a journal paper to report on the experience and key findings of R8305. In the meantime a brief overview of the results of the main technical components of the project is presented here.

Bark wound experiments

Figure 1 gives the geographical spread of the main study sites utilised for the bark wound experiments in the three partner countries. Within these sites 17 species were treated in both the dry and wet seasons using a standard protocol as given in Annex 3. The sites cover two major forest ecotypes, montane forest and miombo. There has been very little prior work on the pathology of miombo trees although these woodlands are extensive and support a great many people in southern Africa.

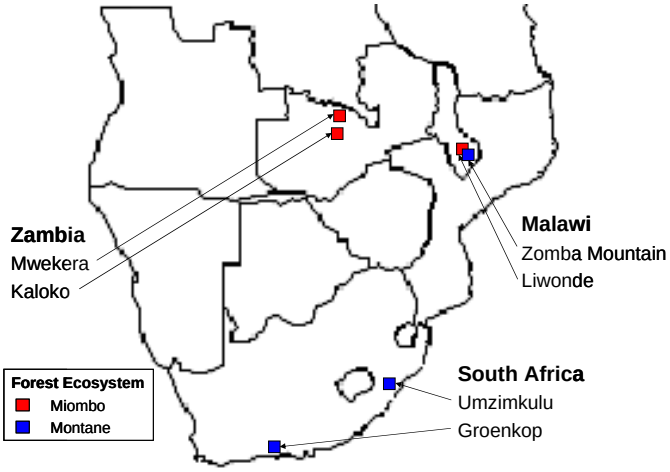


Figure 1 Location of bark wound recovery experimental sites

An overview of the results for bark recovery on the wound and coppice response is given in Table 1. It is evident that species respond very differently to the trauma of bark removal and comparison of sites in Malawi and Zambia suggest that this can also vary within a species between sites. In general the best recovery is in forest species with miombo species generally having a slower response probably as a result of droughting but the species effect is so significant it is not possible to predict response from site or climate.

Table 1 Preliminary results of bark wound recovery experiments

Vegetation	Species	Country	Bark recovery	Coppice regrowth
Forest (afro-montane)	*Cryptocarya myrtifolia*	South Africa	Poor	No
	Curtisia dentata	South Africa	Good	Good
	Ilex mitis	South Africa	No	No
	Ocotea bullata	South Africa	Very good	Good
	Prunus africana	Malawi South Africa	Very good	Poor to good
	Rapanea melanophloeos	Malawi South Africa	No Good	No to poor
	Rhus chirindensis	South Africa	Good	Good
	Warburgia salutaris	South Africa	Good	Good
	Xymalos monospora	Malawi	Poor	Good (but died later)
	Zanthoxylum davyi	South Africa	Poor and slow	Poor
Miombo woodland	*Albizia adianthifolia*	South Africa	Very good	No
	Brachystegia busei	Malawi	Poor & slow	Poor
	Brachystegia spiciformis	Malawi Zambia	Very poor & Slow Good	No
	Dalbergia nitidula	Malawi Zambia	Good Poor	No Good
	Elaeodendron transvaalense	South Africa	No	No
	Julbernardia.paniculata	Zambia	Good	No
	Julbernardia globiflora	Malawi	No	No
	Parinari curatellifolia	Malawi Zambia	Poor and slow Good	No Good
	Pseudolachnostylis maprouneifolia	Malawi Zambia	Good Very good	No Yes
	Pterocarpus angolesis	Malawi	Good	No

Bark recovery:
Very good: Edge and/or sheet growth good & fast to cover the wound relatively quickly
Good: Edge &/or sheet growth good but slow
Poor and slow: There is indication of edge &/or sheet growth but very slow
No: No recovery

Coppice regrowth
Good: good coppice @ base of tree
Poor: some coppice regrowth @ base but slow development and may not survive
No: no coppice regrowth

Four types of response to wounding have been identified:

- Species which produce epicormic shoots at the base of the stem and also on wound sides but without sound edge or sheet growth eg *Dalbergia nitidula*
- Species with good wound recovery and good coppice regrowth eg *P. maprouneifolia* & *O. bullata*
- Species with good edge growth, poor shoot development and high intensity of insect and fungal attack eg *B*. *spiciformis* & *J. paniculata*
- Species that exhibit edge growth and sheet development without epicormic shoots.

In miombo, there is a tendency for the cut edges of bark to dry out and lift away from the underlying wood which increases the effective size of the wound; the presence of termites also means that species which are susceptible to attack tend to die and disappear if bark wounds expose the wood. These differences form the basis of decisions on optimal harvesting strategies (if maximisation of bark harvest volume is the objective). It is obviously not possible to repeatedly strip harvest a species that does not exhibit bark recovery and it would be best to harvest the whole tree; likewise it may be possible to harvest bark from coppice regrowth if present but not otherwise.

Bark wound pathology

A number (57 and 92 from the dry and wet season respectively) of treated trees had sections across the wound removed to examine the pathology of the wound beneath the surface. Fungi were cultured and identified using genetic techniques by the Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria. Fungi which are known to be pathogenic on other species where used to inoculate seedlings to test Koch's hypothesis to determine whether they caused disease in the species they were isolated from. The results of these investigations revealed:

- Extensive wood discolouration present in some cases after wounding and fungal infection
- No correlation between external fungal growth and internal infection
- External fungal growth mostly *Penicillium*, *Trichoderma, Mucor* spp.
- Insects associated with streaking were – wood boring beetles *Ambrosiodmus tropicus*, *Xyleborus principalis*, *X. ferrugineus*, sap feeders
- Fungi found on wounds include - *Ceratocystis albifundus* which is known to be pathogenic on plantation species, *C. fimbriata, other Ceratocystis species, Pesotum quercus* and other *Pesotum* species
- Two new species of fungi were collected and are in the process of being named

Based on these findings it is possible to refine harvesting strategies to minimise losses by whole tree harvesting sensitive species.

Forest inventory

The project made two contributions in terms of forest inventory optimisation. The first was to test randomised branch sampling (RBS) for the estimation of total volume of bark on a tree. The dichotomous nature of branching in miombo species showed that contrary to standard advice there was little advantage in sampling branches according to size i.e. weighting larger branches so they are more likely to be chosen for measurement. This means that branch selection can be done using a dice which is much simpler in the field. Figure 2 amply demonstrates that RBS using a simple random branch selection process gives, for most purposes, adequate estimates of whole tree bark volume.

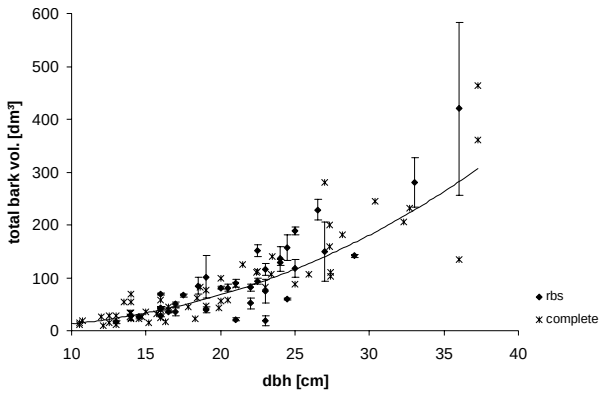


Figure 2 Pooled RBS data for all species across 2 study sites

Simulations of different plot designs on the Mwekera census data indicated that there may be some advantage to using a k-tree (select the k nearest trees to a sample point). This was therefore included in a field inventory in Phirilongwe Forest Reserve in Malawi. Analysis of the resultant data shows that when k=5 that k-tree methods are comparable in a statistical sense with area based plots but are much easier and quicker to enumerate in the field. One disadvantage of k-tree methods is that there is as yet no objective way of determining the virtual area of the plot to permit the estimation of tree density. This is under investigation in GAU but in the meantime Christoph Kleinn's team developed an empirical method for determining plot area which works better than existing methods and this is in the process of being published.

All of this experience contributed to the FAO NWFP assessment guidelines and will be used to provide case study material to the final document. In this way it will be generalised as a contribution to all work on NTFPs within Africa rather than just the SADC region.

Bark yield management

This part of the project was intended to prepare models which could be used to examine the possible implications for future supply of alternative harvesting scenarios. It was to use the results of the inventory, experimental and IK survey activities. Unfortunately, the difficulties described above together with the unavailability of PSP data for miombo from either Malawi or Zambia mean that although models have been produced they are not as detailed as intended. However, this is not a serious constraint on the project as they have sufficient functionality to serve their purpose and in the event it transpired that commercial harvesting of many of not most species is best done through whole tree harvesting which is analogous to timber management which is already familiar to foresters. In order to provide growth data in the future and as a training resource for CBU and Mwekera Forestry College students the staff of CBU and Forest Research have adopted the census areas in Mwekera. Cells (25x25 m) have been selected from the census grid for enumeration as PSPs.

Despite the problems, it is hoped that R8305 has demonstrated the benefits of taking a formal, forest-science based approach to bark harvesting and hence to other wild-harvested, forest-based NTFPs. The eventual outcome was not what was expected and the current universal advice concerning best practice (i.e. repeated strip harvesting) have been shown to be insensitive at best and potentially threatening to the resource at least as far as harvesting commercial quantities is concerned. The more pragmatic approach developed by R8305 was to develop simple tools to determine the ecophysiological profile of a particular species in a specific locality and to use this information to key out appropriate harvesting regimes for small or larger quantities of bark and to test alternatives using the bark yield model. To date the various components of such a system are in place but they still need to be brought together in the planned Bark harvesting handbook.

Bark market and trade survey

Two surveys were undertaken on the medicinal bark trade by the project. The first placed Forest Officers at the customs check posts at Malawi-Mozambique border crossings. These results (see Table 3) revealed that there was a significant quantity of medicinal plants leaving

the country, most of it bound for South Africa and some of it sourced from Mozambique. This trade is not illegal and the material was being openly carried across the border but even so until this survey was done there was little general awareness even among forestry officers that traditional medicine is commercial and figures in regional trade.

Table 3 NTFPs crossing the Mwanza border post, Malawi on 180 days July-Dec 2004

Source	Total forest products				Medicinal products			
	Kgs of products		Number of exporters		Kgs of products		Number of exporters	
Central	1,815	(5%)	13	(10%)	308	(17%)	9	(18%)
North	550	(1%)	2	(2%)	50	(3%)	1	(2%)
South	35,851	(91%)	108	(84%)	1,338	(75%)	37	(74%)
Foreign	1,270	(3%)	5	(4%)	90	(5%)	3	(6%)
Total	39,486	(100%)	128	(100%)	1,783	(100%)	50	(100%)

The results from Malawi raised concerns about the size and extent of the trade across the region and prompted a second study which focussed on a questionnaire survey of market traders in cities and towns in four countries (Malawi, Mozambique, South Africa and Zambia). The sampling strategy used in this study was to randomly select 30 traders from larger markets and all traders present in smaller markets. In all 210 traders were interviewed in an exercise that took only a few man-days for each site. This is the first time that such a wide ranging trade survey has been undertaken for traditional medicines in southern Africa and the results are illuminating. Figure 3 shows that bark represents 50% or more of plants traded in South Africa (=forest) while only around 15% of material is bark in miombo woodland where roots are much more extensively harvested for medicinal use. The identification of bark as the focus of the study reflects the fact that the project built on a previous South African project. Figure 4 shows the average volumes of bark traded and as expected from Figure 3, the largest volumes are traded in South Africa but what was unexpected was the quantities being traded – these figures equate to many tonnes of material per year. Figure 5 shows that the majority of the material coming into Durban market (the largest) is sourced from KwaZulu-Natal (i.e. locally) but that significant quantities are being sourced from neighbouring countries. This supports the findings of the border survey which showed South Africa as the main destination of plants crossing the Mwanza border. The larger amounts of bark traded in Mpauto were also probably en route to Durban given the prominence of Mozambique as a source – so although bark may not be used locally it will become more of a concern in response to demand from South Africa. Furthermore, the survey found that all markets had many and diverse external linkages which reflect ethnic diversity (miners in Kitwe area with linkages back to Uganda and Senegal) or the influence of trade routes (apparently from Mozambique via Malawi and Zimbabwe to South Africa). Figure 6 illustrates some of the more prominent market linkages revealed by the survey.

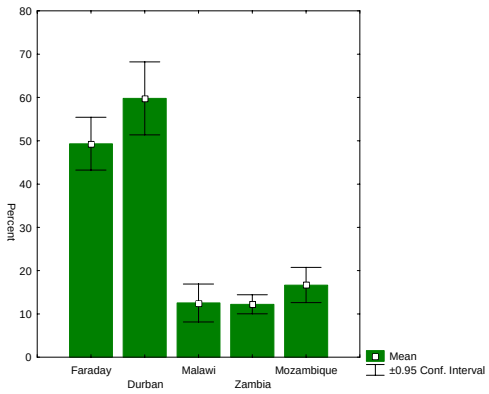


Figure 3 Percent of trade represented by tree stem bark

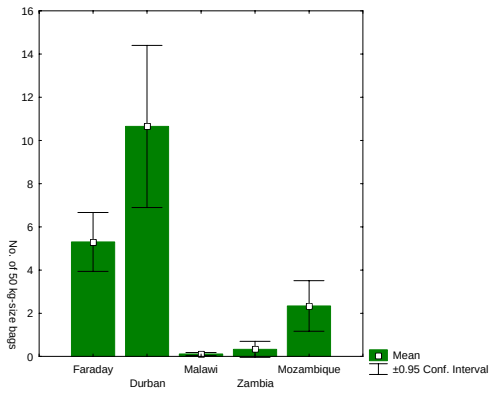


Figure 4 Number of 50 kg bags of bark traded per trader per month

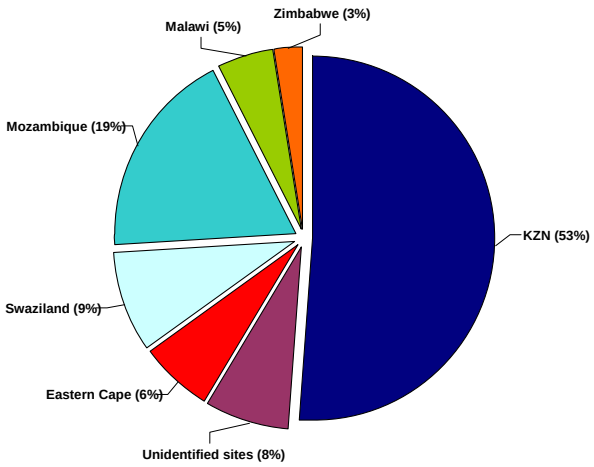
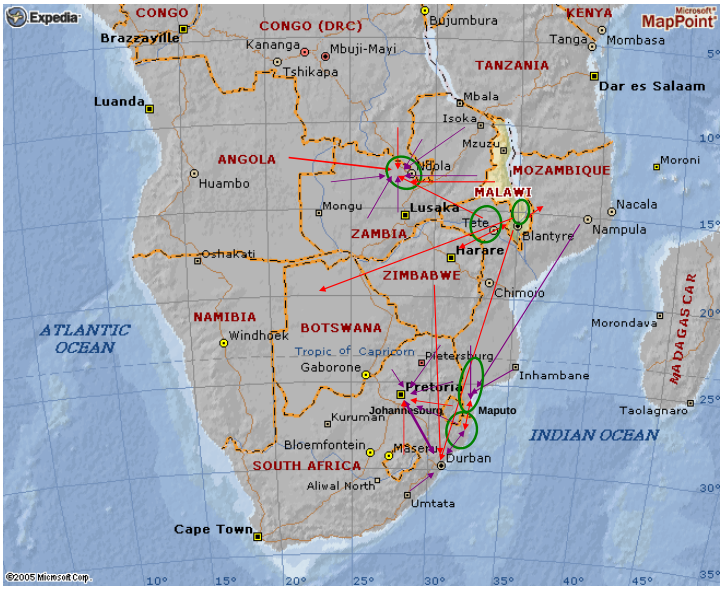


Figure 5 Sources of material entering the Durban herb market



(purple=internal, red=regional movements)

Figure 6 Trade relationships for medicinal tree bark based

Social surveys and engagement

Two social surveys were planned. One was to investigate indigenous knowledge (IK) of bark harvesting practices with healers and commercial collectors; the other was to undertake a base-line survey of perception of bark harvesting as an issue among forestry professional and field staff. However, social surveys were undertaken by sub-contractors in each country and the lack of an opportunity for them to meet to agree on objectives and protocols and indeed the distinction between the two surveys meant that there was a lot of country-level variation in what was actually done. This was a lesson well learnt and afterwards the project invested much more heavily in team workshops and was able to avoid these problems in other aspects of the field work though without stifling individual ownership, use and interpretation of country data (witness the proliferation of internal reports). Nevertheless, it was not possible to retrieve the social surveys and in Malawi two independent studies were undertaken while in South Africa and Zambia they were largely compounded. However, there are several useful generic issues that emerged from these studies.

Regulations and perceptions of access to state forests for traditional medicine vary between countries; in all access for personal use is viewed as benign and as a basic right but

according to the law commercial collection requires a permit and ideally a management plan. However, in the field it can be very difficult to distinguish between the two forms of collection and the split personality which encourages some people but sanctions others for doing essentially the same thing is something field officers understandably struggle with. Ideally a management plan should be prepared to cover all use of the forest to prevent waste and clarify who is allowed to do what. This is not a new observation but the process of interviewing people revealed how little attention they had paid to medicinal plant harvesting but that when prompted they quickly came to the realisation that it was a real issue. It is hoped that project dissemination will be effective in raising general awareness of forest exploitation beyond timber, firewood and charcoal supply. A second survey could be done at some time in the future against the project baseline to determine if this has been successful.

Along with the majority of medicinal plants there is a wealth of traditions relating to where, when and how bark should be harvested. Many of these are conservative of the plants and most advocate only removing what is required to treat patients as and when required. However, such niceties are quickly eroded when needs must and collection gains a commercial motive linked to volume of supply. Many older herbalists decried the waste and over-harvesting they observe in the forest and content that adherence to traditional practices were more conservative. This survey gave an opportunity to engage with herbalists and this proved extremely fruitful. In Zambia, in particular, the Traditional Health Practitioners Association of Zambia[5] (THPAZ) is actively seeking to engage with the Forestry Department over access to forest particularly land on which their members can establish 'botanical gardens'. The CPWild book is a useful output to guide this type of activity though cultivation is not the answer to all supply-side problems. Influential national associations of herbalists attended the PCW and made strong commitments to partnership with forest managers. Self-regulation by strong and representative institutions is potentially more effective than any amount of external sanctions from forestry authorities and it is hoped that the forestry departments take up this opportunity armed with the R8305 Bark harvesting handbook.

Traders are often seen as the villains when trade-based exploitation is unsustainable. However, prior work in Durban, Johannesburg and Maputo markets suggests that many of the traders are disadvantaged (windowed, landless etc.) poor and vulnerable at least in South Africa because they are engaged in nefarious activities and subject to arrest and imprisonment if caught with illegal plants. Experience with the Sisamimpilo Association indicates that at least in some situations, there is sufficient incentives for traders to self-organise and enter into management agreements with forest managers over access and bark harvesting rules. Of course this is not to say that this sector does not also include richer, exploitative individuals but the possibility of engaging stakeholders remote from the forest in sustainable management is one worth pursuing for social as well as resource management reasons.

Over the project it became apparent that the different social, cultural, legal and economic contexts in each country provide quite different opportunities to engage with stakeholders on forest management. A superficial analysis suggests that traders could be partners in South Africa, herbalists in Zambia and Forest managers in Malawi. The trade network study was also intended to examine whether it was possible to elucidate this at a local level using some simple survey tools. This analysis of the available information has yet to be done but the survey can at least describe different types of networks and identify stakeholders within them.

Contribution of Outputs

The development goal for the FRP programme is *livelihoods of poor people improved through sustainably enhanced production and productivity of forest resource systems*. And under this R8305 falls under FRP output 1 *Strategies developed and promoted to maximise the benefits to poor forest-dependant people accruing from current global issues or generic tools* by providing for indicator 1.4 which requires; *inventory data and techniques complied for and/or*

[5] A statutory body which registers and regulates traditional medicine in Zambia – it is highly structured and apparently disciplined with its own 'police' with powers of arrest. It is estimated THPAZ has 40,000 members across the country.

developed for timber and non-timber forest products. It is against these aspirations that the achievements of R8305 should be judged.

Regarding the specific indicator, R8305 has made only a modest contribution to the theoretical advancement of forest inventory but a significant contribution to practice (two simple methods tested and found to increase the efficiency of field work) and uptake of sound inventory designs. The FAO NWFP Guidelines to which R8305 made a significant contribution (it was unlikely to have ever been completed without the assistance of the project) represents the most comprehensive compilation of inventory techniques focussed on NTFPs ever produced. FAO are making funds (US$ 10,000) available to complete the draft text (R8305 was able to complete about 75% of the text at 200+ pages) and have made a commitment to funding the eventual publication of the book in the NWFP Series. Although the book is ostensibly for ACP (sub-Saharan Africa) it will be available globally and will be promoted by FAO networks which probably has the most extensive forestry network in the world.

However, tools left on the shelf do not achieve much and promoting Handbook to people that have little awareness that there is even a problem that needs addressing is likewise not going to be effective. The survey work undertaken by the project confirmed that bark and traditional medicine supplies is a real issue for health, income and biodiversity security across the region and that the tools developed are appropriate to provide sustainable management plans. However, it was apparent that the most effect way of promoting their adoption was to first raise awareness of the underlying problems. This was achieved through promotion of the findings of the market and trade network study to stakeholders through a variety of media and the PCW. However, stakeholders are not homogenous and it is also necessary to identify those that are most receptive to messages about supply sustainability and also motivated and able to change their behaviour and relationship to forest managers and the resource itself. Tools are under development to enable a forest manager to do this at a local level. However, this is not sufficient without a facilitating legal and institutional environment that can make forest access agreements with disparate stakeholders. The Sisamimpilo Association management agreement required a change in forest regulations at the statuary level in South Africa and it is likely similar adjustments will be required in other countries. This is also an important message for bilateral forest development projects as these often promote community or co-management agreements which only permit agreements with forest-adjacent communities and this exclusivity may need to be challenged.

What is most encouraging is that the PCW agreed that at the national and regional level that; firstly sustaining supplies of medicinal plants is a matter of concern to all stakeholders including the general public and secondly that un-facilitated partnerships between different stakeholders emerged from the workshop and other R8305 promotional activities. The last invention of the project; one that was not initially planned, is an inaugural meeting of the nascent regional NTFP network in Zomba in March 2006. The intention is that this meeting will provide an opportunity to develop regional proposals for practical projects (the herbalists want advice on cultivation techniques and access to forest land to create ‘botanic gardens’), advocacy (media and awareness raising), networking (share information on medicinal plants and other NTFPs) and for further research on sustainable harvesting of medicinal trees (there is a need to consider root harvesting in miombo woodland). The proposals prepared by this meeting are to be presented to the SADC Technical Committee on Forestry at their meeting in Zambia in mid-April 2006 and from there forwarded to the SADC Donor's Consultative Conference also in April as well as directly to suitable donors. The progression of the proposals through SADC will be overseen by the FAO regional forestry advisor based in Harare. Furthermore, FAO are providing an opportunity for the project to present posters and policy papers to the 15th session of the African Forestry and Wildlife Commission to be held in Maputo from 29 March - 1 April 2006. These activities provides an exit for the project with some assurance that the process will be continued.

The tasks remaining to the R8305 project team is the completion of data analysis to the level required to inform the Bark harvesting handbook. The project leader and the core team are

strongly committed to doing this as without it we will have wasted all our efforts so far. DWAF, who hosted the PCW are also keen to see this publication come out as a regional resource and have agreed to oversee the publication of the Handbook as a joint publication of DWAF, CBU and FRIM. This should take care of the distribution and long-term availability of the Handbook. The hope is that we can print the Handbook cheaply so it can be printed in large enough numbers to be put on every forestry officers desk across the region.

Foresters have long contended that sustainability is of fundamental importance to people and their well-being but it has proved difficult to get this message accepted by the closest stakeholders let alone civil society or the general public. However, traditional medicine has profound cultural associations as well as obvious relevance to the health of the general populace and income security for more closely involved stakeholders. It may be that traditional medicine could be the trigger that will engender local ownership of forest conservation.