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**FUNDING APPLICATION AND
PROJECT MEMORANDUM FORM**

*on behalf of the
Department for International Development (DFID)
Renewable Natural Resources Research Strategy (RNRRS)*

Programme: FORESTRY RESEARCH PROGRAMME

Production System: Forest/Agriculture Interface

Project Number

R8305

Project Title:

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

Abbreviated Title: *(max. 30 characters)*

Bark harvesting project

Version Number: 3

Draft Peer Review PAC submission Approved
(Ring appropriate word)

Date:

15 September 2003
Submitted 23 June 2003, revised by jrp to 15 July 15

*Please read the Conditions and Agreement (Section G) before completing this document. The completed document should be submitted to **The Programme Manager, Forestry Research Programme, Natural Resources International Limited, Park House, Aylesford, Kent, ME20 6SN** as a signed hard copy in the first instance. A copy of the final agreed version on disk will be required, should the application be funded.*

SECTION A: KEY INFORMATION

PROJECT TEAM

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SUMMARY PROJECT DETAILS

3. Project Summary

The project will develop efficient sampling and mensurational protocols for tree species from which bark is harvested for medicinal use in southern Africa. The study will use computer simulations and field trials to determine optimal sampling methods for individual species in afro-montane forest and miombo woodland. Experiments designed to evaluate different bark harvesting strategies will be undertaken. Long-term PSP data will be used to develop a bark yield model. The results of these studies will be published as a handbook for bark harvesting and generic guidelines to be published by FAO. A training course to accompany the publications will be developed.

4. Starting and finishing dates

Start date: 01 May 2003

End date: 31 March 2005

5. Total Cost

£ 189,985 (excluding VAT)

6. Keywords (including subject, species, countries *etc.*)

South Africa, Zambia, Malawi, sampling methods, experimental harvesting tree bark, medicinal plants, tree wound pathology, sustainable bark harvest.

7. RNRRS Production System and Programme Purpose

Production system: Forest-Agriculture Interface (also semi-arid and tropical moist forest)

The outputs at the species level have regional scope (southern Africa), generalisation of study findings has global significance.

8. Is the research focused, inclusive or enabling?

Enabling

9. Commodity Base

Bark harvested from natural forest trees for medicinal use.

10. Geographic Focus

Malawi, Republic of South Africa, Zambia

11. Client Institutions

Malawi Forestry Department
 National Herbarium and Botanical Gardens of Malawi
 Traditional medicine associations (Zomba, Mulanje and Machinga)

Republic of South Africa Department of Water Affairs and Forestry
 Fort Cox Forestry School
 PE Technikon - Saasveld Forestry School
 Sizamphilo Plant Harvesters Association
 University of Stellenbosch

Zambia Forestry Department
 Kaloko Trust
 Forestry Department
 Forest Research Division (FD)
 SAFIRE

Organic Producers and Processors Association of Zambia

International institutions CIFOR
DFID
FORNESSA – African research network supported by FAO.
GEF
ICRAF (Malawi office)
IUCN (Nairobi office)
Medicinal Plant Sustainability Forum (UK)
Rainforest Alliance

12. Project Location

Republic of South Africa Groenkop Forest - Western Cape
Witelsbos Forest - Eastern Cape
Umzimkulu Forests - KwaZulu-Natal

Malawi Liwonde Forest Reserve (co-management block) – Machinga District
Mulanje Mountain

Zambia Mwekera Forest Reserve – Copperbelt Province
Kaloko Trust (Farm block 71737 Masaiti) – Copperbelt Province

13. If the project is located overseas or if there is an overseas collaborator, has the approval of the overseas government been obtained? If so, provide details.

Yes, see attached letters of support from overseas collaborating institutions.

14. Is the project linked to work funded by other DFID sources (other RNRRS Programmes, DFID TC) or other funding agencies (EU or other bilateral programmes)?

FRP project ZF0077 on NTFP¹ biometrics. This project identified a need for biometrically sound inventory methods for NTFP species. Ideas presented at the expert meeting held in Rome by this project were picked up and developed by the FAO GCP/RAF/354/EC Sustainable forest management in African ACP countries project. This three year project was funded by the EC and ran from 1999 to 2002. The outputs of this project are draft guidelines for NWFP assessment in sub-Saharan Africa and a report of six case studies on different aspects of NWFP biometrics. A workshop to review these two documents is partially funded by FRP as part of the Project Planning workshop that prepared the current document. The proposal seeks to continue this work particularly looking at the problem of efficient inventory designs for quantifying populations of rare tree species.

Commercial Products from the Wild project (CPW project) - funded by the RSA government Innovation Fund and supported by the DFID DWAF bilateral support programme. This was a three year project, completed in 2002 which included a study of resource levels and management recommendations for tree bark harvested for medicinal use as well as a range of other NTFPs including herbs, fruit and grasses. The present proposal will continue and extend experiments and studies started by this project and includes many of the same partners.

The Social Forestry Training and Extension Project of the Malawian Forestry Department was funded by the EU, administered by LTSI and ran from 1997 to 2002. This project undertook the training of extension staff to pioneer community based forest management and tested new participatory approaches to co-management. The aim was to contribute to improved livelihood security for resource poor rural communities. FRIM was contracted by this project to develop participatory forest assessment methods using Liwonde as a test forest. These methods are now available in the form of a

¹ NTFP = non-timber forest product, the phrase in common usage. NWFP = non-wood forest product, the phrase preferred by FAO.

Field Manual which deals mainly with overall evaluation of strategic forest management issues. At the present time the Forestry Department is seeking an extension of the EU project. The proposed work will take place in Liwonde Forest with FRIM and will provide them with experience of detailed resource planning. This experience will be useful to the next phase of the EU project which should be the development of detailed co-management plans.

In Zambia, the project is linked to the on-going work of the Kaloko Trust which is a NGO which promotes sustainable agriculture, woodland use and development. There is also a current IFAD project which is undertaking the reform of the Forestry Department and the introduction of community forestry. A DIDC (Finland) project is supporting training and may be able to take up and disseminate the handbook at the end of the project.

SECTION B: DEMAND, UPTAKE AND GEOGRAPHIC FOCUS

15a. What is the project's purpose?

Purpose: 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**.

The project will contribute locally to the knowledge base on which sustainable management plans can be prepared for tree species from which medicinal bark is harvested. The lessons learnt through the research process will be generalised to provide advice on the most efficient manner to tackle generic NTFP sampling issues.

15b. What developmental problems or needs is the project aimed at?

Tree bark is an important component of the pharmacopoeia of traditional healers in Africa and traditional medicine is still the main source of health care for the majority of Africans. As the population grows and becomes urbanised, forests shrink and the pressure on preferred bark species increases and trade is commercialised and orchestrated by market traders. In recent years the advent of the HIV/AIDS pandemic has increased the demand for medicinal herbs, including tree bark, as traditional healers work with the hospitals to find ways of alleviating the symptoms of AIDS. In Zambia AIDS has also increased the demand for bark as a cheap source of material to make coffins to bury the dead of the poorest people.

Harvesting in RSA forests within a few hours drive of the Durban Herbal Market already compromises all trees of preferred species. The harvesting continues despite the prosecution of illegal harvesters. As far away as Malawi, medicinal plants are harvested for export to South Africa and this trade is likely to extend into Zambia and beyond. Pressure in Malawi is such that local extirpation of two medicinal tree species is already reported from Liwonde Forest (though this may not be solely the result of bark harvesting). Zambia has a relatively low population density but even here many trees close to Kitwe have had bark and roots harvested.

The uncontrolled harvesting of bark could result in: local extirpation of the species; compromised ecological processes in the forest; reduction in forest incomes for owners, collectors, traders and traditional doctors; the loss of useful medicines and compromised health security of the general population.

It is contended that management planning will minimise the risks of forest exploitation. Management planning in turn depends on good quality, ideally quantitative, data of resource availability and growth rates. However, for many forest resources there are few tried and tested methods available for gathering suitable quantitative data. This is because experience indicates that traditional plot-based forest inventory methods do not provide good results for relatively rare, clumped or scattered species and many NTFP resources exhibit these characteristics. The difficulties of quantifying growth and replenishment rates for bark are even greater as very little scientific work has been done on bark recovery after wounding and growth rates in southern Africa. The project intends to provide reliable,

scientific and participatory methods for quantifying bark quantities, growth rates and optimal harvesting strategies. This information can then form the basis for sustainable management plans which will, in turn, secure the livelihoods of people dependant on forest harvesting and the health of those who use traditional medicines.

15c. What is the evidence for the demand or need for the research?

Southern Africa

FRP undertook a survey of constraints in the forestry sector in southern Africa with the aim of identifying those where research could have positive impact on poverty (Macqueen 1999 from FRP projects ZF0101 and ZF0119). Several high priority specific problems for which national capability was inadequate were identified. These were:

High priorities

1. The lack of commercialisation of timber and non-timber forest products based on research directed at the whole value chain, from resource management, through harvesting, processing, quality control, packaging to marketing and sales.
2. The lack of specific marketing studies and development for the following woodland products: medicinals, essential oils and gums, basketry and weaving craft, indigenous fruits, mopane worm and other caterpillars.
3. Inadequate processing, packaging and quality control for woodland products, especially indigenous fruits, medicinals and resins or gums.
4. Inappropriate policies for the use of woodlands and woodland products based on sound economic assessments of woodland products and services such as range, timber, NTFPs, energy, ecotourism etc.
5. Insufficient ecological studies of the regeneration, growth and yield of key woodland species including species site matching.
6. Inadequate operational framework necessary for productive co-management of natural woodlands either in community areas or around forest reserves and in particular the institutional arrangements necessary for success.

Interestingly, the CPW project in RSA did address most, if not all, of these issues for a range of NTFPs including bark harvested for medicinal use. This work was funded by the RSA government and confirms the demand for research on medicinal plants for income generation (the CPW project was financed by the RSA Innovation Fund).

A more detailed survey of marketing problems and opportunities for indigenous medicinal plants in RSA (Manders 1998) recommended actions at two key levels:

- 1) Co-ordinated support for the indigenous medicine industry amongst policy-makers in all levels of government, in business and in NGOs. This would require a supportive, consistent and positive policy and regulatory environment. A focused information and technology transfer system was identified as a key component of the required support.
- 2) Development actions within the market itself which would require a positive policy environment. Such actions should include;
 - recommendations for management and utilisation of existing wild plants,
 - demonstration of management and harvesting techniques in different habitats,
 - co-ordination of logging operations in indigenous forests to also provide bark products,
 - research into the sustainable harvesting of wild plants at both the species population and individual plant level,

- provision of short courses in the harvesting practices, propagation, cultivation and marketing of medicinal plants for a range of farming skills and literacy levels.

Recommendations for promoting the use of plants included research to:

- quantify and identify sustainable harvesting strategies for wild plant stocks,
- prioritisation of forest species, particularly for cultivation due to the small areas of forest remaining in RSA, and the relatively slow growth of forest species.

Furthermore it was suggested that such research should be the specific focus of government and NGO's and should include better management of the resource base.

The SAFIRE and Veld Products Research have both expressed a need for assistance with NTFP resource biometrics and is interested in utilising the project outputs (*Phosiso Sola pers comm*).

International

Evidence for demand for NTFP biometrics is the increasing number of bilateral forestry projects that include NTFP inventory and management. Over the past two years Wild Resources Limited has provided advice on NTFP biometrics to three bilateral forestry projects in Nepal, Ghana and Uganda. In all of these projects the need for NTFP inventory was prompted by the need to include the products of most concern to local people in forest management. The move to community and collaborative forest management also requires that forest management and hence inventory is participatory in nature.

The demand for generic tools for the assessment of NTFP resources was succinctly expressed by the experts invited to the FRP ZF0077 workshop on NTFP biometrics held at the FAO headquarters in Rome in May 2000 (Baker 2001). The demand from the workshop was sufficient to stimulate the editing of the workshop background paper into a FAO publication which eventually came out as Number 13 in the NWFP series and was translated into French and Spanish. This publication has been well received and reviews have been published in a number of international journals.

The need for better tools to quantify forest resources was also expressed in the FRP programme development report by Lawrence and Warren (1999, FRP project ZF0118). They found that better guidance on silviculture and sustainability were ranked as the third and fourth most important priorities for research and dissemination. The present project seeks to address these priorities by developing silvicultural guidelines for bark production and the basic inventory data which underlies planning for sustainable forestry. The emphasis in Lawrence and Warren's report is on participatory management and the present project will address this by working as closely as possible with bark harvesters and communities at large and the generic guidelines will provide protocols suitable for use in a participatory context.

Baker N. (2001) Developing needs-based inventory methods for non-timber forest products. Application and development of current research to identify practical solutions for developing countries. ETRN Series No.2. ETRN/DFID/FAO.

Lawrence A. and Warren K. (1999) Researchable constraints in participatory forest management: a survey of issues and options. FRP report. Unpublished. Reading, UK; University of Reading, Agricultural Extension and Rural Development Department (AERDD).

Macqueen D. (1999) FRP discussion visit to Southern Africa 12 April 1999 – 6 June 1999. FRP problem surveys – No. 1. Chatham, UK; Natural Resources International Ltd., DFID Forestry Research Programme. http://www.frp.uk.com/may2001/orange/content/1_probsurvey.dbm

Manders (1998) Marketing of indigenous medicinal plants in South Africa: A case study in KwaZulu-Natal. FAO, Rome.

15d. What will the project contribute to resolving these demands or needs and over what time-scale?

The project will address the demands listed above concerned with facilitating sustainable management planning for medicinal barks in Southern Africa. In particular, Macqueen's research priority 5 will be directly addressed. The project will also be a significant contribution to the second set of actions identified by Manders (1998).

Over the lifetime of the project we hope to stimulate the implementation of sustained yield management of bark resources in the study forests. Beyond the lifetime of the project the outputs should be able to ensure the conservation of medicinal species and secure steady flows of bark for medicinal use from the study forests. Over the longer term the dissemination of project publications and training programmes will contribute to the implementation of sustainable bark harvesting in southern Africa. This example will be used to influence management for other NTFP products globally through incorporation into more generic FAO publications. The preparation and dissemination of publications and training programmes will contribute to the achievement of the project purpose and in the study sites demonstrate the practical application of the advice contained within them.

The time-scales over which the impact of sustained yield management will make itself felt in terms of income and forest security are long and certainly beyond the scope of a two year project. However, uptake of project outputs over a shorter time period will serve to demonstrate that the demand for advice in this area has at least been met.

15e. Which are the identified client institutions?

The project has been presented to representatives of the following client institutions which are willing to be involved with the project. If the project is successful these institutions it is anticipated that these institutions will be able to adopt the recommendations though several may require financial assistance with the implementation of training programmes. Other institutions listed in Section 11 have yet to be contacted but are expected to be willing to embrace the project outputs.

RSA	Department of Water Affairs and Forestry PE Technikon - Saasveld
Malawi	Forestry Department National Herbarium and Botanical Gardens of Malawi ICRAF, Malawi Office.
Zambia	Forest Research Division of the Forestry Department Kaloko Trust

15f. What are the proposed promotion pathways for the uptake of the project outputs?

i) Have any market studies for the outputs been produced?

Generic market research of the international demand for NTFP assessment advice has been undertaken by LTS International on behalf of Wild Resources Limited. This study (LTS International 2003) indicates that there is strong demand for forest biometrics and NTFP management generally. The dissemination of more than 5000 copies of the FAO NWFP Series number 13 publication (2001) based on FRP project ZF0077 indicates strong demand for generic advice. The continuing growth in interest in natural medicines in the western world (25% growth annually in Germany) and the establishment of a Medicinal Plant Sustainability Forum in the UK indicate a growing interest, if not yet demand for sustainable harvesting of medicinal plants. With sub-Saharan Africa demand remains high for traditional medicines but awareness of the vulnerability of local supplies to overharvesting is not yet widely appreciated.

ii) What are the further stages needed to develop outputs?

Principally, a handbook to be published by FAO. Training in the use of the handbook will be provided to target institutions during the lifetime of the project and by project collaborators thereafter.

iii) What are the further stages needed to develop outputs?

Further development of the training programmes beyond the lifetime of the project will probably be required. Biometrics alone is only a contribution to sustainable management, development of the socio-economic and political environment for collaborative forest management will also be required for the realisation of improvements to livelihoods based on bark harvesting.

iv) How, and by whom, might further stages be carried out and paid for?

It is expected that the project collaborators will be in a position to undertake in-service training programmes. Funding for this could come from operating budget of the Forestry Department or development projects.

Funding for implementation of bark management should come from the operational budgets of forestry departments. However, most African forestry departments are not able to undertake much innovative management without the support of international donors. There are several bi-lateral projects in the collaborating countries which should be in a position to apply the results of the project in the context of community forestry management. Unfortunately the project has not yet been able to generate direct links with donors or projects supporting natural resources or rural livelihoods. Developing such links will be a priority for the project team. There appear to be opportunities for synergy with the following donor projects:

RSA	DANIDA funded training project - DWAF DFID bilateral country programme particularly those in the forestry sector.
Malawi	EU Social Forestry Training and Extension Project (extension)
Zambia	IFAD project supporting institutional reform in the Forestry Department DIDC Finland which is supporting training in the Forestry Department

v) What mechanisms will be used in dissemination, who will be the client audiences and who will handle the dissemination?

The principal project outputs will be the publication of a bark management handbook supported by training courses. The clients for the handbook are those responsible for devising or facilitating forest management planning. In general these are the statutory forestry agencies usually at the local level, development or conservation NGOs and forestry training institutes.

The publications will be disseminated by FAO through their NWFP and regional networks. This ensures timely, global and multi-lingual distribution. The NWFP contacts list contains around 6000 names with around 3000 of these automatically receiving free copies of new publications. For many developing countries, FAO publications are among the few technical documents they receive and this provides unparalleled access to client institutions. Publications are distributed free to any developing country individual or institution on request and FAO are committed to keeping in print and accessible any of their publications which continues to be in demand.

The training courses will be developed by the project collaborators and tested in selected target institutions named in section 15e. After the end of the project they will be run by

trained facilitators within the partner institutions and could be made available to others on a consultancy basis perhaps funded by bilateral forestry programmes.

vi) What baseline data will be collected, and what markers and monitoring system will be emplaced, by the project to enable its developmental impact to be assessed?

The development impact of the project should be up to level E and it is appropriate to consider impact assessment at this level. The baseline data are therefore the number of individuals within client institutions sufficiently skilled to facilitate the development of bark management plans and the number of harvesters who are conversant with best bark harvesting practice. As part of the socio-economic data collection it may be possible to identify markers related to the use of the bark as medicine, especially in hospitals, and these will be addressed as they become apparent. Quantification of such markers is covered in activity 4.2.

15g. Who will the beneficiaries be and are there any groups who will be disadvantaged by the application of the research findings?

The intermediate beneficiaries of the project will be those in the target institutions which will be able to undertake their job more effectively and with greater confidence. The ultimate beneficiaries are the bark harvesters and traders who will have greater income security and the purchasers of the medicines made from the bark who will have a continued supply of remedies perhaps at more stable prices and consistent quality. The benefit to local communities is that sustained use will be assured.

It is difficult to see that any groups will be disadvantaged by the project though it is possible that bark harvesting may conflict with management for other NTFPs, timber or wildlife. It is important that commercial use is not overemphasized to the disadvantage of traditional rural users.

16. Is this proposal a continuation or extension of work already funded by DFID?

Yes, this project is a continuation of the DFID funded ZF0077 NTFP biometrics project. The present proposal seeks to further develop and disseminate best practice in NTFP biometrics. Furthermore the DFID Support Programme for Department of Water Affairs and Forestry in RSA supported the CPW initiative on development of the bark studies and improved bark harvesting practices.

SECTION C: SCIENTIFIC BACKGROUND

17. What work has previously been done, or is currently being pursued, towards the purpose, outputs and activities of the project? A review of literature should be included.

There are three areas associated with the present project which have been the subject of previous studies these being; NTFP biometrics, bark harvesting and basic ecology of the study forests. Each of these is examined in turn and the areas in which this project will develop and utilise extant knowledge will be highlighted.

Generic NTFP sampling issues

The generic issues which underlie the problem definition in 7, 15a and 15b have been the subject of several text books notably; Peters (1996), Martin (1996) and Cunningham (2001) which offer text-book style instruction on NTFP inventory. There are also a few manuals which give advice tailored for specific regions. For example, the manuals for Nepal devised by Branney (1994) and the Nepal Swiss Community Forestry Project (2001) and the FRP-funded manual for Indonesia by Stockdale and Corbett (1998). These mostly offer a single one-size-fits-all design for all species or designs modified for a restricted number of similar species. Textbooks require significant levels of education and confidence to use, while single generic designs do not often yield good results for individual species. For some NTFPs species specific inventory methods have been devised e.g. those developed for rattan (Tandug 1988, Stockdale and Wright 1996, Evans 2002). However, the great variety of possible NTFPs has led to the task of compiling suitable designs for each one being likened to the labour of Sisyphus. What is required is something that can help someone designing a NTFP inventory to choose a design that best fits the species and situation in which they are working. This is the intent of the 'guidelines' publication being developed by FAO however, the guidelines are presently in the form of a rough draft and require a further six months of work to bring to publishable form. Although several issues have been tackled in the preparation of the guidelines it was not possible in the limited number of case studies to develop or test more than a few techniques for application to NTFPs.

The FAO guidelines follow on from previous work by the proposer of this project under the ZF0077 project. The ZF0077 project was commissioned to prepare an issues and options paper for research needs in NTFP biometrics. This work comprised an extensive literature review of around 400 English language references (Wong 2000). The main points arising from the review were confirmed by the May 2000 expert meeting held in Rome and summarised by Baker (2001). The ZF0077 review was later augmented by FAO with around 200 French language papers which identified the same issues and did not change the overall conclusions (Amsellem 2001). The general conclusions of the workshop were:

1. the need to increase awareness of the desirability of sound assessment of NTFP populations and dynamics when considering utilisation of these resources,
2. the need to increase awareness of the importance of including biometric analyses in the planning phase of any data collection exercise,
3. there is a clearly expressed need from field workers for NTFP inventory methods that are simple and easy to use but at the same time are adequate for the determination of harvest levels,
4. further work by inventory specialists on the development of inventory methods and protocols for NTFPs is required, drawing on methods that currently exist in a variety of disciplines,
5. there is an urgent need to provide advice on existing NTFP inventory and analysis methods to field workers.

Subsequent to the Rome workshop, FAO funded (under the GCP/RAF/354/EC project) six case studies on NTFP biometrics (under the direction of the project proposer) which were commissioned

to test ideas on optimal methods for inventorying NTFPs (Wong and Pouakouyou 2003). The case studies covered the following topics:

- Quantifying leaf resources of *Combretum micranthum* populations in Benin
- Quantification techniques for *Pausinystalia yohimba* (Johimbé) bark in the Lokoundjé-Nyong forest, Cameroon
- Quantification of *Gnetum buchholzianum* in the Ngotto forest, Central African Republic
- Testing Techniques to Assess Fruit Yield: The Case of Baobab (*Adansonia digitata*) from the Drylands of Kenya
- Using local knowledge as a basis for stratification of inventory sites: wild mushroom inventory in Liwonde Forest Reserve, Malawi
- Comparative assessment of alternative sampling designs for non-wood forest products in Mwekera National Forest – Kitwe, Zambia

Some of these studies are more useful than others with the ones in Malawi, Zambia, Kenya and Cameroon offering many useful insights into practical inventory problems and how they can be tackled. In particular the case study of Johimbé bark in Cameroon provides a useful comparison of bark yields from a high forest species. However, there remain many outstanding issues and techniques which have not yet been tested with NTFPs. In particular, although RBS was shown to be useful for baobab there remains a need to develop a straightforward protocol for this form of sampling as well as a test of the relative efficiency of RBS and utilisation of the pipe model for estimating yields of fruit.

It was proposed by Wong (2000) that basic features of a resource population such as its spatial distribution and size can be used to design inventory strategies as a means of circumventing the need to provide specific advice for each product. This idea is the basis for the keys which are central to the FAO Guidelines and has been adopted in the US Forest Service draft forest inventory manual and in the notes from the Statistical Services Centre of the University of Reading.

There are a number of generic problems when sampling NTFPs that the current proposal seeks to investigate. Many NTFPs are rare and often clumped at a local scale. Plot-based forestry-style inventories do not provide good results for such distribution patterns because of the large number of empty plots which are expensive to enumerate and confound conventional statistical analyses. The adaptive sampling class of designs (Seber and Thompson 1994, Thompson 2002) are a relatively new innovation which purport to offer efficiencies for rare, clumped distributions such as those exhibited by NTFPs. The basic idea in adaptive sampling is that the number of plots, size of plots, etc., can be modified during the course of the fieldwork in response to the emerging characteristics of the population being sampled. This is an attractive and intuitive idea (it permits you to vary your sampling intensity with population density). However, the only application of these ideas to NTFP sampling have been a few trials of adaptive cluster sampling (ACS), a specific type of adaptive design. ACS has been tried for rare trees in Nepal (Acharya *et al* 2000), *Prunus africana* in Cameroon (Underwood 2000) and clumped trees in the Southern Cape (Geldenhuys *pers comm.*). However, there is still much work on field protocols and analytical techniques that needs to be done before ACS can be comprehensively evaluated and brought into appropriate use. There has been even less work on other novel sampling designs and there is much to learn about how best to sample NTFPs. Several novel designs including ACS will be tested for application to single tree species in afro-montane forest and miombo woodland. The designs to be field tested will be determined through simulation study based on detailed maps of two forests.

Sampling a population poses quite a few difficulties but the development of management prescriptions requires the estimation of the population structure not just population size. The parameters needed to describe population structure are the number and proportions of juveniles, mature and senescent plants. This complicates the sampling design as each stage may exhibit distinctive patterning at different spatial scales. The general advice for trees is to sub-sample juveniles

in nested sub-plots. However, the current project seeks to examine whether this is indeed the best strategy and provide advice on the optimal sizes and orientation of sub-plots within multi-stage designs.

Tree bark as a non-timber forest product

Bark is a protective covering on the stems of woody plants (trees and shrubs). It is composed of several layers; a living inner layer including the cambium and an inert outer layer which can have a range of textures. Bark often contains high concentrations of complex, biologically active and toxic phytochemicals in order to protect the tree from infection and to deter herbivores. Over time, people have discovered that these compounds are effective against human disease (e.g. as a febrifuge) and they have been utilised as traditional medicines in most cultures and also processed into modern pharmaceuticals. Traditional herbal remedies are the most accessible and affordable medicine for rural and poorer people in most developing countries. Consequently, reliance on wild harvested medicines and thus bark is high. The tannins often present in bark are also used to cure leather and hides while other chemicals are used as dyes. The fibrous nature of bast which is an inner bark layer has been exploited in many species in the manufacture of textiles (bark cloth), paper and twine. The outer bark (cork) of some species can also be removed intact and used as a cheap, flexible construction material (e.g. for coffins, bee hives and other containers). (Cunningham 2001)

The demands for bark have led to increasingly high pressure on the natural forests as populations increase and the forests diminish. Trees scarred by bark harvesting are a familiar feature in farmed landscapes and residual forests across the tropics. Within many of these forests large scale harvesting of trees for timber, firewood and medicines is posing a serious risk of extirpation to several popular species and certainly to the continued supply of medicinal bark. For a few species the bark is also exported to northern pharmaceutical companies and export demand has increased pressure on the populations e.g. bark from *Prunus africana* which is exported to Europe (Cunningham and Mbenkum 1993, Acworth *et al* 2001, Hall *et al* 2003).

Although bark harvesting has been subjected to scientific investigation there are still many outstanding issues in terms of inventory, mensuration and growth modelling. Traditional forestry-style inventory was shown to be inappropriate for *Prunus africana* in Cameroon (Acworth *et al* 2001, Wong 2000) i.e. the inventory did not provide estimates within the target sampling error for an individual species in a mixed forest. Allometric relationships have been developed for bark volume based on tree diameter at breast height for various species by the CPW project in RSA, for *Prunus africana* in Cameroon by the DFID Mount Cameroon Project (Acworth *et al* 1998 and Pouakouyou 2002) and the FAO case study on Johimbé (Belinga 2003). This study showed that for Johimbé there is very little bark on the branches compared to that on the bole and it is hardly worth stripping the branches. However, Johimbé is a tall, high forest tree and it seems likely that for woodland trees and shrubs that a greater proportion of usable bark will be on the branches. The current proposal will test the utility of a range of methods including RBS and more conventional proportional sampling (where, say, a random 20% of the branches are sampled) for estimating bark volume within tree and shrub crowns. Besides considering the total volume of bark on a tree it is also necessary to determine the quantities obtained from different harvesting patterns.

Reports on the CPW project in RSA on Bark for Medicinal Use have been published (Geldenhuis (2002, in press) and Geldenhuis *et al* (2002) provide useful information on this project). In this project 37 transects through 13 forests were sampled to record the amount (volume) of bark harvested from target species and to assess the impact of the total amount of bark harvested per tree as percentage of the total bark volume in the main bole of the tree. This study used crown condition as an indicator of tree health in trees subsequent to bark harvesting (of course it is not possible in a one-off inventory to know how long previously the harvesting had taken place nor whether the tree was already moribund). The results indicate that there is a weak relationship between the volume of bark removed and health as the pattern of removal is more significant. Ring-barking (> 80% of stem circumference removed) as expected resulted in tree death.

Under the CPW project in RSA experimental bark harvesting was established in the Southern Cape where harvesting of bark was very limited. Briefly this experiment has the following protocol:

- Two study areas away from area of former illegal bark harvesting: a moister site – Witelsbos Forest (with previous related studies); a drier site – Groenkop Forest (with many other studies of forest ecology), both in the Southern Cape.
- Three tree species: *Ocotea bullata*, *Curtisia dentata* and *Rapanea melanophloeos*. Of these only *C. dentata* was present and treated in both areas.
- Three tree sizes (small, medium and large as defined by stem diameter)
- Two bark removal methods applied to each experimental tree: total bark removal, only outer bark removed (inner bark left) – this was done on opposite sides of a treated tree
- Three strip widths: 5, 10 and 20 cm wide strips (reduced to 15 cm for trees < 20 cm d)
- Two seasons of treatment: mid-winter (July-August, dry and cold period); mid-summer (November-December, warm, moist period)
- For each strip, the bottom 50 cm was painted with a proprietary arboricultural tree seal (paint containing fungicide).

At each site five replicates were done for each treatment combination i.e. 90 trees per site per species (2 x season x 3 x width x 3 x size x 5 replicates). The winter treatment was evaluated in Dec 2001, Jun 2002 and Dec 2002/Jan 2003. The summer treatment was only evaluated during the latter two periods. The results give a clear indication of wound recovery rates after one year.

The results after two years revealed three different species responses to bark harvesting. *Rapanea melanophloeos* does not respond well and after two years there is hardly any bark re-growth and the exposed wood is covered with fungal growth. *Ocotea bullata* responds well with callus growth from the edges of narrow strips after two years. *Curtisia dentata* also responded well but with sheet growth rather than edge growth. Observations of other species during the inventory indicate that *Cryptocarya myrtifolia* does not respond well, but others like *Prunus africana* and *Ilex mitis* recover rapidly through sheet growth, even if the bark was removed up to the main branches.

Initial results from the CPW experiments indicate that bark re-growth is not affected by tree size or strip width. Removing only the outer bark appears to kill about 20% of the inner bark but is difficult to remove and provides very small quantities of bark, furthermore it is often the inner bark that is used medicinally. Proprietary tree seal is expensive and did not reduce the amount of fungal or insect infestation. Season is expected to have an effect but this has not yet been confirmed as the analysis of the CPW experiment has not been completed. A first task for this project R8305 is therefore to complete and summarise the CPW data. The present proposal will assist with the full analyses of the experiments and extend observations on treated trees for a further two years. The analyses presented at the end of the project will therefore include four years worth of growth and recovery data for the three species included in the CPW experiments. Similar experiments will also be conducted on other afro-montane species extending from the southern Cape to Malawi and also for miombo species from Malawi to eastern Zambia.

It seems that traditional healers would strip bark in small pieces often from only one side of the tree and that at least some species can withstand repeated harvesting of this type (as seen in heavily scarred roadside trees such as *Azadirachta indica* and *Khaya senegalensis* in northern Ghana and *K. senegalensis* in Hanoi, Vietnam). The current advice for many species is to mimic this and prescribes harvesting strips of mature bark at frequent intervals (i.e. the Cameroonian guidelines for *Prunus africana* prescribe removal of strips from opposing quarters of the tree from ground level to the height of the first branch at five year intervals - Acworth *et al* 2000). However, prescriptions of this type are not likely to work well for species such as *Rapanea* which do respond well to bark damage.

A possible alternative management system for bark would be to fell a mature tree (if a tree is dying with less than 40% live crown or it is earmarked for timber), strip all its bark and to subsequently harvest the bark from coppice regrowth. A harvesting system based on coppice re-growth was proposed for Lokta (*Daphne bholua* and *D. papyracea*) bark harvested from shrubs in Nepal (Jeanrenaud and Thompson 1986) but it is not clear if these were ever fully implemented though attempts are still being made (Chitrakar and Prescott-Allen 1996, Nepal Swiss Community Forestry Project 2001). The attraction of such a system is that it maximises the initial yield and provides a continuing, albeit relatively small, supply of bark into the future. It has also been suggested that felling of dying trees for coppice management may present an opportunity to salvage some useful product and rejuvenate the trees. The ability to produce coppice is a function of the anatomy of the species being harvested so this system would not work for all species. In order to determine if this is a viable management prescription for a particular species some means of assessing coppicing ability as well as the optimal age/size for coppice treatment and the potential yields and longevity of such a system are required. The pharmaceutically active compounds have also to be present in useful quantities in the relatively immature bark of coppice shoots.

Observations during the bark damage inventory in Kwa-Zulu Natal showed that moribund trees of *Ocotea bullata* and *Curtisia dentata* develop epicormic shoots at the base of the stem. These shoots were heavily browsed if not protected by branches or dense fern growth and their survival appears to depend on the survival of the main stem. If the tree was cut both *Ocotea*, *Curtisia* and *Prunus* developed coppice shoots which can grow fast if they are protected or out of reach of browsing animals. Height growth of coppice shoots of *Ocotea bullata* was 3 to 4.5 m in 18 months. So these species could be managed as coppice, but unfortunately *Rapanea* did not show this coppicing response to cutting and optimal management would require felling mature trees and managing regeneration for future supplies. Such systems could be simulated using growth models as for timber.

Ecology of forests from which bark is harvested

Some of the RSA study sites and species have been the subject of previous ecological study. Much of this information is relevant to bark harvesting and provides an invaluable resource for the project. For example, in the Groenkop site there have been studies on:

- Sampling techniques for forest inventories (van Laar and Lewark 1973)
- Growth, ingrowth and mortality (Geldenhuys 1998)
- Litter fall, flowering and fruiting patterns of a range of woody species (Geldenhuys and Theron 1994, Koen and Geldenhuys 1992)
- Vertical microclimate gradients, i.e. temperature and humidity levels from forest floor to above canopy, and the patterns in rainfall interception and stem flow (Lübbe and Versfeld 1991)
- Population demography and phenology of the fern *Rumohra adiantiformis* and the impacts of frond harvesting on sustainability of the fern resource (Geldenhuys and van der Merwe 1988)
- Bird-insect-habitat relations and the impact of timber management practices (Koen 1992)
- Population demography of the understorey shrub, *Trichocladus crinitus* (Geldenhuys and Delpont 1981)
- Lightning impacts on the forest and species and recovery patterns (Geldenhuys *et al* 1994)
- Timber harvesting impacts on the spread of the alien invader timber tree *Acacia melanoxylon* (Geldenhuys 1996)
- Regeneration patterns of important canopy tree species (Geldenhuys 1993, Geldenhuys and van Laar 1992, Koen 1991)
- Experimental bark harvesting from selected species (Geldenhuys *et al* 2002).

There has been less work on the study forests in Malawi and Zambia. During the project all available information on the species and forests relevant to the development of bark yield models will be collated and incorporated into model parametisation.

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SECTION D: OUTPUTS AND ACTIVITIES

18a. What are the outputs of the project?

There are four outputs which the project will use to achieve the purpose given in 7. The first three outputs deal with the main technical issues being tackled by the project while the fourth makes results available to a wider audience.

1. Protocols for the efficient field sampling of tree species in natural forest

The results and experience gained from completion of the activities under this output will be used to document efficient protocols for obtaining precise quantitative estimates of medicinal bark volumes present within in natural forests in southern Africa. The protocols will include details of optimal sampling designs (plot configuration and distribution) for determining the stocking of a particular species within natural forests and also protocols for determining bark volume on trees and shrubs. Bark volume tables will be presented for the species in the study. It is likely that different designs will be best for species with differing distribution patterns and also in different environments. Guidance will be given on data analysis and interpretation.

2. Methods for determining best practice bark harvesting techniques for tree species with differing bark anatomy ecophysiological profiles

This output will present protocols for first determining tree response to bark harvesting. These will take the form of a simple protocol that can be used to determine bark response pattern and rates. CPW experience suggests that useable results can be obtained after six months so this should not unduly delay the management planning process. Based on the experimental results and observations of coppicing ability the handbook will advise on strategies for establishing sustainable bark harvesting for individual species.

3. Techniques for quantifying bark productivity

Bark productivity is made up of two components, the population dynamics and growth rates of the trees and the wound response and growth rate of bark. To be able to determine the productivity of bark it is necessary to know something of both of these as well as the management system to be applied (repeated cutting, coppice or population management). This output will provide details of the protocols devised by the project to determine bark volume on a tree or shrub and growth rates. The output will also contain a bark growth and yield model which can be parameterised with experimental and observational data to forecast the bark production from a range of management systems.

4. Dissemination of project results

Dissemination of the first three outputs is essential if the research is to have any development impact. The project will prepare a handbook detailing the protocols developed and direct advice for the species included in the experiments for dissemination by FAO and the collaborating institutions. However, even the most clearly written handbook can be incomprehensible until explained and the protocols experienced. This output will therefore include preparation of training materials and prepared trainers to accompany the handbook. It is also important to know what impact the project is having so this output also includes assessment of changing skill levels and awareness in the client institutions.

Development impact is the ultimate objective of the FRP programme and thus seeks to measure the contribution of its research projects to livelihoods. In terms of markers which could aid future assessment of development impact, perhaps the most relevant would be the price of specified volumes of bark and the form in which it is offered for retail. NTFP markets are often dominated by the wholesalers such that collectors are not able to influence prices. It is hoped that knowledge of resource scarcity and acceptance of the need for management will serve to empower collectors and this should be reflected in them being able to negotiate a larger share of the resource value. Likewise, greater appreciation of the value of the product should lead to value-addition at source and also processing to minimise waste. These can both be detected by the increased appearance of dried and

ground bark instead of raw slabs. The further back in the market chain this occurs the more likely it is that the collectors (usually the poorest) are benefiting. However, there is already a certain amount of processing of bark (e.g. the collector in Liwonde (Malawi) was chopping bark for sale to RSA wholesalers) which would need to be accounted for.

18b. What are the expected environmental impacts (beneficial, harmful, neutral)?

i) Direct

Direct, harmful impacts will be damage to trees and sites involved in the harvesting and productivity studies. Site damage will be minimised as much as possible but there are some trees that will inevitably be fatally damaged in the experiments. The converse of this will be the positive benefits in terms of increased survival of trees once the results of the experiments are translated into practice.

ii) Indirect

A potential indirect negative impact would be increased risk of overharvesting if the inventories alert people to the presence of harvestable trees they did not already know about. This is a particular concern for study sites in the Eastern Cape and the project will need to ensure the security and confidentiality of inventory data.

19. Describe the project activities

Project operation

The project will take place over seven study sites as indicated in Table 1. There is more than one site in each country and several partners. This will make for a logistically complex project but will optimise replication and therefore robustness of the results.

Table 1 Project study sites

Country	Study site	Activities	Description
Malawi	Liwonde	Experimental harvesting Test inventory Bark allometry	Miombo woodland – co-management pilot area
	Mulanje Mountain	Experimental harvesting	Montane forest – biosphere reserve
RSA	Groenkop*	Experimental harvesting Bark allometry Measurement of coppice growth	Montane forest near coast
	Witelsbos*	Experimental harvesting	Montane forest near coast
	Umzimkulu	Re-inventory of 2000 TSP Test inventory	Montane forest, heavily exploited by Sizampilo Association
Zambia	Mwekera	100% survey of simulation test block Experimental harvesting Test inventory	Miombo woodland – research forest
	Kaloko Trust	Experimental harvesting Test inventory Bark allometry Measurement of coppice growth	Miombo woodland – rural development NGO, charcoal coupes on 50 yr rotation

* Measurement of coppice growth of trees of different species harvested on known dates for timber production will be done in the greater Southern Cape forest area by Forest Management staff.

There are a number of alternative harvesting strategies that can be used for tree bark,

- repeated bark stripping
- harvesting of coppice re-growth
- whole tree harvesting

All of these will be considered by the project. Protocols will be developed for trials that will be necessary to determine the best harvesting strategy and will be presented in the form of a handbook

and accompanying training. The data arising from the project will be used to develop a strategic bark management decision support model for use by forest managers.

Details of the protocols to be used in the study itself are outlined as far as possible at this stage of the project below. Changes to these intentions and protocols for specific activities such as the bark volume assessment will be communicated to FRP in quarterly reports. The first such report will give full details of the protocols in use for the experimental treatment of trees the second will detail all other protocols.

Roles of sub-contractors and local people

Building on the experience of the CWP project, local bark harvesters will be invited to participate in the experiments and field work. The advantage of this is that it provides a platform for knowledge sharing, for harvesting to mimic actual practice, enhances the credibility of the methods to traditional harvesters and will stimulate uptake and dissemination of best practices.

In RSA the project will work closely with the Sizamimpilo Association which is an urban-based market association of medicinal plant traders (who also do the harvesting). This association was established in November 2000 with the objective to 'harvest medicinal herbs, barks, roots, tubers, leaves or any other part of any plant in a sustainable manner, for medicinal purposes, with the co-operation and agreement or licensing by the relevant local, regional, provincial, national and other authority for the benefit of all its individual members'. At the beginning of 2003 the association has 200 registered members (with women well represented – the majority are women) and have entered into a license agreement with DWAF for harvesting barks from forests in the Umzimkulu area subject to sustainable management plans². In RSA involving commercial collectors in resource management has been a ground breaking venture which resulted in changes to the licensing regulations in the Forest Act and evidence of recovery in the licensed forests. The project will contribute to the further development of the association through provision of paid work and by improving their management practices.

In Malawi, the experiments will be undertaken by a range of people including district forestry staff and local bark harvesters especially those involved in the co-management pilot areas. Staff of the National Herbarium who have been trained in ethnobotany will be engaged to undertake the surveys of local knowledge. They will be included in project workshops which deal with these aspects of the project work.

In Zambia, the work will be undertaken as far as possible with local people especially bark harvesters. Recent difficulties in the region have resulted in significant loss of income and the consequent invasion of the forest principally to make charcoal for sale as an income of last resort. Involving such people in field activities while they are present in the forest has been used to provide incomes for forest residents at less risk to the forest (as in the FAO Guidelines case study, Malambo *pers comm*). Wherever possible the employment opportunity represented by the project field work should be distributed as sympathetically as possible without compromising the quality of the work. Although the project is being run by the University it is not considered appropriate to use students as the main source of labour, however, students will be given opportunities to participate in field work for project work. The Kaloko Trust have trained forestry staff who will oversee field work using people resident on the Trust land. The foresters will also be included in data handling and analyses (the Trust has solar powered computers) and invited to all project workshops.

² Traditionally traders/commercial collectors were not permitted to hold forest harvesting licenses. Negotiations between the Association and DWAF resulted in a change to the regulations in the RSA Forest Act to make this possible. Since then the CWP project has been able to assist the Association to improve the processing, packaging and marketing of the barks to increase revenues and make the medicines more palatable to increasingly urbanised customers.

Data handling and analysis

This project, R8305, will be seeking to collect knowledge from local bark harvesters. The use of such information is sensitive and is the property of the harvesters and their societies. This will be recognised by assigning the harvesters the intellectual property of their contributions to the project. This provision will take precedence over any other assignment of intellectual property rights by the contract between Wild Resources Limited and NR International. A means of conveying this assignment of rights to the harvesters will be determined in consultation with experts in this area.

Experience with the FAO NWFP assessment project suggests that the Zambian and Malawian collaborators have severe constraints on their ability to handle and analyse large quantities of data. The project will seek to provide significant capacity building in this area through the provision of desk-top computers for both institutes along with copies of project software. Support in terms of training visits will be provided during the life of the project. Workshops to familiarise the team with analyses and to contribute to interpretation of the results will be held. One person from each collaborating institute will be invited to the workshops this means three people from Zambia, two from Malawi and four from RSA. Two analysis workshops are planned, one on local knowledge in Malawi, data handling and analysis in Zambia.

Output 1: Protocols for the efficient inventory of medicinal bark resources in natural forest developed and tested

At the Saasveld workshop ten activities were agreed for Output 1. These are all concerned with the determination of efficient methods for quantifying the volume of bark available in a particular forest. The estimation of a resource requires that the abundance and size/age profile of the species and that the quantity of bark on each tree can be estimated.

The ZF0077 project concluded that sampling designs should be tailored for individual populations according to their distribution patterns, size and product type. The proposed project will first describe the type of distribution patterns exhibited by individual tree species in natural forest and then simulate a range of alternative sampling designs to determine the most statistically efficient. This will be achieved by analysing the frequency of trees in a 100% census of trees within a reasonable area of two forests. In the 1970's a permanently marked 25 ha section of Groenkop forest (Southern Cape) was censused. All trees greater than 10 cm were counted and measured in 14.3 x 14.3 m cells. No similar data exists for the miombo woodland in either Zambia or Malawi and there is therefore a need to generate a suitable dataset. The site chosen for the census is a 1 x 1 km block of Mwekera Forest close to Kitwe in Zambia. In this area all trees greater than 5 cm will be identified and measured in 20 x 20 m cells. The larger size has been selected because the miombo woodland is less dense than the Groenkop forest and the distributions patterns consequently larger. These data will be used to generate a virtual forest on a computer which can then be sampled at will. The sampling designs to be simulated will include a range of novel methods including ACS. This is likely to involve the derivation of estimators from first principles and will require inputs from a research statistician. Based on the results of the simulated sampling

Field trials of the statistically optimal designs in several forests to represent each of the partner countries. The sites selected for this study will be Liwonde Forest in Malawi, Mwekera Forest and the Kaloko Trust area in Zambia and probably one of the Umzimkulu or Southern Cape forests in RSA. The field trials will determine the logistical strengths, weaknesses and practicality of the proposed methods and will be used to develop detailed field protocols and determine the relative merits of each design for inclusion in the project outputs.

The amount of bark present on a tree is usually estimated using allometric relationships between bark volume and overall stem dimensions, usually diameter at breast height. A dataset of bark thickness and stem diameter has been accumulated for many South African tree species. However, there is a need to provide simple protocols for this work to be repeated for other species and to make the

existing information more widely available. Furthermore, there is a need to understand the relationship between the total amount of bark on a tree and that portion of it which can be harvested using a range of different techniques and to explore the use of tree architecture as a basis for sampling and estimating bark volumes for branches. Work to develop these protocols and understanding will take place alongside field sampling and experimental work. Suggested areas for investigation are:

- sampling for branch bark
- bark thickness at different heights of stem
- bark volume from coppice shoots

This work on bark allometry will be undertaken in all three countries and where possible utilising trees harvested for timber e.g. from logging operations in Groenkop and other Southern Cape forests and for charcoal production by the Kaloko Trust in Zambia. In Liwonde and Mwekera, non-destructive sampling of trees and bark will be used with limited felling of check trees.

Output 2: Best practice bark harvesting techniques developed for trees with different bark anatomy and ecophysiological profiles

How any particular species responds to different types of damage depends upon its bark anatomy ecophysiological characteristics. Trees respond in different ways to bark damage, bark response and growth rates will vary (as demonstrated by the CPW project) and not all species can coppice. Within a species, responses can vary depending on habitat conditions and the levels of stress the tree suffers. So coppice regrowth may only occur in moister habitats and browsing stress may mean a tree does not have resources to withstand bark damage. The term ‘ecophysiological profile’ has been used here to encompass all of these species/site responses.

Strip harvesting entails significantly wounding the bole of a tree which is something much studied by arboriculturalists. However, this body of knowledge is not accessible to the project team so Dr John Hall of SAFS will undertake a literature review of the tree wounding literature on behalf of the project. The output will be a summary of knowledge on wound responses and commercial bark harvesting and an annotated bibliography. The project will also support the completion and publication of the previous CPW bark harvesting experiments.

The objective of the experiments to be established by this project is to determine the bark recovery pattern for an additional eight species. Four species from montane forest and four from miombo will be tested. The sites for the experiments have been selected to cover as much as possible of the range of the species within southern Africa. The south-north transect from Groenkop to Mulanji Mountain covers 20° latitude while the east-west transect from Liwonde to Mwekera covers 7° longitude of miombo woodland. The species to be used in the experiments will be drawn from the list given in Table 2 depending on the availability of the species in sufficient numbers for experimental treatment. Some species on this list were in the CPW project in RSA and are included here in order to continue these experiments and also to examine whether responses remain the same across the geographical range of the species. Species not included in the CPW project have been identified with the assistance of herbalists in Zambia and Malawi using information provided by the Kaloko Trust and the National Herbarium of Malawi. The species are all ones for which there is high demand and are relatively common.

Table 2 Sites and species for bark harvesting experiments

Country	Site	Notes	Species
RSA	Groenkop	South – north transect in montane forest	<i>Ilex mitis</i>
	Witelsbos		<i>Prunus africana</i>
	Nzimankulu		<i>(Ocotea kenyensis)</i>

Malawi	Mulanji Mountain		<i>Rapanea melanophloeos</i> <i>Xymalos monospora</i>
	Liwonde	East – west transect in miombo woodland	<i>Brachystegia spiciformis</i> <i>Dalbergia nitidula</i> <i>Julbernardia paniculata</i> <i>Parinari curatellifolia</i> <i>Pseudolachnostylis</i> <i>maprouneifolia</i>
Zambia	Kaloko Trust		
	Mwekera		

The new experiments established by the project will be a simplified form of the CPW experiments and will draw on the results of this study. Since tree size, strip width and tree seal were not found to have significant impact on bark recovery these treatments will not be used in the new experiments. The effect of season has not yet been confirmed through analysis of the CPW results but is expected to have an impact on pathogen attack and wound response. The proposal is that the new experiments will have the following treatments.

Strip width = fixed at 20 cm

Strip length = 1 m starting at 1.3 m from the base of the tree

Strip orientation: East side of tree

Season: dry season (July) and wet season (December)

Tree seal: Not used (though mud or leaves may be applied if indicated by local practices)

Tree size: Two classes divided according to bark maturity (to be reviewed in the field)

Replicates per treatment: minimum of 10

Total number of trees required: 40 (2 x season, 2 x bark maturity class)

Site visits by Coert Geldenhuys in July 2003 will review these protocols in the field and make any modifications necessary – these will be relayed to FRP in the progress report for the first quarter (September 2003). These protocols have been developed by Jenny Wong, John Hall, Coert Geldenhuys and Christoph Klienn all of whom have experience in forest biometrics and experimental design.

The project will also continue bark harvesting experiments initiated by the CPW project (see above). The trials of the initial three species will be continued to provide better estimates of longer term bark recovery (extending the study to five years).

Observation of the CPW experiments and harvested trees shows that there can be significant fungal growth and staining on the wood exposed by bark removal. The significance of this invasion in terms of tree health and mortality risk is not known as the fungal species involved have not been identified. Dr Jolanda Roux from FABI will lead an investigation of the fungal mycota in order to assess the role of species in decay and other influences on tree health. This links to her recent research on wound invasion in indigenous tree species of southern Africa. The work entails collection visits to each experimental site and the assessment of fungal species that develop on wounds during the first year of the project. Dr Eric Boa will oversee the work programme and review the significance of the results in terms of best bark harvesting practice.

Output 3: Bark yield models developed for different harvesting systems

This output is mostly concerned with the dynamics of harvested populations. There are three elements to the understanding of population dynamics, the rates of; (a) regeneration, (b) growth and (c) mortality.

(a) Regeneration

Regeneration can be from seed or from coppice, suckers etc.. It is not possible within this project to look at the dynamics of regeneration from seed. However, many trees, especially those in miombo woodland have the ability to coppice (sprout from above ground suffrutex) or sucker (arising from below-ground suffrutex) . Bark harvesting for fibre is often the inner layer of immature bark on coppice shoots. It is not known if harvesting of this type of material is also suitable for use

medicinally. This will need to be investigated with the herbalists during the local knowledge collection exercise. In any event it will be useful to determine the coppice response of each species and to measure their growth rates and bark productivity. Preliminary protocols for coppice response study will to some extent be opportunistic and measure the number, height, diameter and bark thickness of coppice shoots on trees and stumps of the study species as they are encountered on the study sites. Measurements will be made at six monthly intervals.

For miombo trees, coppice is the dominant mode of regeneration and this will be studied by measuring coppice regrowth on stumps left after charcoal harvesting in the coupe cutting system being developed by Kaloko Trust in Zambia. This should provide an overview of coppicing ability and rates over four years as the charcoal harvesting was started in 1999.

It is also the intention to implement a study of coppice regrowth in Southern Cape forests. Stumps remaining after timber felling would be marked and coppice growth will be observed and measured at six monthly intervals over the duration of the project (2 years). Rates of shoot growth between coppice, natural seedlings, transplanted wildlings and coppice derived from smaller sized trees will be compared by measuring at least 20 plants in each category for each species.

(b) Growth rates

Long term data are required for determining tree growth rates and certainly population dynamics. Such data is derived from the repeated measurement of permanent sample plots (PSPs) in which all trees are recorded. There are PSP programmes in each country but not all have been measured recently or not with the intention of recording bark characteristics.

There are 13 long-term PSP plots maintained by DWAF covering the full geographical range of indigenous evergreen forest in RSA that were established between 1987 and 1989 which have had two subsequent enumerations. Application has been made to DWAF for re-measurement of three additional plots established in 1998 (two in the Umzimkulu area) during 2003. All the PSP data will be made available to the project at no cost.

In Zambia the Forest Research Division (FRD) has been maintaining a series of three fire experiments in Mwekera Forest but the data are only available on the original field sheets. A computer will be provided so the FRD can enter the older data. The project will fund re-measurement of the three fire plots by FRD and include FRD staff in activities to do with PSP analysis and growth modelling.

In Malawi there are silvicultural experimental plots in three forests with three replicates at each site. Of these, the nine control plots which had no treatments are of interest to the project. The project will fund FRIM to undertake a detailed re-measurement of these plots.

(c) Mortality

Background mortality rates will be determined from the PSP data. However, it is important to have some understanding of the effect of bark harvesting on tree mortality especially where harvesting has been intense. Such data will be obtained by re-surveying forests in the Umzimkulu area which were surveyed for bark damage in 2000. During the previous surveys records were made of the extent of bark damage and in several forests permanent sample grids were installed. Some of these areas have already been re-assessed and the project will undertake to complete a re-assessment of the areas inventoried in 2000 in each of these forests. This study will use the 2000 inventory protocols with some modifications to align the sample transects with the locations used in 2000. These data will permit an examination of mortality and coppice development following bark harvesting.

Bark yield models

The data derived from these three sources along with growth bark recovery rates etc derived from Output 2 will be used to develop species specific bark growth and yield models. These models will be used to estimate bark productivity based on tree size and site type. Such models are required to

determine optimal sizes for whole tree based bark harvesting scenarios and to determine population turnover rates. Although the models in the form of yield tables will be incorporated into the Handbook it is not (at this stage) considered appropriate to include PSP protocols or techniques for growth modelling into the Handbook.

Output 4: Preparation, testing and dissemination of project results

Having developed an understanding of management planning for sustainable bark harvesting it is important to disseminate this as appropriately as possible. This requires careful consideration and the first task is to identify the clients for the knowledge and the target institutions who can be used to access them. The project has identified forestry officers, NGO facilitators and others involved with forest management planning. It still remains to identify what they need and the form in which information can be made accessible to them, so this is the first task under this output.

There are many different media and channels that can be used to disseminate the research findings; academic publications, handbooks, manuals, extension materials, posters, etc.. The main ones identified thus far are publications and training materials though all opportunities to publicise the project will be utilised as they arise.

Publications

The results of the project will be presented and disseminated with three audiences in mind:

A. Extension materials (practitioners)

- Bark harvesting handbook for southern Africa – to cover best practice management for bark harvesting, covering choice of sampling design for resource assessment, development of appropriate harvesting strategies and the establishment of an adaptive management approach with sound monitoring protocols. The handbook will be of primary relevance to southern Africa and include a summary of the results of the study in terms of expected growth rates and management prescriptions for the 10-15 species included in the study.
- FAO Guidelines for NTFP inventory – the experience of the project will be distilled into generic advice that would apply to all NTFPs. For example, sampling techniques devised for rare bark harvested trees will be applicable to other rare species. It is proposed that the results of the project are incorporated into the work being undertaken by the FAO Forestry Department (FOPW) to develop generic guidelines for NWFP assessment.

B. Academic papers (researchers)

- Journal articles – these will be prepared at the end of the project as opportunities arise with the indicator being the acceptance and publication of papers after peer review.
- Presentation at XII World Forestry Congress, Sept 2003
- Presentation at RSA Forests & Woodlands symposium to be held in 2004

C. Public information materials

- Policy briefs for decision makers in the forestry and health sectors
- Information on bark harvesting issues for general public presenting using a variety of media e.g. radio, newspaper articles etc..

The extension materials for FAO (handbook and guidelines) will be prepared and disseminated by FAO/FOPW at no cost to the project. This will ensure that they reach a wide audience and will remain in print for as long as they are in demand. The Handbook will be published and disseminated by the southern Africa regional office in Harare while the more generic guidelines will be disseminated

internationally from Rome. Throughout the project opportunities to present information to the media will be used whenever possible.

Training courses and materials

In the educational and infrastructural context of most African target institutions the preparation of documents alone cannot guarantee the desired uptake and implementation of new field practices. A vocal demand expressed at the ZF0077 Rome workshop (Baker 2001) was for training. Since the meeting this need has been confirmed in the form of specific requests for NTFP inventory training by the Ghana Forestry Commission and the Uganda Ministry of Water, Lands and Environment under their respective bilateral forestry projects.

There is a need to test the effectiveness of the format devised for the Handbook. It will also need to be accompanied by training materials and courses. Three training courses on the use and application of the Handbook will be undertaken (one in each country) for 15 people drawn from the target institutions and clients identified under sections 11 and 15e.

At the end of the project there should be sufficient skills within the partner institutes to deliver training courses in the use of the handbook and guidelines. Assistance with training in non-partner client institutions could potentially be provided on a consultancy basis by any or all of the project partners.

Development indicators

Given the development goals of DFID it is important to consider, in general, sustainable use and forest conservation, and how the results can be translated into improved income security or opportunities for the very poor. A two year research project cannot be expected to have achieved this goal but it should be able to demonstrate significant progress along the development impact scale.

For the present project this should be achievement of steps C, D and hopefully E (see Table 3). The project will therefore focus on the preparation of technical handbooks and guidelines suitable for use by the facilitators of local management plans for bark harvesting. In most cases these facilitators are drawn from state forestry department district staff or development NGOs with some technical training.

Monitoring of the success of the project in achieving the indicated development steps requires establishing a suitable indicator, recording baseline levels for it and repeating an assessment exercise at the end of the project. For the present project it is proposed that the number of people within client institutions who are aware of the significance of medicinal bark harvesting and ways in which to determine sustainable exploitation levels. The activities required to achieve this are included under output 4. It is the District level staff of forestry departments and NGOs that are the target audience for project outputs within client institutions. This is because they are the people charged with preparing local level management plans and interface with bark harvesters. Within this group, questionnaire surveys of awareness of bark harvesting issues will be undertaken within the first six months of the project and again within the last two months. Sampling will focus on the districts within which the project is implemented and in a paired control district. Advice will be taken from the socio-economist for the project on the design and implementation of the questionnaires.

In addition, in order to provide a link with Millennium Development Goals related to human health the project will seek to build links with representatives of the health professions. In particular doctors in hospitals treating HIV/AIDS will be asked to provide an indication of the role played by herbal medicines, especially those derived from tree bark, in the treatment of their patients. Based on these findings it may be possible to derive some markers which could indicate whether the project was having an impact on the delivery of health care in the region.

Verification of the overall success of the project would be by documented requests for the Handbook, Guidelines and associated training from non-partner target institutions.

Table 3 Relevant sections of DFID A-H scale for verification of steps in achieving developmental impact

Step	Description	Means of verification
C	Development of appropriate research based products through adaptation/packaging	Software, <i>technical manuals, guidelines, databases</i>
D	Promotion of products into client institutions	<i>Project maturity workshop, training, policy briefs, correspondence, dissemination lists</i>
E	Adoption of products by client institutions	<i>Correspondence, annual reports and policy papers of client institutions, institutional arrangements for internalisation of uptake.</i>

Italics indicate most probably verification for bark harvesting project.

Project maturity workshop

It is a requirement of FRP that a maturity workshop is held at the close of the project. The workshop is intended to disseminate outputs to decision makers, senior forestry staff and a wide cross section of client institutions, amongst other objectives. This workshop will be held in the last few months of the project and will involve the project team, invited representatives of the main client institutions and other interested groups. It is proposed it should be hosted by FAO as a sub-regional workshop to encourage the attendance of institutions in countries within southern Africa who are not involved with the project. If co-funding were made available the maturity workshop could be subsumed with a wider SADC-region workshop on medicinal plant management using tree bark as an example. Additional funding for a wider ranging workshop will need to be obtained from other donors. Starting as soon as the project is approved negotiations through FAO with other donors will seek to obtain the required funding. The maturity workshop is included as an activity under Output 4.

The minimum attendance for the core workshop focussing on the main client institutions in the collaborating countries identified in 11 would be 32 people. Ideally the workshop should be held somewhere central or at a location close to an experimental forest so a field visit can be arranged. This suggests either Zomba or Kitwe. However, siting it in Durban would permit a visit to the herb market and also participation of more than just representatives of the Sisamphilo Association. The venue for the workshop will be decided by the end of the first year of the project and will depend upon available finances and logistics. The workshop would need to be for two days and include a visit to either a field site or to the herb market. A provisional attendance list would be as indicated in Table 4.

Table 4 Provisional invitees for project completion workshop

Country	Institution	Number of people	
UK	Wild Resources	Jenny Wong	1
Germany	Goettingen	Christoph Klienn	1
Zimbabwe	FAO – SADC office	Michel Lavaerdiere	1
Italy	FAO – Rome office	NWFP officer	1
RSA	DWAF	Wessel Vermulen + 2	3
	ForestWood	Coert Geldenhuys + 1	2
		Dominic Mitchell	1
	Sisamphilo	+ 2	2
	Forestry Schools	+ 2	2
	Stellenbosch	+ 1	1
	FABI	+ 1	1
Malawi	Herbarium	+ 1	1
	Forestry Dept	+ 2	2
	FRIM	Gerald Meke + 1	2
	ICRAF	+ 1	1
	University & Forestry School	+ 2	2
Zambia	Copperbelt U.	Fabien Malambo + 1	2
	Forest Research	+ 1	1
	Forestry Department	+ 2	2
	Kalako Trust	+ 2	2
	SAFIRE	+ 1	1
Total attendance			32

20a. Complete the logframe:

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS OF ACHIEVEMENT (OVIs)	MEANS OF VERIFICATION (MOVs)	RISKS AND ASSUMPTIONS OUTSIDE PROJECT CONTROL
<p>GOAL</p> <p>New knowledge applied to problems in forest and tree resource management, the resolution of which benefits forest and tree dependent poor people in the Forest/Agriculture Interface.</p>	<p>By 2005, increased human capital for poor households through: enhanced forest management skills; less destructive tree-product harvesting and improved processing, packaging and marketing capability; and healthier nutritional use of indigenous tree products.</p>	<p>National and local adoption rate surveys.</p> <p>National and local socio-economic surveys</p>	<p>Poor people invest benefits to improve choices and options for livelihood strategies.</p>
<p>PURPOSE</p> <p>1. 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</p>	<p>1.8 inventory data and techniques compiled and / or developed for timber and non-timber forest products</p>	<p>Annual research programme reports.</p> <p>External refereeing.</p> <p>External O/P reviews.</p> <p>Client institutions' reports.</p>	<p>Resources managers, producers and processors are able to adopt new knowledge.</p> <p>Enabling cultural, economic, social and political environment exists for widespread application of new knowledge and is not contrary to measures that enhance sustainable livelihoods.</p> <p>Capabilities of client institutions radically enhanced.</p>
<p>OUTPUTS</p>	<p>INDICATORS OF ACHIEVEMENT</p>	<p>MEANS OF VERIFICATION</p>	<p>RISKS AND ASSUMPTIONS OUTSIDE PROJECT CONTROL</p>
<p>1. Protocols for the efficient inventory of medicinal bark resources in natural forest developed and tested</p>	<p>Field and statistical tests of suggested methods verify their worth</p>	<p>Reports of comparative field studies of alternative inventory strategies</p>	<p>Felled trees of target species are available to the project</p>
<p>2. Best bark harvesting practices developed for trees with differing bark anatomy and ecophysiological profiles</p>	<p>Records indicate sustainable bark yield from at least one harvesting technique per species</p>	<p>Reports of experimental studies</p>	<p>Results from five years of observations are maintained over longer period</p>
<p>3. Bark yield models developed for different harvesting systems</p>	<p>Tree growth and population turnover rates quantified for study species</p>	<p>Project reports</p>	<p>Study period is long enough to measure bark production</p>
<p>4. Preparation, testing and dissemination of project results</p>	<p>Handbook in use within target institutions</p>	<p>Requests for the Handbook, Guidelines and associated training</p>	<p>Results from selected species are generally applicable</p>
<p>ACTIVITIES</p>	<p>INPUTS – PHYSICAL AND FINANCIAL</p>	<p>MEANS OF VERIFICATION (Milestones)</p>	<p>RISKS AND ASSUMPTIONS OUTSIDE PROJECT CONTROL</p>

<p>1.1 May 03 Collation of data suitable for simulation studies of alternative sampling designs</p> <p>1.2 Aug 03 Design of data collection protocols based on local knowledge</p> <p>1.3 Oct 03 Characterisation of species distribution patterns based on collated data</p> <p>1.4 Nov 03 Simulation testing of a range of alternative sampling designs</p> <p>1.5 Dec 03 Development of measurement protocols for field sampling</p> <p>1.6 Apr 04 Field testing of best methods for differing spatial pattern from simulation in study sites identified by the project initiation workshop</p> <p>1.7 Apr 04 Field testing of alternative designs for quantifying population structure</p> <p>1.8 Jul 03 Estimation of bark yield from alternative harvesting scenarios</p> <p>1.9 Jul 04 Field data analysis from 1.6 and 1.7</p> <p>1.10 Sep 04 Preparation of recommended protocols</p>	<p>Budget</p> <table border="0"> <tr> <td>Staff Costs</td> <td>£99,937</td> </tr> <tr> <td>Overhead</td> <td>£18,288</td> </tr> <tr> <td>Equipment</td> <td>£12,800</td> </tr> <tr> <td>T & S</td> <td>£45,460</td> </tr> <tr> <td>Miscellaneous</td> <td>£13,500</td> </tr> <tr> <td>Total</td> <td>£189,985</td> </tr> </table>	Staff Costs	£99,937	Overhead	£18,288	Equipment	£12,800	T & S	£45,460	Miscellaneous	£13,500	Total	£189,985		
Staff Costs	£99,937														
Overhead	£18,288														
Equipment	£12,800														
T & S	£45,460														
Miscellaneous	£13,500														
Total	£189,985														
<p>2.1 May 03 Evaluate experimental protocols used in established bark harvesting trials in southern Cape.</p> <p>2.2 Jun 03 Collect local knowledge on bark harvesting practices</p> <p>2.3 Jun 03 Review literature of wound responses in trees</p> <p>2.4 May 03 Develop experimental protocols for target species and identified sites for field trials</p> <p>2.5 Jul 03 Establish dry season trials for target species and field sites</p> <p>2.6 Sep 03 Collect data and apply treatments according to experimental protocols</p> <p>2.7 Jan 04 Assess fungal growth on treated trees in terms of decay and impact on tree health</p> <p>2.8 Jan 04 Establish rainy season trials for target species and field sites</p> <p>2.9 Mar 04 Review preliminary results of dry season then rainy season trials</p> <p>2.10 Jun 04 Evaluate local knowledge on bark harvesting techniques</p> <p>2.11 Sep 04 Analysis of experimental results</p>															

2.12 Jan 05 Prepare report of results from experimental work and local knowledge investigations			
2.13 Sep 04 Identify best bark harvesting practices			
3.1 May 03 Assess available data on population dynamics in permanent sample plots			
3.2 Sep 03 Evaluate survival/recovery of bark harvested trees in RSA forests previously inventoried			
3.3 Jun 03 Re-measurement of permanent sample plots from 3.1 as required			
3.4 Dec 03 Analysis of data from permanent sample plots			
3.5 May 04 Building bark yield prediction models for target species			
3.6 Oct 04 Definition and description of alternative bark harvesting systems			
3.7 Dec 04 Evaluation of alternative harvesting systems using BYP models			
3.8 Jan 05 Documentation of BYP models and their use/application			
4.1 Aug 04 Review of potential users of information and their needs in relation to bark harvesting			
4.2 Sep 04 Implement monitoring of impact of project on client institutions			
4.3 Nov 04 Prepare three papers for publication in peer-reviewed journals or presented at conferences			
4.4 Apr 04 Develop framework for handbook on best practice for bark harvesting			
4.5 Jun 04 Hold three workshops for development and testing of training support for Handbook within target institutions			
4.6 Aug 04 Obtain feedback from workshops with target institutions			
4.7 Nov 04 Publication and dissemination of handbook			
4.8 Jan 05 Preparation of generic advice for publication by FAO			
4.9 Feb 05 Project maturity workshop			

Dates on activities are the start dates many continue beyond the specified month – see activity chart for details.

20b. Complete an activity chart over the life of the project

YEAR 1: 2003-4

MONTH

Activity	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1.1 Collation of data suitable for simulation studies of alternative sampling designs		X	X		X	X						
1.2 Design of data collection protocols based on local knowledge					X							
1.3 Characterisation of species distribution patterns							X					
1.4 Simulation testing of a range of alternative designs								X				
1.5 Development of measurement protocols for field sampling									X			
1.6 Test of best methods for differing spatial pattern from simulation in study sites												
1.7 Field testing of alternative designs for quantifying population structure												
1.8 Estimation of bark yield from alternative harvesting scenarios				X	X	X	X	X	X	X	X	X
1.9 Field data analysis from 1.6 and 1.7												
1.10 Preparation of recommended protocols												
2.1 Evaluate experimental protocols used in established bark harvesting trials in southern Cape		X	X									
2.2 Collect local knowledge on bark harvesting practices			X	X	X	X	X	X	X	X	X	X
2.3 Review literature of wound responses in trees				X	X							
2.4 Develop experimental protocols for target species and identified sites for field trials		X	X									
2.5 Establish dry season trials for target species and field sites				X	X							
2.6 Collect data and apply treatments according to experimental protocols						X	X	X	X	X	X	X
2.7 Assess fungal growth on treated trees in terms of decay and impact on tree health										X	X	
2.8 Establish rainy season trials for target species and field sites										X	X	
2.9 Review preliminary results of dry season then rainy season trials												X
2.10 Evaluate local knowledge on bark harvesting techniques												
2.11 Analysis of experimental results												
2.12 Prepare report of results from experimental work and local knowledge investigations												
2.13 Identify best bark harvesting practices												
3.1 Assess available data on population dynamics in permanent sample plots		X	X									
3.2 Evaluate survival/recovery of bark harvested trees in RSA forests previously inventoried						X	X					
3.3 Re-measurement of permanent sample plots from 3.1 as required			X		X			X				
3.4 Analysis of data from permanent sample plots									X	X		
3.5 Building bark yield prediction models for target species												
3.6 Definition and description of alternative bark harvesting systems												

YEAR 1: 2003-4
MONTH

Activity	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
3.7 Evaluation of alternative harvesting systems using BYP models												
3.8 Documentation of BYP models and their use/application												
4.1 Review of potential users of information and their needs in relation to bark harvesting					X	X						
4.2 Implement monitoring of project impact on client institutions						X	X	X				
4.3 Prepare three papers for publication in peer-reviewed journals or presented at conferences							X					
4.4 Develop framework for handbook on best practice for bark harvesting												
4.5 Hold three workshops for development and testing of training support for Handbook within target institutions												
4.6 Obtain feedback from workshops with target institutions												
4.7 Publication and dissemination of handbook and guidelines						X						
4.8 Preparation of generic advice for publication by FAO												
4.9 Project maturity workshop							X					

Overseas travel

To	By	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Kitwe, Zomba	Jenny Wong					X							
Mwekera	Coert Geldenhuys				X								
Liwonde	Diana Rau				X								
Kitwe, Zomba	Dominic Mitchell					X							
Mwekera	Coert Geldenhuys					X							
Malawi, Zambia	Jolanda Roux										X	X	
Kitwe	Christoph Kleinn												X
Kitwe	Coert Geldenhuys												X
Kitwe	Gerald Meke												X
Kitwe	Wessel Vermeulen												X
Kitwe	Jenny Wong												X

YEAR 2: 2004-5

MONTH

Activity	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1.1 Collation of data suitable for simulation studies of alternative sampling designs												
1.2 Design of data collection protocols based on local knowledge												
1.3 Characterisation of species distribution patterns												
1.4 Simulation testing of a range of alternative designs												
1.5 Development of measurement protocols for field sampling												
1.6 Test of best methods for differing spatial pattern from simulation in study sites	X	X	X									
1.7 Field testing of alternative designs for quantifying population structure	X	X	X									
1.8 Estimation of bark yield from alternative harvesting scenarios	X	X	X	X	X	X	X	X				
1.9 Field data analysis from 1.6 and 1.7				X	X							
1.10 Preparation of recommended protocols						X	X					
2.1 Evaluate experimental protocols used in established bark harvesting trials in southern Cape												
2.2 Collect local knowledge on bark harvesting practices	X	X										
2.3 Review literature of wound responses in trees												
2.4 Develop experimental protocols for target species and identified sites for field trials												
2.5 Establish dry season trials for target species and field sites												
2.6 Collect data and apply treatments according to experimental protocols			X	X						X	X	
2.7 Assess fungal growth on treated trees										X		
2.8 Establish rainy season trials for target species and field sites												
2.9 Review preliminary results of dry season then rainy season trials	X	X										
2.10 Evaluate local knowledge on bark harvesting techniques			X	X								
2.11 Analysis of experimental results						X	X				X	
2.12 Prepare report of results from experimental work and local knowledge investigations										X	X	X
2.13 Identify best bark harvesting practices						X	X					
3.1 Assess available data on population dynamics in permanent sample plots												
3.2 Evaluate survival/recovery of bark harvested trees in RSA forests previously inventoried												
3.3 Re-measurement of permanent sample plots from 3.1 as required												
3.4 Analysis of data from permanent sample plots												
3.5 Building bark yield prediction models for target species		X	X	X	X	X	X					
3.6 Definition and description of alternative bark harvesting systems							X	X				
3.7 Evaluation of alternative harvesting systems using BYP models									X	X		
3.8 Documentation of BYP models and										X	X	X

YEAR 2: 2004-5
MONTH

Activity	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
their use/application												
4.1 Review of potential users of information and their needs in relation to bark harvesting												
4.2 Implement monitoring of project impact on client institutions											X	X
4.3 Prepare three papers for publication in peer-reviewed journals or presented at conferences								X	X	X	X	X
4.4 Develop framework for handbook on best practice for bark harvesting	X	X										
4.5 Hold three workshops for development and testing of training support for Handbook within target institutions			X	X	X							
4.6 Obtain feedback from workshops with target institutions					X	X						
4.7 Publication and dissemination of handbook and guidelines								X	X	X	X	X
4.8 Preparation of generic advice for publication by FAO											X	
4.9 Project maturity workshop											X	X

Overseas travel

To	By	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Zomba	Fabien Malambo			X									
Zomba	Jameson Mbunda			X									
Zomba	Gerald Meke			X									
Zomba	Malawi herbarium			X									
Zomba	Sociologist			X									
Durban	Christoph Kleinn											X	
Durban	Fabien Malambo											X	
Durban	Jameson Mbunda											X	
Durban	Catherine Nguvulu											X	
Durban	Jenny Wong											X	
Durban	Gerald Meke											X	
Durban	Malawi herbarium											X	
Durban	Zambia Forestry Dept.											X	
Durban	Malawi Forestry Dept.											X	
Durban	Jolanda Roux											X	
Durban	ICRAF (Malawi)											X	
Durban	SAFIRE											X	
Durban	Francois Ndeckere											X	
Durban	Michel La											X	
Durban	Saasveld + Forestry Schools											X	
Durban	Malawi U & FS											X	
Durban	FS Zambia											X	

SECTION E: FINANCIAL INFORMATION

PROJECT TITLE: Developing biometric sampling systems and optimal harvesting methods for medicinal tree bark in southern Africa
START DATE: 01-May-03 **END DATE:** 31-Mar-05
DATE THIS SECTION F SUBMITTED TO FRP:

SECTION E: FINANCIAL INFORMATION

21a. Total funding requested from DFID £223,232

ACRONYMS		
Lead Institute	WRL	£39,855
Collaborator 1	CABI	£900
Collaborator 2	Copperbelt University	£34,620
Collaborator 3	DWAF	£0
Collaborator 4	FABI	£3,500
Collaborator 5	FAO	£0
Collaborator 6	ForestWood	£56,608
Collaborator 7	FRIM	£34,150
Collaborator 8	Gotteningen	£18,602
Collaborator 9	UWB	£1,750
Total		£189,985

21b. Summary of funding (£) requested (derived from Question 22)

YEAR	Year 1 2003/04	Year 2 2004/2005	TOTALS
Staff Costs	49,825	50,112	99,937
Overheads	9,536	8,752	18,288
Capital Equipment	12,800	0	12,800
Travel and Subsistence	23,210	22,250	45,460
Miscellaneous	550	12,950	13,500
Total (exc. VAT)	95,921	94,064	189,985
VAT	16,786	16,461	33,247
TOTAL COSTS	112,707	110,525	223,232

21c. Will your organisation charge Value Added Tax? Yes /~~No~~

VAT registration number 801117290

21d. Contributions from other organisations towards the costs of the project

Staff costs (in-kind)	Year 1	Year 2
DWAF	10,000	8,500
FABI	1,650	1,375
FAO	1,340	3,350

21e. If this proposal is being submitted elsewhere for funding, state the organisation and when a decision is expected

This project is not at present being submitted to other funding sources.

22a. Staff Costs

Name	Daily rate	Days		Salary costs (£)		
		Year 1	Year 2	Apr 03 - Mar 04	Apr 04 - Mar 05	
Lead Institute						
Wild Resources Limited						
PI - Jenny Wong	250	25	20	6,250	5,000	
Administrator	100	24	24	2,400	2,400	
Socio-economist	250	1	2	250	500	
Statistician	350	6		2,100	0	
Subtotal Lead Institute				11,000	7,900	18,900
CABI Bioscience						
Eric Boa	300	3	0	900	0	
Subtotal Collaborator 1				900	0	900
Copperbelt University						
Senior staff	34	47	54	1,598	1,836	
Technical staff	17	350	221	5,950	3,757	
Labour	5	210	400	1,050	2,000	
Subtotal Collaborator 2				8,598	7,593	16,191
DWAF						
Wessel Vermulen	In kind	45	30			
Technical staff	In kind	20	45			
Subtotal Collaborator 3				0	0	0
FABI						
Jolanda Roux	In kind	30	25			
Subtotal Collaborator 4				0	0	0
FAO						
Staff member	In kind	10	25			
Subtotal Collaborator 5				0	0	0
ForestWood						
Coert Geldenhuys	200	43	62	8,600	12,400	
Dominic Mitchell	200	14	26	2,800	5,200	
Senior assistant	57	38	44	2,166	2,508	
Junior assistant	43	20	20	860	860	
Sisamphilo Association	7	50	50	350	350	
Subtotal Collaborator 6				14,776	21,318	36,094
FRIM						
Senior staff	34	70	70	2,380	2,380	
Technical staff	17	193	193	3,281	3,281	
Labour	5	160	160	800	800	
Subtotal Collaborator 7				6,461	6,461	12,922
University of Gottingen						
Christoph Kleinn	228	30	30	6,840	6,840	
Subtotal Collaborator 8				6,840	6,840	13,680
University of Wales, Bangor						
John Hall	250	5	0	1,250	0	
Subtotal Collaborator 9				1,250	0	1,250
Subtotal Collaborators				38,825	42,212	81,037

TOTAL	-VAT	49,825	50,112
	VAT	8,719	8,770
TOTAL	+VAT	58,544	58,882

22b. Overheads

Name	%	Apr 03 - Mar 04	Apr 04 - Mar 05	
Lead Institute				
Wild Resources Limited				
PI - Jenny Wong	30	1,875	1,500	
Administrator	30	720	720	
Socio-economist	40	100	200	
Statistician	40	840	0	
Subtotal Lead Institute		3,535	2,420	5,955
CABI Bioscience				
Eric Boa (6, 4)	0			
Subtotal Collaborator 1		0	0	0
Copperbelt University				
All staff	15	1,290	1,139	
Subtotal Collaborator 2		1,290	1,139	2,429
DWAF				
All staff	0			
Subtotal Collaborator 3		0	0	0
FABI				
Jolanda Roux	0			
Subtotal Collaborator 4		0	0	0
FAO				
Staff member	0			
Subtotal Collaborator 5		0	0	0
ForestWood				
All staff	15	2,216	3,198	
Subtotal Collaborator 6		2,216	3,198	5,414
FRIM				
All staff	15	969	969	
Subtotal Collaborator 7		969	969	1,938
University of Gottingen				
Christoph Kleinn (44, 23)	15	1,026	1,026	
Subtotal Collaborator 8		1,026	1,026	2,052
University of Wales, Bangor				
John Hall (5, 0)	40	500	0	
Subtotal Collaborator 9		500	0	500
Subtotal Collaborators		6,001	6,332	12,902

TOTAL (exc VAT)	9,536	8,752
VAT	1,669	1,532
TOTAL	11,205	10,283

22c. Capital Equipment

Equipment	Apr 02 - Mar 03	Apr 04 - Mar 05	
Lead Institute			
Wild Resources Limited			
N/A			
Subtotal Lead Institute	0	0	0
CABI Bioscience			
N/A			
Subtotal Collaborator 1	0	0	0
Copperbelt University			
Computer + field equipment	6,500		
Subtotal Collaborator 2	6,500		6,500
DWAF			
N/A			
Subtotal Collaborator 3	0	0	0
FABI			
N/A			
Subtotal Collaborator 4	0	0	0
FAO			
N/A			
Subtotal Collaborator 5	0	0	0
ForestWood			
N/A			
Subtotal Collaborator 6	0	0	0
FRIM			
Computer + field equipment	6,300		
Subtotal Collaborator 7	6,300	0	6,300
University of Gottingen			
N/A			
Subtotal Collaborator 8	0	0	0
University of Wales, Bangor			
N/A			
Subtotal Collaborator 9	0	0	0
Subtotal Collaborators	12,800	0	12,800

TOTAL (exc VAT)	12,800	0
VAT	2,240	0
TOTAL	15,040	0

22d. Travel and Subsistence

Visit Details	Apr 03 - Mar 04	Apr 04 - Mar 05	
Lead Institute			
Wild Resources Limited			
Travel	900	900	
Subsistence	400	400	
Subtotal Lead Institute	1,300	1,300	2,600
CABI Bioscience			
N/A			
Subtotal Collaborator 1	0	0	0
Copperbelt University			
Travel	2,600	3,650	
Subsistence	950	2,050	
Subtotal Collaborator 2	3,550	5,700	9,250
DWAF			
N/A			
Subtotal Collaborator 3	0	0	0
FABI			
Travel for fieldwork	2,000	1,000	
Subtotal Collaborator 4	2,000	1,000	3,000
FAO			
N/A			
Subtotal Collaborator 5	0	0	0
ForestWood			
Travel	5,700	3,000	
Subsistence	3,300	3,100	
Subtotal Collaborator 6	9,000	6,100	15,100
FRIM			
Travel	3,000	2,700	
Subsistence	3,000	3,940	
Subtotal Collaborator 7	6,000	6,640	12,640
University of Gottingen			
Travel	1,200	1,350	
Subsistence	160	160	
Subtotal Collaborator 8	1,360	1,510	2,870
University of Wales, Bangor			
N/A			
Subtotal Collaborator 9	0	0	0
Subtotal Collaborators	21,910	20,950	42,860

TOTAL (exc VAT)	23,210	22,250
VAT	4,062	3,894
TOTAL	27,272	26,144

22e. **Miscellaneous**

Details	Apr 03- Mar 04	Apr 04- Mar 05	
Lead Institute			
Wild Resources Limited			
Maturity Workshop (36 participants)			
Travel		5,205	
Accommodation		1,920	
Honorariums		4,500	
Refreshments		75	
Materials		100	
Publicity/Media		500	
Hire of Room		100	
Subtotal Lead Institute	0	12,400	12,400
CABI Bioscience			
N/A			
Subtotal Collaborator 1	0	0	0
Copperbelt University			
Printing consumables	125	125	
Subtotal Collaborator 2	125	125	250
DWAF			
N/A			
Subtotal Collaborator 3	0	0	0
FABI			
Laboratory consumables	250	250	
Subtotal Collaborator 4	250	250	500
FAO			
N/A			
Subtotal Collaborator 5	0	0	0
ForestWood			
N/A			
Subtotal Collaborator 6	0	0	0
FRIM			
Printer consumables	175	175	
Subtotal Collaborator 7	175	175	350
University of Gottingen			
N/A			
Subtotal Collaborator 8	0	0	0
University of Wales, Bangor			
N/A			
Subtotal Collaborator 9	0	0	0
Subtotal Collaborators	550	550	1,100

TOTAL (exc VAT)	550	12,950
VAT	96	2,266
TOTAL	646	15,216

SECTION F: CURRICULUM VITAE

CURRICULUM VITAE OF APPLICANT/SCIENTIFIC STAFF

SURNAME: WONG

FORENAMES : Jennifer Ley Gn

AGE: 43

DEGREES etc. (include subject, class, university and date):

1981 BSc II:I Natural Environmental Science. Sheffield University

1983 MSc Environmental Forestry. University of Wales

1992 PhD University of Wales (Watershed planning)

POSTS HELD (with dates):

10/02 – present *Director* – Wild Resources Limited.

3/98 – 9/02 *Forest biometrics consultant*

6/96 - 2/97 *Forest Information Systems Specialist* (Ghana)

2/94-5/96 *Forestry Data Processing Analyst* (Ghana)

RECENT PUBLICATIONS (titles and references):

Wong J. (2002) Inventory and management of non-woodland trees in the UK. Paper presented at the Agroforestry Forum annual meeting, 19 June 2002. Royal Agricultural College, Cirencester.

Wong J., Youde E., Dickinson D. and Hale M. (2002) Report of the Rhododendron feasibility study. Report to the Beddgelert Rhododendron Management Group.

Wong J.L.G., Thornber K. and Baker N. (2001) Resource assessment of non wood forest products: Experience and biometric principles. NWFP Series 13, FAO, Rome. (English, French, Spanish)

Wong J.L.G. (2001) Biometrics and NTFP inventory. Paper presented at the IUFRO 4.11 meeting 'Forest biometry, modelling and information science' 26-29 June. Greenwich. In press.

Wong J.L.G. (2000) The biometrics of non-timber forest product resource assessment: A review of current methodology. <http://www.etfrn.org/etfrn/workshop/forum/frame.html>.

Killman W., Preto G., Russo L., Vantomme P., Wilkie M.L. and Wong J. (2000) The potential of non-wood forest products in sub-Saharan Africa: towards a better assessment of forest resources providing NWFP.

Wong J.L.G. (1998) Growth, mortality and yield of the reserved forest of Ghana. Consultancy report No. 10. Technical assistance to the Forest Sector Development Project Ghana. ODA contract No. CNTR 955528A.

Wong J.L.G. (1998) Non-timber forest products from the Forest Reserves of Ghana. Consultancy report no. 11. Technical assistance to the Forest Sector Development Project Ghana. ODA contract No. CNTR 955528A.

CURRICULUM VITAE OF APPLICANT/SCIENTIFIC STAFF

SURNAME: GELDENHUYS

FORENAMES : Coert Johannes

AGE: 56

DEGREES etc. (include subject, class, university and date):

1968 BSc Forestry University of Stellenbosch

1969 BSc (Hons) Forestry University of Stellenbosch

1975 MSc Forestry University of Stellenbosch

1989 PhD (Botany) University of Cape Town

POSTS HELD (with dates):

2001 to 2003 Honorary Research Fellow in Faculty of Science & Agriculture, University of Natal

May 1997 to present: FORESTWOOD cc:

1990 to April 1997: Ecologist/Scientist CSIR: Division of Water, Environment and Forestry
Technology

1969 to 1990: Research and project/programmer manager. South African Forestry Research
Institute, Department of Water Affairs and Forestry:

RECENT PUBLICATIONS (titles and references):

Geldenhuys, C.J. 1991. Inventory of indigenous forest and woodland in southern Africa. South African Forestry Journal 158, 83-94.

Geldenhuys, C.J. 1993. Reproductive biology and population structures of *Podocarpus falcatus* and *P. latifolius* in southern Cape forests. Botanical Journal of Linnean Society 112, 59-74.

Geldenhuys, C.J. 1994. Growing useful indigenous species on the forest margin: potential and requirements. In: Everard, D.A. (ed). Dynamics, function and management of forest ecotones in the forest-plantation interface. Environmental Forum Report, Proceedings of Forestry Forum Research Meeting, Sabie, May 1994. p.104-113.

Geldenhuys, C.J. 2000. Commercial products from the wild: sustainable utilisation, commercialisation and domestication of products from indigenous forest and woodland ecosystems - A progress report. In: Seydack, A.H.W., Vermeulen, W.J. & Vermeulen, C. (eds). Towards sustainable management based on scientific understanding of natural forests and woodlands. Proceedings: Natural Forests and Woodlands Symposium II, Knysna, South Africa, 5 - 9 September 1999. pp 342 - 347.

Geldenhuys, C.J. in press. Meeting demands for *Ocotea bullata* bark: implications for conservation of high-value and medicinal tree species. In: Lawes, M., Eeley, H., Shackleton, C. & Geach, B. (eds). Use and value of indigenous forests and woodlands in South Africa. University of Natal Press, Durban.

Geldenhuys, C.J. in press. Concepts and approach towards development of sustainable resource use of non-timber forest products: the example of bark harvesting for traditional medicine. In: Multiple use management of natural forests and savanna woodlands, Proceedings of Natural Forests & Savanna Woodland Symposium III, 6-9 May 2002, Berg-en-Dal, Kruger National Park.

Geldenhuys, C.J. & Lübbe, W.A. 1991. Sustainability of bark production from the southern Cape forests: possible alternatives. In: Van Warmelo, W. (ed). Proceedings of a Workshop: Traditional Medicine and plant management in the western Cape, Kirstenbosch, 13 March 1990. Flora Conservation Committee Report No 91/1. p.12-16.

CURRICULUM VITAE OF APPLICANT/SCIENTIFIC STAFF

SURNAME: HALL

FORENAMES : John Bragwyn

AGE: 60

DEGREES etc. (include subject, class, university and date):

1963 B.Sc. (Special) in Botany, University of London (Imperial College)

1967 PhD. University of London (Botany: Plant Ecology)

POSTS HELD (with dates):

1984 - present. Lecturer/Senior Lecturer, School of Agricultural and Forest Sciences, University of Wales, Bangor, UK

1978 - 1984. Senior Lecturer/Associate Professor/Professor, Division of Forestry, University of Dar es Salaam, Tanzania

1966 - 1967. Research Assistant, Botany Department, University of Reading, UK

1967 - 1971. Lecturer, Botany Department, University of Ife, Nigeria

1971 - 1978. Lecturer/Senior Lecturer, Forestry Department, University of Ibadan, Nigeria

RECENT PUBLICATIONS (titles and references):

Hall, J.B. 1996. Seedling ecology and tropical forestry. In: Ecology of tropical forest tree seedlings (ed by M.D. Swaine), pp. 139-159. Parthenon/UNESCO, Carnforth/Paris

Hall, J.B. 1998. Catching up with the humid forest zone: management challenges for dryland tree resources. In: Plants for food and medicine (ed by H.D.V. Prendergast, N.L. Etkin, D.R. Harris and P.J. Houghton), pp. 263-275. Royal Botanic Gardens, Kew.

Hall, J.B. 2002. *Sclerocarya birrea* (A.Rich.) Hochst. In: Plant resources of tropical Africa: precursor (ed by L.P.A. Oyen and R.H.M.J. Lemmens). PROTA Programme, Wageningen. 187 pp. (ISBN: 90-77114-02-5)

Hall, J.B., Aebischer, D.P., Tomlinson, H.F., Osei-Amaning, E. & Hindle, J. 1996. *Vitellaria paradoxa*: a monograph. School of Agricultural and Forest Sciences, University of Wales, Bangor. 105 pp.

Hall, J.B., Sinclair, F.L. & O'Brien, E.M. In press. *Prunus africana*: a monograph. School of Agricultural and Forest Sciences, University of Wales, Bangor.

Hall, J.B., Tomlinson, H.F., Oni, P.I., Buchy, M. & Aebischer, D.P. 1997. *Parkia biglobosa*: a monograph. School of Agricultural and Forest Sciences, University of Wales, Bangor. 107 pp.

CURRICULUM VITAE OF APPLICANT/SCIENTIFIC STAFF

SURNAME: MALAMBO

FORENAMES : Fabian Mazuba

AGE: 50

DEGREES etc. (include subject, class, university and date):

1981 Bsc (For) University of Dar es Salaam

1987 Msc (Wood Science) University of Wales Bangor.

POSTS HELD (with dates):

1998 to date; Lecturer- Wood Science, Utilisation & Technology of Wood and Non Wood Forest Products.

1994 to 1997; Consultancy work

1989 to 1994; Divisional Manager- Wood Processing Company

1982 to 1989; Researcher- Properties and Utilization of Wood and Non Wood Forest Products.

RECENT PUBLICATIONS (titles and references):

Malambo F.M., Njovu F. and Sampa M. (2002) Comparative assessment of alternative sampling designs for non-wood forest products in Mwekera National Forest – Kitwe – Zambia. Final report for the FAO project GCP/RAF/354/EC.

CURRICULUM VITAE OF APPLICANT/SCIENTIFIC STAFF

SURNAME: VERMUELEN

FORENAMES : Wessel Johannes

AGE: 44

DEGREES:

1983: B.Sc. Forestry, University of Stellenbosch

1988: B.Sc. (Hons) Botany Cum Laude, University of Pretoria

1995: M.Sc. Botany, University of Stellenbosch

Currently registered at the University of Stellenbosch for the degree Ph.D Forestry (Conservation Ecology).

POSTS HELD:

1983 - 1989. Forestry Scientist, Conservation Forestry, Department of Environment Affairs, Pretoria.

1989 - Date. Head: Scientific Services, Indigenous Forest Management, Department of Water Affairs and Forestry, Knysna.

RECENT PUBLICATIONS:

Vermeulen, W.J. 2000. Management of natural forests. In: Owen, D.L. (ed.). South African Forestry Handbook 2000. Volume 2. The Southern African Institute of Forestry, Menlo Park. pp. 601-612.

Vermeulen, W.J. 2000. Forest dynamics monitoring in the southern Cape. In: Seydack, A.H.W., Vermeulen, W.J. & Vermeulen, C. (eds.). Towards Sustainable Management Based on Scientific Understanding of Natural Forests and Woodlands. Proceedings: Natural Forests and Savanna Woodlands Symposium II, Knysna, South Africa, 5-9 September 1999. Department of Water Affairs and Forestry, Knysna. pp. 266-269.

Vermeulen, W.J. & Seydack, A.H.W. 2000. Management policy changes for blackwood (*Acacia melanoxylon*) in the Southern Cape. In: Seydack, A.H.W., Vermeulen, W.J. & Vermeulen, C. (eds.). Towards Sustainable Management Based on Scientific Understanding of Natural Forests and Woodlands. Proceedings: Natural Forests and Savanna Woodlands Symposium II, Knysna, South Africa, 5-9 September 1999. Department of Water Affairs and Forestry, Knysna. pp. 45-52.

Kok, H.R. & Vermeulen, W.J. 2002. Towards FSC certification for the management of the Southern Cape forests. In: Seydack, A.H.W., Vorster, T., Vermeulen, W.J. & Van der Merwe, I. (eds.). Multiple Use Management of Natural Forests and Savanna Woodlands: Policy Refinements and Scientific Progress. Proceedings: Natural Forests and Savanna Woodlands Symposium III, Berg-en-Dal, Kruger National Park, Department of Water Affairs and Forestry, Pretoria. pp. 242-252.

Seydack, A.H.W., Vermeulen, W.J. & Sass, J. 2002. Divergent modes of dynamics in Kologha forest (Eastern Cape, South Africa). In: Seydack, A.H.W., Vorster, T., Vermeulen, W.J. & Van der Merwe, I. (eds.). Multiple Use Management of Natural Forests and Savanna Woodlands: Policy Refinements and Scientific Progress. Proceedings: Natural Forests and Savanna Woodlands Symposium III, Berg-en-Dal, Kruger National Park, Department of Water Affairs and Forestry, Pretoria. pp. 56-67.

Seydack, A.H.W., Vermeulen, W.J., Heyns, H.E., Durrheim, G.P., Vermeulen, C., Willems, D., Ferguson, M.A., Huisamen, J. & Roth, J., 1995. An unconventional approach to timber yield for multi-aged, multispecies forests. II. Application to a South African forest. *Forest Ecology and Management* 77: 155-168.

CURRICULUM VITAE OF APPLICANT/SCIENTIFIC STAFF

SURNAME: MEKE

FORENAMES : Gerald Simeon

AGE: 37

DEGREES etc. (include subject, class, university and date):

1996-1998. BSc Honours and Masters of Science in Forestry Science: Stellenbosch University, Republic of South Africa.

1991. BSc. in Agriculture with credit, University of Malawi

POSTS HELD (with dates):

1993 - present. Principal Forestry Research Officer: Ministry of Forestry and Natural Resources, Forestry Research Institute of Malawi.

1999 - 2000. Project Manager, Ecology of Miombo Edible Mushroom project.

1999. Consultant. Invasive weeds management plan in the Lake Chilwa wetland area and its catchment.

1995 - 1997. Production of Forestry Extension Kit for extension workers.

RECENT PUBLICATIONS (titles and references):

Meke G. 2002. Using local knowledge as a basis for stratification of inventory sites: wild mushroom inventory in Liwonde Forest Reserve, Malawi. Final report for the FAO project GCP/RAF/354/EC.

Abbot, P.G., Lowore, J.D., Ngulube, M., Meke, G. and Chipompha, S. 1995. Utilization of non-timber forest products: an example from the Miombo woodlands of Malawi. Proceedings of the 2nd Crop Science Conference for Eastern and Southern Africa, Blantyre, Malawi.

Phiri, G. Meke, G.S and Kamundi, 1999. Evaluation of the threats from alien species and formulation of control measures. Consultancy report. Boa, E., Ngulube, M and Meke G. 2000. Proceedings of first regional workshop on wild edible mushrooms from miombo woodlands

Meke, G.S., 1997. Insects associated with *Uapaca kirkiana*. An M.Sc Thesis, University of Stellenbosch, South Africa.

Chipompha, N.S., Chilima, C.Z, and Meke, G.S., 1996. Protection of trees from fires, pests and diseases. Forestry extension kit for field workers in Malawi. Volume 4. GOM/UNDP 5th Country Programme Community Forestry Sub-component, Lilongwe Malawi.

CURRICULUM VITAE OF APPLICANT/SCIENTIFIC STAFF

SURNAME: KLEINN

FORENAMES : Christoph

AGE:

DEGREES etc. (include subject, class, university and date):

1998 Universität Freiburg "Habilitation" (Forest Inventory, Biometry and Mensuration)

1991 Universität Freiburg Doctoral Degree (Sampling, Forest Inventory)

1984 Universität Freiburg Diplom-Forstwirt (comparable to M.Sc. Forestry)

POSTS HELD (with dates):

01.02- Full Professor. Chair of Remote Sensing and Forest Inventory, University of Göttingen.

11.96-12.01 Head Biostatistics Section, Associate Professor, CATIE, Costa Rica.

04.91-10.96 Wissenschaftlicher Assistent (Assistant Professor), Abteilung Forstliche Biometrie, Universität Freiburg.

07.87-03.91 Wissenschaftlicher Angestellter (Full time Research Associate), Abteilung Forstliche Biometrie, Universität Freiburg.

10.85-06.87 Programmer at Computer Center, University Hospital Freiburg.

04.84-09.85 Freelance Computer Programmer and Forestry Consultant.

RECENT PUBLICATIONS (titles and references):

Kleinn C. 2002. New technologies and methodologies for national forest inventories. *Unasylva* 210. Vol. 53 2002/3. p. 10-15.

Kleinn C, D Morales 2002: Al establecer parcelas permanentes de observación: ¿Vale la pena tomar seriamente en cuenta consideraciones estadísticas y metodológicas? *Revista Forestal Centro Americana* (accepted for publication).

Kleinn C, D Morales. 2002. Inventario de árboles fuera del bosque, p-180-190 en: Orozco L, C Brumér. *Inventarios forestales para bosques latifoliados en América Central. Série Técnica, Manual Técnico No. 50, CATIE. 264p.*

Kleinn C, L Corrales, D Morales. 2002. Large area forest cover estimates in the tropics – the case of Costa Rica.

Environmental Assessment and Monitoring 73(1):17-40.

Kleinn C, J Pérez. 2001. Consideraciones estadísticas en la investigación científica en el campo de recursos naturales. *Agroforestería en las Américas, Vol.7 No 27, p.25-30.*

Kleinn C. 2000. A cautionary note on the minimum crown cover criterion in forest definitions. *Canadian Journal of Forest Research* 31(2):350-356.

Kleinn C. 2000. Estimating metrics of forest spatial pattern from large area forest inventory cluster samples. *Forest Science* 46(4):548—557.

Corrales, Kleinn C, Soihet C. 2000. Working papers 34-44 of FAO-FRA (entre 32 y 55 páginas): *Bibliografía comentada. Cambios en la Cobertura Forestal de 11 países Latino Americanos de México a Colombia.*

Kleinn C, and R. Davis. 2000. En el camino hacia una compilación de información forestal global. *Revista Forestal Centroamericana. Abril-Junio 2000, No. 30. p.85.*

Kleinn C. 2000. On large area inventory and assessment of trees outside forests. *Unasylva* 200. Vol. 51. p.3-10.

Kleinn C, J Jovel, L Hilje. 1999. A model for assessing the effect of distance on disease spread in crop fields. *Crop Protection* 18(9):609-617.

CURRICULUM VITAE OF APPLICANT/SCIENTIFIC STAFF

SURNAME: BOA

FORENAMES : Eric

AGE: 50

DEGREES etc. (include subject, class, university and date):

1976-1980 **Ph.D.** *Forest pathology: Ash canker disease* (University of Leeds)

1975-1976 **Diploma in Education** (University of Aberdeen, Aberdeen College of Education)

1971-1975 **B.Sc.** Class 2.1. Botany and Microbiology (University of Aberdeen)

POSTS HELD (with dates):

1995 to present *Development scientist* CABI BIOSCIENCE [UK Centre], CAB International.

1991 – 1994 *Tree Crops Scientist* Natural Resources Institute, Chatham, UK

1990 (2 months) *Agricultural Scientist, Philippines* Agricultural Education Programme (AGRED-EC), Landell Mills/Doxiadis.

1988-1991 *Team Leader, Clove Project, Indonesia* ODA. Balitro, Bogor.

1981-1987 *Bamboo Project, Bangladesh.* ODA. Forest Research Institute, Chittagong.

1981 *Head of Biology. Corpus Christi School* Leeds Education Authority, UK

RECENT PUBLICATIONS (titles and references):

Boa, E.R (2003) Wild Edible Fungi. A global overview of uses and importance to people. FAO.

Bentley, J., Boa, ER, Stonehouse, J (2003) Neighbour trees: shade, intercropping and cacao in Ecuador. Human Ecology (in press).

Boa, E.R., Bentley, J.W., Stonehouse, J. (2001) Standing on all three legs: the técnico as a cross-cultural occupational group. *Economic Botany* 55: 363 – 369.

Boa, E.R., Bentley, J.W., Stonehouse, J. (2000) *Cacao and Neighbour Trees in Ecuador. How and Why Farmers Manage trees for Shade and Other Purposes.* Final Technical report for ACRI and USDA.

Boa, E.R. (2000) *Assessment of bamboo research needs.* Report for the SHABGE CARE/DFID project in Bangladesh.

Boa, E.R (2000) *Tree health and Agroforestry: research demands, needs and strategy.* Programme development study for the Crop Protection Programme of DFID. 89 pp.

Boa, E.R., Ngulube, M. and Meke, G. (2000) *First Regional Workshop. Sustainable Use of NTFPs. Wild Edible Fungi.* The Forestry Research Institute of Malawi, Zomba. 64 pp.

CURRICULUM VITAE OF APPLICANT/SCIENTIFIC STAFF

SURNAME: MITCHELL

FORENAMES : Dominic

AGE: 38

DEGREES etc. (include subject, class, university and date):

1983 –1987 University of Cape Town - Bachelor of Social Sciences (Hons) (Political Science; Economics ; Sociology)

Mediation (Roger Fisher)(IMSSA)(ACCORD)

Facilitation (Dick Salem & Associates)

Arbitration (IMSSA)

Lead Social Auditor (FSC)

POSTS HELD (with dates):

1999 – current: Founder of Fakisandla Consulting

1994-1999: Founder of Interface Africa

1992-1994: Regional Co-ordinator Consultative Business Movement

1989-1992: Political Reporter Natal Newspapers

RELEVANT EXPERIENCE

Lead Social Consultant:

- Commercial Products from the Wild – Indigenous Forest and Grasslands (Medicinal and Fibre Plants National Project, RSA)
- Durban Unicity medicinal plants industry development strategy
- KwaZulu Natal Provincial business plan for medicinal plants
- Managing a national stakeholder participation process for the development of Regulations for the National Forest Act for artment of Water Affairs & Forestry (RSA)
- Conversion of Inanda Tea Estate into an organic vegetable and medicinal plant nursery
- Ilembe District Council Local Economic Development plan

Social Assessor:

- Singisi Forest Products (FSC Assessment for SGS)
- SAFCOL Eastern Cape (FSC Assessment for SGS)
- Masonite Africa (FSC Assessment)
- Esidweni Housing Project
- Ntshongweni Housing Project

Lead Social Consultant: North West KZN Economic Regeneration Project

Social and institutional design: Southern KwaZulu Economic Regeneration Strategy team

Project Manager: Planning and implementation Umzimkulu Game Park

Specialist economic input: KwaMashu Project Packaging Phase II

Land mediation: Lusthof Conflict(North West KwaZulu-Natal); Schaapvlakte conflict (Newcastle), Van Rooyen conflict (Vryheid)

RECENT PUBLICATIONS (titles and references):

CURRICULUM VITAE OF APPLICANT/SCIENTIFIC STAFF

SURNAME: Roux

FORENAMES : Jolanda

AGE: 31

DEGREES etc. (include subject, class, university and date):

1992 BSc (Microbiology and Chemistry) University of the Orange Free State

1994 BSc Honours (Microbiology) University of the Orange Free State

1995 MSc University of the Orange Free State.

1998 PhD University of the Orange Free State. Thesis: Diseases of *Acacia mearnsii* in South Africa with particular reference to Ceratocystis wilt

POSTS HELD (with dates):

- 2001+ Deputy co-ordinator IUFRO 7.02.07 Diseases of tropical forest trees
1999+ Senior researcher, Forestry and Agricultural Biotechnology Institute, University of Pretoria
- 1998+ Editor of Institute Newsletter: Tree Protection News
- 1996+ Manager: Tree Pathology Co-operative Programme (TPCP) Field Services. Responsible for extension, disease diagnosis, maintenance of trials and training of foresters
- 1994-7 Responsible for maintaining the freeze-dried fungal culture collection of the Tree Pathology Co-operative Programme, University of the Orange Free State
- 1993-7 Temporary Laboratory Assistant and Demonstrator for undergraduate Microbiology Practical Sessions, Department of Microbiology and Biochemistry, University of the Orange Free State

RECENT PUBLICATIONS (titles and references):

- Myburg, H., Gryzenhout, M., Roux, J., Heath, R.N., Wingfield, B.D. & Wingfield, M.J. 2002. Cryphonectria canker on *Tibouchina* in South Africa. *Mycological Research* 106: 1299-1306.
- Van Staden, V., Erasmus, B.F.N., Roux, J., Wingfield, M.J. & van Jaarsveld, A.S. 2002. Modelling the spatial distribution of two important South African plantation forestry pathogens. *Forest Ecology and Management* (Accepted).
- Barnes, I., Roux, J., Wingfield M.J, Coetzee, M.P.A & Wingfield, B.D. 2001. Characterisation of *Seiridium* spp. associated with cypress canker based on β -tubulin and histone gene sequences. *Plant Disease* 85, 317-321.
- Barnes, I., Roux, J., Wingfield M.J, Coetzee, M.P.A & Wingfield, B.D. 2001. Characterisation of *Seiridium* spp. associated with cypress canker based on β -tubulin and histone gene sequences. *Plant Disease* 85, 317-321.
- Roux, J., Harrington, T.A., Steimel, J.P. & Wingfield, M.J. 2001. Genetic variation in the wattle wilt pathogen *Ceratocystis albofundus*. *Mycoscience* 42, 327-332.
- Roux, J., Steenkamp, E.T., Marasas, W.F.O., Wingfield, M.J. & Wingfield, B.D. 2001. Characterisation of *Fusarium graminearum* from *Acacia* and *Eucalyptus* using β -tubulin and histone gene sequences. *Mycologia* 93, 704-711.
- Wingfield, M.J., Slippers, B., Roux J. & Wingfield, B.D. 2000. Worldwide movement of forest fungi, especially in the tropics and Southern Hemisphere. *BioScience* 51, 134-140.
- Roux, J., Dunlop, R. & Wingfield, M.J. 1999. Susceptibility of elite *Acacia mearnsii* families to Ceratocystis wilt in South Africa. *Journal of Forestry Research* 4, 187-190.
- Roux, J. & Wingfield, M.J. 1997. Survey and virulence of fungi occurring on diseased *Acacia mearnsii* in South Africa. *Forest Ecology and Management* 99, 327-336.
- Roux, J., Kemp, G.H.J. & Wingfield, M.J. 1995. Diseases of black wattle in South Africa - A review. *South African Journal of Forestry* 174, 35-40.

SECTION G: CONDITIONS AND AGREEMENT

IF ACCEPTED FOR FUNDING, THIS PROJECT WILL OPERATE UNDER THE STANDARD TERMS AND CONDITIONS AS SET OUT IN THE SPECIMEN RESEARCH CONTRACT OF NATURAL RESOURCES INTERNATIONAL LIMITED ON BEHALF OF THE RENEWABLE NATURAL RESOURCES RESEARCH STRATEGY OF THE DEPARTMENT FOR INTERNATIONAL DEVELOPMENT. THE FINAL VERSION OF THIS PROJECT MEMORANDUM WILL FORM PART OF THE CONTRACT AND WILL BE A LEGALLY BINDING AGREEMENT BETWEEN ALL PARTIES INVOLVED IN THE PROJECT.

Note: This application should be submitted through (1) the Head of Department, (2) the officer who will be responsible for administering any grant that may be awarded, and (3) any collaborator(s) named in QUESTION 2 above.

The following highlights some important points from the Contract. Reference must be made to the Contract for any contractual obligations.

Financial

- i. Project costs provided in Questions 21 and 22 of this Application shall be based on the best estimates of the applicant(s) and must allow for inflation.
- ii. Where any provision for overhead charges is appropriate, it shall be calculated on the basis of gross salary costs only.
- iii. Unless agreed in advance in writing, NR International shall not be responsible for any cost or expense of any kind, incurred for any reason, in excess of the agreed project funding. The applicant's institution will be expected to absorb increases in costs caused by inflation above the estimated levels.
- iv. Project allocations are by financial years. Under no circumstances can money be moved from one financial year to another as this contravenes Treasury Regulations.
- v. Invoices for work completed are expected to be issued by the applicant's institution on a timely basis (Clause 10 of the Contract refers). This is very important, as delays in payment will result if invoices submitted do not follow the required format or adhere to the invoicing schedule agreed.

Research

- vi. The applicant shall submit to NR International progress reports which may be requested at any time in respect of the project. Failure to submit reports on time may, at the discretion of NR International, may result in the withholding of funds or the termination of the project.
- vii. In brief, current requirements are:
 - a) Quarterly report (one page)
 - b) Annual report (one page)
 - c) Final report (see below)
 - d) Milestone and project spending forecasts, annually and split into quarters.

Full details of formats and timing are contained in the Contract and its Appendices.

- viii. The applicant shall submit to NR International a final report to be received within 60 days of the project completion date. Under normal circumstances, the final quarterly payment or 10% of the

total project cost, whichever is less, will be retained by NR International until it has approved the final report.

ix. Any specific papers arising from the project shall acknowledge DFID's sponsorship of the project, (see Clause 18 of the Contract). Reprints of published articles shall be sent in duplicate to NR International.

Overseas Travel

x. The Project Leader will inform the British High Commission or Embassy of every country visited providing details of the project where necessary. Names and addresses are available from NR International on request.

xi. The Project Leader will seek permission from NR International prior to embarking on any overseas travel not previously agreed to in the Project Memorandum form. Failure to seek and obtain prior approval will result in payment being withheld.

xii. Economy Class fares (or their equivalent) must be regarded as normal and only in exceptional circumstances will higher class fares be approved.

General

xii. CVs of all staff participating in research projects must be submitted to NR International before their participation commences, regardless of the stage at which they are recruited.

xiii. NR International shall be informed, in writing, immediately, of any variation in the project timescale, whatever the reason, and seek the approval of the Programme Manager for any extension to the project.

xiv. Attention is drawn to Clause 20 of the contract detailing the issue of Intellectual Property Rights.

I confirm that I have read the terms of contract issued by Natural Resources International Limited and, if the project proposal is successful, I agree, acting on behalf of the applying institution, to accept and be bound by the conditions therein.

Signature of Applicant:

Name (typed): Dr Jennifer Ley Gn Wong

Position (typed): Managing Director, Wild Resources Limited

Date: 23 July 2003

FOR COMPLETION BY HEAD OF DEPARTMENT AND OFFICER RESPONSIBLE FOR ADMINISTRATION OF ANY GRANT AWARD

I confirm that I have read this application and that, if granted, the work will be accommodated and administered in the Department/Institution and that my Department/Institution will absorb increases in costs above the levels specified in this application, unless agreed otherwise by NR International.

Signature of Head of Department:

Name (typed): Dr Jennifer Ley Gn Wong

Date: 23 July 2003

Signature of Administrator:

Date: 23 July 2003

Name and full address including phone and fax numbers (typed): Gareth Wyn Davies
Wild Resources Limited
Robinson Building
Deiniol Road
Bangor
Gwynedd
LL57 2UW
Tel: 01248 382282
Fax: 01248 354997