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Development of Forest Research Networking System

A report prepared for the Namibia-Finland Forestry Programme

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Executive summary: main findings and recommendations

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This report is a product of a short-term consultancy on Development of Forest Research Networking carried out in Namibia from 10 March to 14 April 2002. International, regional and national networks and other collaborative arrangements are discussed and their benefits to the Directorate of Forestry (DOF) are assessed. In addition, existing information sources relevant to Namibian forestry research are identified and their potential use is analyzed, and guidelines for establishment and maintenance of Permanent Sample Plots are compiled.

The major problem in Namibian forestry development is not a lack of research information but a weak capacity to make use of research information available in Namibia and elsewhere.

- The development of forestry information services should have a high priority. It is recommended that the Ministry of Environment and Tourism / NFFP selects suitable person to be train as librarian (BA degree) at the Technicon South Africa or at the University of Gaborone.
- Mopane information centre at the DAPP Tree Planting & Environment should be supported by DOF and other stakeholders, and donors.
- Memorandum of Understanding should be signed with the most important partners. MOU Triparty should be signed between the DOF, MRCC and OAC.
- To fully benefit from the latest agreement between the European Union and 77 African, Caribbean and Pacific (ACP) countries it is advisable to submit a concept paper on forestry and forest research to the EU-delegation in Windhoek. Preferably, the concept paper should be written together with other stakeholders, for example MRCC and OAC.
- The unproductive *Eucalyptus* plantation in Onankali should be transferred to a highly productive Onankali Model Agro-Forest run by the Onankali Community Trust, using *Eucalyptys camaldulensis* seedlot 17297, indigenous fruit trees and agricultural crops.

The report is available from:

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Acronyms

AAS	African Academy of Sciences
AIDAB	Australian International Development Assistance Bureau
CBNRM	Community Based Natural Resources Management
CIDA	Canadian International Development Agency
CIFOR	Centre for International Forestry Research
COSTECH	Commission for Science and Technology (Tanzania)
CRIAA	Centre for Research Information Action in Africa
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAPP	Development Aid from People to People
DEA	Directorate of Environmental Affairs (MET-GRN)
DFID	Department for International Development (formerly ODA, UK)
DOF	Directorate of Forestry (MET-GRN)
DRFN	Desert Research Foundation of Namibia
EDF	European Development Fund
ETFRN	European Tropical Forest Research Network
EU	European Union
FAO	Food and Agriculture Organisation (United Nations)
FC	Forestry Commission (Zimbabwe)
FORNESSA	Forestry Research Network for Sub-Saharan Africa
FRIM	Forest Research Institute (Malawi)
GEF	Global Environment Facility
GFRA	Global Forest Resources Assessment (FAO)
GIS	Geographic Information Systems
GRN	Government of the Republic of Namibia
ICRAF	International Centre for Research in Agroforestry
IFTTF	Indigenous Fruit Tree Task Force (Namibia)
IUFRO	International Union of Forestry Research Organisations
KEFRI	Kenya Forestry Research Institute
MAWRD	Ministry of Agriculture, Water and Rural Development (GRN)
MET	Ministry of Environment and Tourism (GRN)
MHETEC	Ministry of Higher Education, Training and Employment Creation (GRN)
MOU	Memorandum of Understanding
MRCC	Multi-disciplinary Research and Consultancy Centre (UNAM)
NACSO	Namibian Association of CBNRM Supporting Organisation
NAWIC	Namibian Agriculture & Water Information Centre
NBRI	National Botanical Research Institute
NEPRU	Namibian Economic Policy Research Unit
NFFP	Namibia-Finland Forestry Programme
NFRC	National Forestry Research Centre (DOF-MET-GRN)
NGO	Non-Governmental Organisation
NRSC	National Remote Sensing Centre
NUCA	Namibian University College of Agriculture (UNAM)
OAC	Ogongo Agricultural College
ODA	Overseas Development Administration (presently DFID)
PON	Polytechnic of Namibia
PRA	Participatory Rural Appraisal
PSP	Permanent Sample Plot

RAISON	Research and Information Services of Namibia
S.W.A.	South West Africa
SA-DC	Southern Africa Development and Consulting (CRIAA)
SADC	Southern African Development Community
SPDC	Special Programme for Developing Countries (IUFRO)
SSD	Social Science Division (MRCC-UNAM)
TAFORI	Tanzania Forestry Research Institute
TOR	Terms of Reference
TSCN	Tree Seed Centre Network (SADC)
UN	United Nations
UNAM	University of Namibia
UNESCO	United Nations Educational, Science and Cultural Organisation
WWF	World Wide Fund For Nature

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I express my gratitude to all people and institutions that have supported the consultancy by sharing the time and expertise, and providing access to relevant documents and information. Especially, I would like to thank Mr Joseph Hailwa (e-mail: hailwa@forestry.met.gov.na), the Acting Director of Forestry, Dr Vesa Kaarakka (e-mail: kaarakka@africaonline.com.na), the Consultant Team Leader of the Namibia-Finland Forestry Programme (NFFP), Mr Harsen Nyambe (e-mail: nyambe@forestry.met.gov.na), and Ms Esther Lusepani-Kamwi (e-mail: lusepani@africa.com.na) for useful discussions during the networking process in Windhoek, and Ms Helena Nangutuwala for valuable assistance during the research evaluation and data collection visit to northern Namibia from 21 to 27 March 2002. I owe special thanks to Mr Elia Shipandeni, senior headman of the Eenhana constituency, for important feedback on my research findings. I thank Ms Ingrid Demasius, Namibia Scientific Society, for kindly organizing special training course How to Produce a Book, a component of this consultancy. I would also like to thank Ms Wilhelmina Mberira, the Secretary of NFFP, and Ms Päivi Haapanen, Indufor, for organizing transport, accommodation and other essential support services. Dr Kari Korhonen and Mr Martinus Gelens kindly provided important back-up data and documents on research and development activities carried out in the 1990s. I thank the DOF and NFFP staff for critical review and comments of the draft report presented in the wrap-up meeting; especially I would like to acknowledge Mr Vincent Louw, Mr Michael Otsub and Ms Christa Theart for their valuable contribution to the manuscript. I was warmly welcomed by the DOF staff and the NFFP team members, and I felt comfortable and relaxed, which motivated me throughout the consultancy.

Windhoek 12 April 2002

Antti Erkkilä

1. INTRODUCTION

The proposed Mission Statement for the Research Division of the Directorate of Forestry, drafted in the Research Workshop 12-13 March 2002 in Windhoek, is as follow:

To conduct integrated forestry research, including indigenous knowledge, and disseminate forest research information which will enable forestry practioners and users to improve the livelihood of the people through sustainable forestry, agroforestry and tree management.

A recent overview of the existing system of research in Namibia put forward the following definition:

Research is an activity which sets out systematically to broaden the range of information on a given subject, and/or by analysis to cause reassessment of its significance. A researcher is the person who is able to design and process data gathering and analysis. The researcher will make her or his product available through recognized media for peer review (Research in Namibia... 2001).

A characteristic of all Namibian ministries consulted was that none of them had in place, full and appropriate policies and procedures to govern how research should be carried out and what should happen to the results. In general, the data collected is not easily accessible to members of the research community via, e.g. web enabled databases. The attention is not consistently drawn to the legal or moral requirements to deposit off the research results, and other documents either with local counterpart institutions of the National Library (Research in Namibia... 2001).

Directorate of Forestry (DOF) is administratively part of the Department of Natural Resource Management of the Ministry of Environment and Tourism (MET). Mr Joseph Hailwa, BScForHons is the Acting Director of Forestry. DOF has two divisions:

Forest Research Division

Headed by Acting Deputy Director, Mr Harsen N. Nyambe, MSc

Forest Management Division

Headed by Acting Deputy Director, Mr Moses Chakanga, MScFor.

Forest Research Division has three major institutions:

National Remote Sensing Centre

Headed by Mr Harsen N. Nyambe, MSc

Inventory and Mapping Section

Headed by Ms Ndapanda Kanime, BScHons

National Forestry Research Centre (e-mail: nfrc@namib.com)

Headed by Ms Esther Lusepani-Kamwi, MScFor

National Forestry Research Centre (NFRC) is located in Okahandja, 70 km north of Windhoek. NFRC has a large, fenced ground with a new office building, two new houses and two older houses to accommodate staff members, and a nursery. The office building provides excellent space for various research activities. The facilities include a few personal computers, installed with Word and Excel programmes, but no statistical software packages. There is an excellent library room, but no library services – during the visit on March 2002 a few research documents were piled on the shelves without any systematic order.

Senior staff members at NFRC in Okahandja include:

Ms Esther Lusepani-Kamwi, MScFor, University of Stellenbosch, 1999
Ms Rusta Mungandjela, MScFor, University of Stellenbosch, 1998
Ms Helena Nangutuwala, BScFor, Australian National University, 2002
Mr Michael Aimanya, Forestry Diploma, Zimbabwe Forestry College, 1999

NFRC has three research stations:

Hamoye in the Kavango Region

Headed by Ms Selma Elago, forestry certificate holder

Walvis Bay in the Erongo Region

Headed by Mr Chaka Mubita, forestry diploma holder

Kanovlei in the Otjozondjupa Region

Headed by Mr Robert Simasiku

The objectives of the consultancy were to:

- a) provide concrete mechanisms for international, regional and national networking and related information sources relevant to forest research for the DOF Research Division,
- b) draft guidelines for establishment and maintenance of Permanent Sample Plots (PSPs) for research and monitoring purposes,
- c) train DOF staff in the establishing, and maintaining different forms of networking.

2. RESEARCH CAPACITY

2.1 Division of Forest Research

Networking requires sufficient capacity and inputs from all parties. Networking is never a one-way direction. In other words, the research partner will soon lose the interest for cooperation, if there is no reply on a letter or e-mail, or if duties agreed are neglected, or if they are not completed as agreed. It is obvious that the **research capacity of DOF should be increased**. Three qualified staff members in Okahandja do not form enough, so-called critical mass of research expertise. On the other hand much of the activities in the research stations are routines such as producing seedlings for the public or sand dune stabilization. Some of the routine activities are organized from Okahandja, and not from the nearest Forestry Station; compare Okahandja – Hamoye 700 km, Rundu – Hamoye 30 km.

In general, the major problem is NOT shortage of research information as such but there is a weak capacity to make use of available research information. However, it should be kept in mind that only PhD holder is formally qualified researcher, and young graduates would need several years to build up the necessary expertise. In that sense **during the last 12 years there has been remarkable attachments.**

2.2 Forestry Library and dissemination of publications

A functional library service is a must for any productive forest research. The current state of the Forestry Library in Windhoek is unsatisfactory. The library does not even have basic source documents, such as Dewey Decimal Classification System. The library is also used as boardroom which is an inconvenient arrangement.

In general the forestry staff is not accustomed to use public and scientific libraries, and information systems, such as:

- Namibian Agriculture & Water Information Centre
- M A N Muller Library at the NBRI
- Namibian National Library
- Environmental Affairs Library
- Namibian National Archives
- Namibian Scientific Society

The Library Act instructs the government institutions to deposit 20 copies of the research results, and other documents to the governmental libraries (Hillebrecht, pers. comm., 2002). A quick search in the UNAM library database produced only four DOF publications, all of them socio-economic studies by Kamminga (2001), but no forest inventory reports, for example. However, many of the NFFP reports have been deposited to the National Library and NBRI but none of the so-called firefighting videos.

The publication *Management of Mopane in Southern Africa: proceedings of a workshop held at the Ogongo Agricultural College, northern Namibia, 26th 29th November 1996* (Flower et al. 1999) is one of the most important publications produced by DOF. Apparently many copies have been distributed, however, there are still about 1000 copies left at the Head Office. Unfortunately,

no copies have been disseminated to the DAPP Tree Planting & Environment, which is a major information centre of mopane shrubland management in northern Namibia. Mr Celestinus Ndongi, Project Manager, who attended the mopane workshop in 1996 has not yet received his personal copy either. It seems that with OAC, only a few copies are available, e.g. Mr Osman Hamid was not aware that the publication is available at the Head Office in Windhoek.

The university education provides training in scientific writing, and each student should produce a BSc and/or a MSc thesis. **The theses written by staff members hold important, and perhaps, unique information on Namibian forestry issues.** However, these research findings are poorly distributed. There are only two theses - Hailwa (1996) and Louw (1999) - available at the Forestry Library.

2.3 Recommendations

- **Forest Research should be seen as a responsibility of all qualified DOF staff.** Each of the MSc holders, and preferable also BSc holders, should be in-charge of at least one research project, regardless of the assignment to the Research or Management Division.
- Research should be seen, besides of national importance, also as a **possibility for personal career development.** Staff member in-charge of research planning, data collection, and analyses should realize that she or he will be the author of a research publication, together with others who contributed to the research.
- In the future, it would be beneficial to place at least some of the qualified researchers of DOF Research Division to the new ministerial building to be constructed in Windhoek.
- Forestry Library and the ministerial library at Directorate of Environmental Affairs should be combined, and a Memorandum of Understanding signed on library services provided for DOF. The other possible option is to move the Forestry Library, including all CD-ROMs, to Okahandja where an excellent library room is available. The library and information services for the Head Office and districts could be provided through e-mail. However, this would require a qualified information officer.
- **It is highly recommended that the Ministry of Environment and Tourism/ NFFP selects suitable person to be train as librarian (BA degree) at the Technicon South Africa or at the University of Gaborone.** The Ministry of Basic Education, Sport and Culture would then employ the person to work within the ministerial or Forestry Library (for further information contact Ms Ellen Namhila, Director of Namibia Library and Information Services, e-mail: enamhila@mec.gov.na)
- All incoming publications and periodicals should be registered by a qualified librarian before further dissemination to Forestry Districts, or before the staff members at the Head Office are allowed to loan books from the library. The library holdings should be loaned to staff members only.
- The CDS/ISIS database software package provided by the UNESCO should be reinstalled in order to access holdings in other governmental libraries. TreeCD acquired in 1996

should be reinstalled at the Head Office, and recently acquired TreeCD should be installed at NFRC in Okahandja, or at the NBRI in Windhoek.

- Intranet with back-up services, network disc station and printer, would improve information facilities at the Head Office, reduce the possibility to lose expensive CD-ROMs, and a need for personal printers. However, a poorly maintained network may allow the dissemination of computer viruses. The current system is sufficient, especially in the absence of **qualified data manager - a suitable person should be trained for this function.**
- The senior staff at the Head Office should be aware of the Library Act, and make sure that it is followed accordingly.
- **Mopane information centre** at the DAPP Tree Planting & Environment should be supported by DOF and other stakeholders, and donors. A feasible mechanism to support this important initiative would be the transfer of a total of 500 copies of *Management of Mopane in Southern Africa* to DAPP, and allow selling the publication for N\$50 per copy for the benefit of the information centre. The DAPP Tree Planting & Environment should be assisted in writing a proposal *Dissemination of Information on Sustainable Management of Mopane Shrubland in North-Central Namibia*. The possible source for funds would be **EC-Budget-line for Environment and Tropical Forest**, for further information contact Ms Petra Pellfolk, Young Expert in Training, EU-delegation, Sanlam Centre, Windhoek. NFFP could support the above-mentioned information centre by donating copies of the video production *The Forest is My Farm*, and allow selling for N\$50 per copy. The mopane information centre is an important initiative, which supports the sustainable natural resource management, and the development of tourism, and consequently home industries in northern Namibia (for example souvenirs made of mopane).
- Workshop report *Management of Mopane in Southern Africa* could be distributed to relevant stakeholders in the steering committee meetings, during informal visits, when meeting VIPs etc. This is an important and concrete public relation practice. The same applies for newly produced Tree of the Year posters, etc.
- MSc and BSc holders should write an article based on major findings in their thesis. The article could be submitted for publishing to the Namibia Scientific Society, for example. The minimum requirement would be a summary which is distributed to DOF Offices, and to relevant stakeholders. At least two copies of theses should be deposited to the Forestry Library – the relevant universities should be contacted in order to clarify the copyright issues.
- Staff members should be encouraged to **report the research findings** in staff meetings. The same applies to lessons learnt in national and international research workshops and conferences.
- **Agreements on exchange of forestry publications** should be signed with relevant forestry institutions, e.g. the University of Joensuu, Finland (e-mail: mihdot@joensuu.fi).

- It is highly recommended to expose forestry staff to the available library and information services. Annual meetings and workshops organized in Windhoek could include visits to NBRI, and other information centres.
- DOF Research Division should apply for **Namibia Scientific Society membership** (N\$ 172.50 for April 2002 – March 2003). The annually published Journal and the quarterly published Newsletter are posted to members free of charge.

3. RESEARCH NETWORKING

3.1 International cooperation

International networking is crucial for any forest research in Namibia. The researchers should be aware of worldwide trends that impact on forest research. International networking practices include conferences, workshops and seminars, and meetings with foreign consultants and scientists in Namibia and abroad. There is no research permit system for foreign researchers, and consequently reporting and feed-back is inadequate. The only current international research and development initiative is *Domestication, Post-Harvest Handling and Marketing of Selected Fruit Trees* funded by FAO.

The Faculty of Forestry of the University of Joensuu (Finland) is a lively, internationally oriented centre of research and education. The team consists of 10 professors, 80 researchers/lecturers and 10 laboratory and clerical staff members. Active research is done in order to improve the ability to manage the forest resources more successfully in the changing world. The Faculty is actively conducting research on e.g. the environmental modeling in order to improve our ability to manage the forest resources more successfully in the changing world. For example, the award-winning Centre of Excellence in Forest Ecology Research concentrates on the effects that climate change may have on forests. Besides the research on the boreal forest ecosystem, Finland's principal nature resource, numerous international contacts characterize the Faculty's research activities in Europe, Southeast Asia and Africa. The Faculty is the coordinator of SilvaNetwork, network of academic forestry institutions in Europe; the president of SilvaNetwork is Prof. Paavo Pelkonen (e-mail: paavo.pelkonen@forest.joensuu.fi). SilvaNetwork links with other similar networks in northern America, Latin America and Asia. **SilvaNetwork has not yet established any strong links to forest research networks in Africa, however, the network can be utilized to look for potential European research partners.**

The Faculty of Forestry of the University of Joensuu coordinated the Concerted Action project *Tree seedling production and management of plantation forests (1997-2000)* supported by the EU under the INCO-DC Programme. The coordinator of the INCO-DC project was Dr Timo Pukkala, Professor of Forest Management Planning (e-mail: amo.pukkala@forest.joensuu.fi). He is the author of more than 200 scientific publications, a supervisor of several doctoral students, and a member of the editorial board of Forest Ecology and Management. He has working experience from several developing countries in Asia and Africa. **DOF Research Division participated in this particular INCO-DC project, the contact person is Ms Rusta Mungandjela.** The DOF participation in the project was rather passive, and the assistance in the data analysis was not fully utilized, for example. The project facilitated the production of four PhD degrees - researchers from Kenya, Tanzania, Zimbabwe and Finland.

The Tropical Silviculture Unit of the University of Helsinki, Finland houses two permanent fulltime positions in tropical forestry (one Professor, Dr Olavi Luukkanen, olavi.luukkanen@helsinki.fi, and one lecturer), with a strong emphasis on training and research in dryland forestry. Since 1995 doctoral theses on dryland forestry have been produced by students from Sudan, Ethiopia, Thailand, China and Finland. The Unit is presently involved in dryland forestry research in the Sudan, Kenya and Tanzania, with formal collaboration agreements with the research institutions in these countries (KEFRI, TAFORI, Agricultural Research Corporation of the Sudan).

European Tropical Forest Research Network (ETFRN) is a network of European organizations involved in (sub) tropical forest research. It is presently supported by Directorate General for Research of the European Commission under the INCO-DEV Programme. ETFRN News No. 35 2001/2002 is titled *Innovative Financing Mechanism for Conservation and Sustainable Forest Management* – available at the Forestry Library in Windhoek.

The other relevant international networks and institutions include IUFRO and its Special Programme for Developing Countries (SPDC), and FAO.

3.2 Regional cooperation

The University of Natal in South Africa has approximately 21 000 students, 9 faculties (Community and Development Disciplines, Engineering, Human Sciences on Durban and Pietermaritzburg Campus; Law, Management Studies, Medical Faculty, Science and Agriculture), 41 schools and 13 university-wide centres and research institutes. Forestry Programme offered by the Faculty of Science and Agriculture aims to produce graduates capable of developing and managing intensive tree plantations and farms by combining environmental constraints with principles of intensive agriculture and community forestry. The forestry expertise is e.g. in silviculture of fast growing plantations; breeding and cloning for quality fibre production; rural, African community development and community forestry; and elements of indigenous forest ecology.

Dr Janusz Zwolinski (e-mail: zwolinski@nu.ac.za), Professor and the Head of Forestry Programme, has received his professional forestry qualification and work experience based on achievements of the European Schools of Forestry. This has been followed by 18 years of forestry research, research management, post-graduate studies and academic engagements in South Africa and the United States, and various professional trips to Australia, Canada, New Zealand, and South America. He has over 50 refereed publications and about 100 popular articles and industrial reports. **Dr Horst Kassier**, Senior Research Fellow, has a long experience in developing forest management and growth modeling. He is responsible for the development and implementation of forestry planning systems and tools, including GIS and mapping, spatial databases, digital terrain models, land-use and plantation details. **Dr Coert Geldenhuys**, Senior Research Fellow, is one of the most experienced scientists specializing in ecology and management of indigenous forests across Africa with special interest in rainforest and woodland management, assessment and dynamics, impacts of disturbance, and development of sustainable multiple-use management systems and restoration techniques. He has been leading research projects for rainforest and woodland management in many African countries.

Forestry Programme at the University of Natal of South Africa is the leading organization in **the proposal *Developing management support for indigenous and plantation forests and agroforestry systems in South and East Africa*** submitted to EU- INCO – Research for Development Programme (for further information contact Prof. Zwolinski). DOF Research Division is not participating in this particular consortium. The general objectives of the proposed research are, a) increasing knowledge on the yield and management of indigenous forests, plantation forests and agroforestry systems in South and East Africa; b) developing appropriate research methods for growth and yield modeling; c) and increasing the number of tools applicable to the planning and monitoring of forest resources in South and East Africa. The specific objectives of the research proposal are, a) model the growth and yield of indigenous forests and

trees; b) model the growth and yield of plantation forests; c) model agroforestry systems; d) develop databases to store and up-date research and forest inventory data; and e) develop Decision Support Systems for the management of plantation forests and agroforestry systems.

The Kenya Forestry Research Institute (KEFRI) is a national public institution established in 1986. The institute undertakes research in all aspects of forestry, tree development and natural resources development and conservation. The institute also undertakes training aimed at transferring developed technologies. The core research programmes of KEFRI are: Farm Forestry, Natural Forests, Dryland Forestry and Forest Plantations. It is within these programmes that research addresses the productivity, growth, development and modeling of tree establishments in on-farm trees development, natural forests, plantations and in drylands forests and woodlands. KEFRI has about 90 University graduate scientists who implement research programmes, modern research and training facilities which include catering and hostels. There are six major Regional Research Centres, each with one - three sub-centres to enhance research trials and activities in the various ecological zones of Kenya. KEFRI has participated in the INCO Concerted Action Tree seedling production and management of plantation forests (1997-2000) coordinated by the University of Joensuu. **Dr Mbae Muchiri**, experienced in forest mensuration, growth predictions and growth modeling, has acquired his PhD at the University of Joensuu.

The Tanzania Forestry Research Institute (TAFORI) was established in 1980 to bridge the gap resulting from the 1977 collapse of the East African Agricultural and Forestry Research Organisation that formed part of the East African Community. There is a master plan that has research programmes, namely (and according to priority): Management of Natural Forests, Community and Farm Forestry, Plantation Forestry and Tree Improvement, Forest Resource Assessment, Forest Operations and Utilisation, and Socio-economics, Policy and Forestry Extension. The seventh programme is the service oriented support programme. Some 37 research project profiles have been identified. Professional research staff amount to 22, half of the staff has graduate training. The remaining half has a first degree. Further staff recruitment and training is contemplated. The critical mass is about 35 researchers. The technical staff consists of some 30 people. TAFORI has strong links with national and international organizations. This includes Tanzania Commission for Science and Technology (COSTECH); Sokoine University of Agriculture, CIFOR, FAO, FINNIDA, ICRAF, IIBC, KfW, World Bank (IBRD/IDA), etc. TAFORI participated in the INCO Concerted Action Tree seedling production and management of plantation forests (1997-2000) coordinated by the University of Joensuu. **Dr Ladislaus Nshubemuki**, specialist in site evaluation and tree species selection, has acquired his PhD at the University of Joensuu.

The Research and Development Division of the Forestry Commission (FC), Zimbabwe, undertakes and conducts cost effective and client oriented research for the entire forestry sector in Zimbabwe, to make known the results of the research thereof and to develop technologies to manage forests. There are three operational units: Plantation Forestry Research, Indigenous and Social Forestry Research, and Technical Services. Research on Plantation Forestry involves silviculture and management, tree breeding and forest protection. Indigenous and Social Forestry Research involve natural forest management including GIS and inventory applications, agroforestry research and extension. Technical services include biometrics, publications and data storage and retrieval. The Division runs a number of permanent field stations strategically located in different climate zones as well as satellite stations throughout the country. The researchers are assisted by a number of technicians and field personnel for trials' maintenance and data collection.

FC has participated in the INCO Concerted Action Tree seedling production and management of plantation forests (1997-2000) coordinated by the University of Joensuu. **Dr Dan Mabvurira**, experienced in growth and yield modeling, forest management planning and economics, has acquired his PhD at the University of Joensuu.

The Forest Research Institute (FRIM) of Malawi was established in 1957, conducts operational forestry research to generate usable technologies and provide information for sustainable management, conservation and utilization of forests/trees and allied natural resources. FRIM's problem-oriented research is organized and implemented through a programme-based structure of four core strategy areas of Plantations, Indigenous Woodland Management, Trees on Farm, and Seed and Tree Improvement. Research on Plantation Forestry focuses on improving management and productivity of plantations. Priority research activities include improving the supply of high quality propagation material, productivity and stand dynamics, diversifying plantation species, pest and disease control, harvesting and wood utilization. The current research focus in Indigenous Woodland Management is on productivity and utilization, ecology and reproductive biology, silvicultural and community-based management systems of miombo woodlands. Trees-on-Farm Research focuses on development of improved management guidelines for existing traditional agroforestry practices, domestication of indigenous fruit trees for incorporation into smallholder farming systems and development of an integrated pest management scheme for agroforestry species. Seed and Tree Improvement research focus is on genetic improvement of important plantation and agroforestry species, establishment and management of seed production areas, identification and certification of in-situ seed collection areas for indigenous species and studies in seed technology.

The other relevant regional networks and institutions include **Forestry Research Network for Sub-Saharan Africa (FORNESSA – in 2001 DOF was a member of steering committee)**, African Academy of Sciences (AAS), ICRAF, and CSIR in Pretoria. Earlier close links with the **SADC Tree Seed Centre Network (TSCN)** project (for example marula provenance trial was established in Iiheke and Onuno, northern Namibia) were maintained. This CIDA-funded project continued until September 2001. **Capacity building in forestry research programme is an initiative through AAS to encourage and support young and senior scientists** (AAS Nairobi, e-mail: aasi@africaonline.co.ke).

3.3 National cooperation

Namibian University College of Agriculture (NUCA) is a newly established institution within the University of Namibia (UNAM). In the new administrative set-up, the Ogongo Agricultural College (OAC, e-mail: oac@mweb.com.na) will be part of the Faculty of Agriculture and Natural Resources. The Faculty of Agriculture and Natural Resources offers undergraduate degree programmes leading to Diploma in Forestry. According to **Prof. J.P. Msagi** (e-mail: jpmsangi@unam.na), Head of Department of Natural Resources and Conservation, **networking could include research proposals, exchange of publications, field data collection and experiments, and exchange of students.**

Forestry Department in Ogongo has a high emphasis on agroforestry research (see Research Workshop papers on Effect of *Acacia nilotica* and *Colophospermum mopane* on pearl millet growth and yield; The potential of mopane worms in the agro-silvipastoral systems of north-central

Namibia). Near the forestry nursery in Ogongo *Tephrosia vogeli*, a small multi-purpose shrub, have been planted for demonstration and training purposes – ICRAF funded project. The other demonstration plots include *Sesbania sesban*, and *Azadirachta indica* (neem). Alley cropping is demonstrated with pear millet (mahangu) and *Leucaena leucocephala*. For further information contact Mr P. Chikasa or Mr Osman Hamid (e-mail: osmanh@mweb.com.na).

Dr Martin N. Mbewe (e-mail: mmbewe@unam.na), Department of Biology, has assisted DOF Research Division in data analysis. Biology students have been sent for training to the NFRC in Okahandja. From the NFRC point of view the training period seems to be too short to fully benefit student work force, and to conduct any long-term research trials. The Head of the Department of Biology is **Prof. Godwin P. Kaaya** (e-mail: gkaava@unam.na).

Multidisciplinary Research and Consultancy Centre (MRCC) is the strongest research unit at UNAM. MRCC comprise Social Science Division (SSD), Life Science Division, and Science and Technology Division – the two last mentioned divisions are gradually starting to develop their research activity. SSD has produced numerous recognized research papers, and staff members have also published in recognised academic journals; the Centre is known for a highly motivated and qualified research staff. **Mr Gert van Rooy** (e-mail: gvanrooy@unam.na) is the Head of SSD. The SDD research programmes include five major programmes: Urban Programme (including urban environment), Economic Programme (including a component on capacity building), Gender Programme (capacity building on gender training), Community Based Natural Resources Programme (formation of conservancies, community based tourism, etc.), Lands Programme (indigenous land use, resettlement issues, etc.), and Poverty & Livelihood Programme (poverty issues from the Namibian point of view). The Programme on Good Governance will be set-up soon. **SSD is willing to collaborate in surveys and data analysis.** SSD has strong links to the Central Statistic Bureau of the National Planning Commission.

National Botanical Research Institute (NBRI) is within the Directorate of Research and Training of the Ministry of Agriculture, Water and Rural Development. NBRI has provided courses and services for DOF staff in plant identification. Unfortunately, most of specimens collected by DOF staff have not full-filled the standards of NBRI. Mr Moses Chakanga has represented DOF in Tree Atlas steering committee. Information services provided by NBRI, including the **database of 4000 plant species** (common names, distribution, status, uses etc.), is rarely utilized for Namibian forestry development. Contrary to the recent overview of the existing system of research in Namibia (Research in Namibia... 2001) there seems NOT to be any major duplication in research between DOF Research Division and NBRI but there is certainly scope for streamlining complementary activities (for further information contact Dr Gillian Maggs-Kölling, Chief Agricultural Researcher, e-mail: gmk@mweb.com.na).

Indigenous Fruit Tree Task Force (IFTTF) includes members from various sectors dealing with indigenous fruit trees. Its main objective is to coordinate the activities related with fruit tree promotion and also to design a national strategy for the promotions of indigenous fruit trees. The task force allows sharing experiences from different projects and avoids duplication of efforts. DOF representative in the IFTTF is Ms Esther Lusepani-Kamwi from NFRC.

3.4 Other contacts

Princeton University, USA – Wageningen University

The status of the research projects conducted by **Prof. Emmanuel Kreike**, African Studies Program, Princeton University, is as follow:

a) A very much revised version of what was originally his history PhD thesis at Yale University (Kreike 1996), the study on **agricultural and environmental change in the northern and central floodplain of north-central Namibia** will be published soon by Heinemann (probably in 2003),

b) After having the final revisions for the above, Dr Kreike will finalize the study on **the Ovambo "traditional" agroforestry system**. There is a database but it is not yet complete, the study is expected to be completed by early 2003. Parts of one of the chapters are forthcoming in a book on African Environments: Past and Present edited by William Beinart.

c) The field research for a third project has been completed, namely **on the impact of the Apartheid wars on society and environment** in the Namibian-Angolan (the four Os and the Lower Kunene Province of Angola) and the Mozambican-South African border region (the northern Lowveld region of RSA's Northern Province and the Gaza Province of Mozambique). The impact in northern Namibia of the war (including on forestry) was quite dramatic. As a small but probably interesting detail there were one or two illegal hardwood cutting operations in colonial Namibia; the well-known one in the 1970s and 1980s but another operation ran from the 1930s up to the 1960s (it may be that the two are actually connected), and involved the highest South African colonial official in Ovamboland, C.H.L. Hahn.

Polytechnic of Namibia

Mr Patrick Graz (e-mail: ufpgraz@iafrica.com.na) is doing research on the development of a **conceptual model of the savanna woodlands**, see the website www.polytechnic.edu.na/natural/staff/pgraz. The research is currently under review for publication by Conservation Ecology. Mr Patrick Graz has written a literature review on *Schinziophyton rautanenii* (will be published in latest Dinteria); the research includes issues such as spatial structure / population structure, as well as seedling development under different intensities of shade. He is planning to conduct research, a) on the effect of clipping on recruitment of woody plants in the savanna woodlands (project approved by PON, but no manpower at this stage available), b) recruitment / spatial development of *Schinziophyton rautanenii*, c) nut yield of *S. rautanenii* in relation to tree growth. Mr Patrick Graz is a doctoral student of Prof. Klaus Klaus v. Gadow, **University of Göttingen**, Germany (see also Mitlöhner 1993).

Mr Dave Joubert (e-mail: djoubert@polytechnic.edu.na) is looking at various aspects of bush encroachment, including fruit production, seedling germination and survival in relation to various factors (including rainfall). He hopes to conduct a PhD study on the effects of bush encroachment, and different bush clearing strategies on various vertebrate groups (species composition, abundances and diversity), starting in 2003.

Messrs Dave Joubert, **Ibo Zimmermann**, **Peter Cunningham** and Patrick Graz have initiated a joint project looking at the aging of *Acacia mellifera* bushes. Messrs Peter Cunningham and

Patrick Graz would possibly be interested in the development of a series of PSPs. Their references, current interests and CVs can be viewed at the above mentioned website.

WWF/UNESCO "People and Plants Initiative"

Dr Tony Cunningham (e-mail: peopleplants@bigpond.com), currently based in Australia, left Namibia in 1992. Since then he has been working for a **programme** the WWF/UNESCO "People and Plants Initiative" (see the website www.rbgekew.org.uk/peopleplants for further information, and the two reviews of ethnobotanical information) **for southern, East and West Africa - which form an information resource for participants in the African Ethnobotany Network (AEN)** which was formed in 1997 in Harare, Zimbabwe. The other relevant contact is **Dr Hoft Robert** (e-mail: Robert.Hoft@unesco.unon.org), who co-ordinates things from the UNESCO side. Despite being a great success (e.g. 30 African MSc students trained through field related projects, several methods manuals produced), the African component of the programme is in short of funding. Look also for the methods manual on *Applied ethnobotany* by Cunningham, published by Earthscan in the UK. Dr Tony Cunningham has closed links with NBRI.

Forestwood cc

Dr Coert Geldenhuys (e-mail: cgelden@mweb.co.za) of Forestwood (Pretoria) would be interested in the following research topics, relevant to Namibian forestry development:

- a) **Woodland dynamics, in particular rates of recruitment, growth and mortality along an environmental gradient** - possibly a rainfall gradient from east to west and north to south, and the main woodland types, of which Mopane woodland would be one. The Makambu plots in the **Kavango Region** should be an integral part of such a proposal. The information is crucial for yield regulation for sustainable resource use - it is long-term and often considered as not essential.
- b) **Fire management and control in relation to regeneration requirements of key tree species.** The small plots may not be ideal for this kind of research, but a different, opportunistic approach focusing on key aspects of regeneration requirements would, perhaps, yield better results. The treatments should include some drastic ones to pull the extremes (endpoints of degree of impact) apart. That should help to see clearer the direction of positive or negative impact.
- c) **Probably the most crucial research for the future is in the field of integrated small business development in the rural area based on the wood and non-wood forest products, and the development of relevant commercialization models - from resource area, through product development to the market.** This is in line with the things in the Innovation Fund Project, Commercial Products from the Wild with its components of Bark for Medicinal Use, Roots, bulbs and herbs for Medicinal Use, Fibres for Crafts, and Fruits for Juices and Jams. That project in South Africa is now coming to an end, but a lot have been learn from it, and some good models for sustainable resource use have been developed, in addition to the development of alternative resources, product development, and development of institutional structures. It seems highly likely that the research team of Dr Geldenhuys will get some funding to develop a research and development network along these lines in southern Africa, and **Namibia** will be one of the participatory countries. The other project proposal has been submitted for the domestication of Marula from a southern Africa genetic base and cultivation approach, and **Namibia** should be part of it. In the fibre work there has been on *Hyphaene petersiana*, and a lot could be done with the

palms in the north-central **Namibia**. The critical issue is that while research focuses on specific products and product groups and their resource plants, the key will be in the successful integration of product development in different groups within a community to diversify benefits and spread the pressure on the natural resource, and to develop viable and productive alternative resources to sustain production without degrading the natural resource (when demands on the resources increase).

3.5 Recommendations

- Prof. Janusz Zwolinski (e-mail: zwolinskij@nu.ac.za) should be contacted for further information concerning the proposal *Developing management support for indigenous and plantation forests and agroforestry systems in South and East Africa*, and in order to acquire information on PSPs.
- Networking with South African partners should include the **University of Stellenbosch, Faculty of Forestry**.
- **The cooperation with CIFOR, as well as that to the Sudan, initiated by Dr H.O. Kojwang, the former Director of Forestry, should be followed-up.**
- The University of Joensuu and UNAM has agreed on student and staff exchange. The scholarship covers accommodation and food, no tuition fees are paid. The Faculty of Forestry and the Department of Biology of the University of Joensuu provide courses in English on Environmental Science and Forestry. For more information on Student Exchange, contact Ms Outi Savonlahti, Director of International Affairs (e-mail: outi.savonlahti@joensuu.fi), or the relevant person at UNAM. For information on environmental and forestry studies at the University of Joensuu look for the web-page www.joensuu.fi/students or contact Mr Markku Ropo (e-mail: markku.ropo@forest.joensuu.fi).
- **FAO should be contacted before any more PSPs are established.** This is essential in order to coordinate similar efforts in the region. On the other hand, **Namibia may offer partnership and testing ground to monitor on-farm and off-forest trees.**
- **Namibian forest inventory reports should be made available for FAO Global Forest Resources Assessment (GFRA) programme.** In the recent report of GFRA 2000 the Namibian forest inventory results were not fully utilized, and consequently the final report shows inaccurate forest cover data, including changes 1990-2000.
- **It is absolute a must that outdated - more than 5 years old – DOF contact information in the FAO database is updated as soon as possible!**
- **It is recommended to sign a Memorandum of Understanding Triparty (MOU) between DOF, MRCC and OAC.** MOU would formalize, and clarify the duties of collaborating parties. In general, most of the interviewed people preferred to have a written MOU rather than maintaining so-called gentlemen agreements.

- The cooperation between DOF and MRCC is strongly recommended, especially concerning the latest agreement between the European Union and 77 African, Caribbean and Pacific (ACP) countries. The overall allocation for Namibia within the 9th EDF amounts Euro 91 million for poverty alleviation, rural development and human resource development. Rural development extends well beyond agriculture and covers most, if not all the economic and social sectors, which have a bearing in rural areas (land management, rural livelihood, natural resources management). It would be crucial that DOF Research Division is well represented on August 2002 when priorities are set-up. **A concept paper on forestry and forest research should be submitted as soon as possible to the EU-delegation in Sanlam Building, Windhoek** (contact person: Ms Patrice Pillet, Agricultural Advisor). It would be important to make sure that DOF Research Division is listed for an important focal point for the delegations defining the priorities of the country.
- Similar preparations should be made in order to highlight the importance of forest research and capacity building concerning **GTZ** funds (20 million euros) for appropriate land management, as well as for the **World Bank/GEF funded Integrated Ecosystem Program through the National Conservancy Network**.
- DOF Research Division should closely **follow-up the Useful Plants Programme of NBRI** when streamlining the FAO funded project on *Domestication, Post-Harvest Handling and Marketing of Selected Fruit Trees*.

The production of **Trees and Shrubs book of NBRI should be supported**, if possible, by photographing specific rare tree species in the Caprivi Region. NFFP should have an active role in this specific task which may have low priority for NBRI but is essential for forestry development in Namibia (for further information contact Dr Gillian Maggs-Kölling, Chief Agricultural Researcher, e-mail: gmk@mweb.com.na).

The other relevant national stakeholders for DOF Research Division include:

- **National Planning Commission – Central Statistics Office**, DEA, MAWRD, National Library of Namibia, and National Archives. **Dr Phoebe Barnard from DEA** is the contact person on *Biodiversity and Development – Namibia's ten-year strategic plan of action for sustainable development through biodiversity conservation 2001-2010*. DOF is the leading organization of Forest Biodiversity Focal Group.
- Networking with the following NGOs is strongly recommended: Northern Namibia Forestry Committee, DAPP Tree Planting & Environment, Centre for Research Information Action in Africa (CRIAA, email: criaawhk@iafrica.com.na), Onankali Community Trust, and Desert Research Foundation of Namibia (DRFN).
- DOF Inventory and Mapping Section, and NRSC should support the production of **Environmental Profile for the Kavango Region** by providing inventory data and other relevant services to the Research and Information Services of Namibia (RAISON), contact Dr John Mendelsohn (e-mail: mendelso@iafrica.com.na).

4. RESEARCH PROJECTS

4.1 Mopane shrubland management

The process of designing the experiment on Mopane Shrubland Management started with Participatory Rural Appraisal (PRA) in the area around Outapi in 1994 (Gelens 1999). The trial was established next to the DAPP Tree Planting & Environment together with the local community nearby. The four treatments have been replicated 5 times and have been allocated at random to 20 square plots of 0.5 ha each. The following data collections have been conducted during the period of 7 years:

1995 Mr Martinus Gelens

June: baseline data collection

October: treatments, and measurement of standing stock after treatment

1996 Mr Martinus Gelens

June: data collection (no tree numbers in the field data sheets)

October: treatments

- 1997 Mr Andrew Jamieson**
 September?: data collection (data sheets 7-10, 14-15, 19-20 missing, Field data sheets have tree numbers)
 October: treatments
 Report was written on changes 1996-1997; see QuatroPro or Lotus files in the computer currently used by Ms Rusta Mungandjela
- 1998 Mr Andrew Jamieson and Ms Rusta Mungandjela**
 September: data collection (data sheets 1-6, 11-13, 16-18 missing, Field data sheets have tree numbers)
 October: treatments
 Note: there is some confusion between 1997 and 1998 data sheets due to the fact that the year of measurement is not indicated in data sheets
- 1999 Mr Vincent Louw and Mr Nicky Orub**
 July 12-16, treatments and data collection were done at the same time (Tree numbers attached to the trees were missing; data collection was carried out in all plots)
- 2000 Mr Vincent Louw and Mr Kebby Mutanikelwa**
 August/September: treatments and data collection were done at the same time (tree numbers attached on the trees were missing, the numbers were removed from plots no 2-20 and new numbers were attached to the trees; in other words **in 2000 a new numbering system was started**, and only plot no 1 was left with old numbers attached to the trees; tree number no 1 is always located next to the sub-plot centre, the direction from the sub-plot centre is indicated on the pole with a painted dot, the numbers can be found by moving counterclockwise)
- 2001 Mr Michael Aimanya and Mr Kebby Mutanikelwa**
 July: treatments and data collection were done at the same time (field data sheets have tree numbers)
- 2002 Dr Antti Erkkilä and Ms Helena Nangutuwala**
 March 25: field evaluation of plots no 17-20; corner poles, Poles indicating the centre of sub-plots, tree numbers attached on the trees as reported by Mr Vincent Louw; a recent problem is the bulls jumping over the fence to the trial area.

Mopane Shrubland Management trial in the Omusati Region is a unique effort to provide information for sustainable management. The number of beneficiaries would be about 0.5 million poverty-stricken people in northern Namibia. **Despite a few confusions in the data collection, the trial is well-maintained and allows scientifically sound analysis, and conclusions.**

4.2 Mopane chronosequential measurements on-farm

The research on Mopane Chronosequential Measurements On-farm was initiated by Gelens (1996d). The research consists of four farms where mopane has been managed since 1970s, and 1980s. The data collection was started in 1996. Mr Andrew Jamieson and Ms Rusta Mungandjela conducted data collection in 1998, and a draft report was written (look for a WordPerfect file on the computer used by Ms R.M.). Location map of the four farms would be with the original field data sheets handed over to Mr Andrew Jamieson. If needed, Mr Martinus Gelens would be able to help in locating the farms (Gelens, pers. comm., 2002).

4.3 Australian tree species and provenance trials

The idea of Australian tree species trials dates back to 1992, when His Excellency, President Sam Nujoma approached the Australian Government for assistance to assess the potential use of Australian woody species in northern Namibia. In response, the Australian International Development Assistance Bureau (AIDAB) contracted CSIRO Division of Forestry through the Australian Tree Seed Centre to conduct an advisory visit to Namibia, see Gunn B.V. 1993. *Report to AIDAB on technical advisory visit to Namibia: 23 March to 5 April 1993*. A further advisory visit based on the project proposal by the DOF was undertaken between the 13 August and 13 September 1994, see Gunn B.V. 1994. *Report to AIDAB on technical support provided to Namibia's forestry sector*. During the visit, as part of a nursery training course held at Grootfontein for the forestry staff, seed for the trials at Ogongo, Okashana, and Hamoye were sown in the Grootfontein nursery. Mr Adam Harrison and Dr Charlotte Flower (ODA project) were in-charge of the initial trial preparations until mid-October 1994, when the responsibilities were handed over to Mr Antti Erkkilä (FINNIDA project).

The objectives of the trials were to:

- 1) test suitable Australian tree species and provenances for firewood and pole production,
- 2) establish demonstration plots for extension work,
- 3) train Namibian forestry officials and students in trial design and establishment.

Three trial areas were selected using the following criteria:

- 1) growing conditions fairly representative to meet specific objectives in the northern part of Namibia,
- 2) trial area easy to access, monitor, and supervise.

A total of 48 different species and seedlots were included in the three trials. In addition, the buffer zones included 18 species and provenances, not represented in the replicated trials. **In the replicated trials**, Australian origin seed represented 40 seedlots, one seedlot was from India, one from Zimbabwe, and the rest were local provenances – four indigenous tree species were included. **In the buffer zones**, 26 different species and provenances were planted, 9 of them indigenous species. Species and provenances from Australia and Zimbabwe were selected by Mr Brian Gunn from the Australian Tree Seed Centre - those species and provenances have specific CSIRO seedlot numbers. The consignment note and seed certificate from the Australian Tree Seed Centre gives information on number of parent trees, their origin - name of locality, latitude, longitude and altitude, viable seeds per 10 g and pre-treatment required.

Due to the administrative confusions, the supervision of seedling production in the Grootfontein Forestry nursery had to be partly organized from the Head Office. Obviously, it was impossible to the officer placed in Windhoek to follow-up, and give instructions for daily nursery activities in Grootfontein. The **pricking out** of *Casuarina* and *Eucalyptus* seedlings took an unacceptably long time. Also, many other basic nursery operations were not carried out in time. A special supervision from Windhoek was needed in several operations, e.g. removing empty pots, grading of seedlings, transferring young seedlings from heavy shading and hardening off. The confusion in decision making processes and responsibilities at the Grootfontein Forestry Office had its influence on the work performance at the nursery, and consequently to this particular research. In addition, the potting soil in Grootfontein was unfertile sandy soil which had **poor water holding capacity**. This type of growing medium does not enhance growth of seedlings, and loose sand cannot form a solid earth ball around the roots of the seedlings to endure transportation and successful planting results. It should be noted that the highly **alkaline irrigation water** had negative effects to the early development of seedlings. Nevertheless, the inoculation of *Acacia* and *Casuarina* seedlings was done according to the instructions given by the Australian Tree Seed Centre. *Acacia* seedlings were treated with *Rhizobium* peat inoculum. The *Frankia* inoculum for *Casuarina* seedlings was provided by Dr Paul Reddell, CSIRO Division of Soils.

In Ogongo and Okashana Messrs Antti Erkkilä and Martinus Gelens (ODA project) organized pegging, and supervised tree planting. In Hamoye site preparation, planting and supervision was organized by Mr Ulrich Mittring (GTZ). It was soon realized that there was not enough time and resources to supervise the trial establishment in Hamoye, and therefore Mr Erkkilä visited Hamoye only 3 times; consequently the trial establishment and tree planting in Hamoye was not as ideal as in Ogongo and Okashana.

Since the transport of seedlings proved to be a major problem, it was decided that seedlings will be moved to Ogongo as soon as they are big enough and when the transport would be available. The transportation took place 3.1.1995. At that time the nursery worker in-charge was on leave and he was replaced by a worker from the kitchen – this person was not trained to carry out nursery activities. Consequently, the watering of seedlings was irregular and the seedlings were even in danger of drying. This was especially due to the small pot size, and potting soil, which had poor water holding capacity. Luckily, Mr Rob Morgan (VSO), lecturer at the college, volunteered watering the seedlings during the weekends and in general, kept an eye on the nursery operations.

All forestry students in Ogongo were on holiday during the critical period of the trial establishment. In addition, there was some confusion among the staff about the amount of student involvement in the trial establishment. As a consequence, after planting seedlings in Ogongo and Okashana, students refused to work any more in these trials, e.g. beating up, weeding and inventories. Later, 22.1.1995 in Ogongo goats were allowed to enter into the nursery causing a severe damage. Nevertheless, the trial was redesigned and new seedlings were transported from Onankali (1.2.1995) and from Grootfontein (3.2.1995). Transport of seedlings to the trial areas proved to be time consuming and complicated exercise, e.g. Mr Antti Erkkilä organised 3.2.1995 the transport of seedlings from Grootfontein to Hamoye, due to the fact that the Grootfontein Forestry Office did not have forestry staff available to guide the truck.

The trial designs were as follow:

Ogongo: 6 replications, 5 seedlings in row per replication, 24 seedlots, spacing 3.5 m x 3.5 m, total number of seedlings 720; total number of seedlings in the buffer zone 272;

Okashana: 6 replications, 5 seedlings in row per replication, 19 seedlots, spacing 3.0 m x 3.0 m, total number of seedlings 567; total number of seedlings in the buffer zone 117;

Hamoye: 5 replications, 10 seedlings in two parallel rows per replication, 13 seedlots, spacing 4.0 m x 4.0 m, total number of seedlings 700.

In Ogongo seedlings were planted 10.2.1995, in Okashana 15.2.1995, and in Hamoye 8-12.2.1995. **In Ogongo and Okashana seedlings were watered just before planting, and no watering was conducted thereafter.** The date of planting was ideal, due to the fairly good rainfall on the day following the tree planting, in Ogongo 110 mm and in Okashana 20 mm. In Okashana some seedlings were planted too shallow. As a consequence, after the first rainfall root collars of seedlings were exposed. In sandy soil plants should be rather planted more deep than shallow. The pitting should be done before the rains; the pits must be filled before planting by spreading the original topsoil to the bottom of the hole, and then the rest of soil on the top.

In Ogongo and Okashana the height of the seedlings were measured twice in 1995, and twice in 1996, and in Hamoye once in 1995. The initial results after 2-3 months of planting were promising, especially from Ogongo and Okashana; the survival after beating up varied 80-90 % and most seedlings were growing rapidly - the highest *Eucalyptus* was 1 m. The survival and initial growth performance of *Casuarina* seedlings was fairly poor. This could be expected, since the seedlings were small and root collar quite thin at the time of planting. Some *Eucalyptus* had been attacked by termites in Okashana.

The successful trial establishment in Ogongo and Okashana proved that tree planting without watering is possible even in harsh environmental conditions of northern Namibia. In that sense the trial was unique in the history of tree planting in Namibia.

Trials were evaluated in July 1995 by Mr Brain Gunn and Dr Bernice Lee (Australian Agency for International Development). The successful trial establishment convinced the evaluation team, and consequently the Government of Australia decided to support the Namibian forestry development even further, including providing scholarships for university studies in Australia.

The planning, trial establishment and supervision from 20.10.1994 to 1.6.1995 required traveling of a total of 19 650 km (Mr Antti Erkkilä only). The total time spent outside Windhoek Head Office for this particular purpose was 39 days 3 hours and 20 minutes.

There is no accurate information available of the cost of the establishment of the trials, except **Okashana, where the cost of clearing and fencing, labour and material included, was about N\$ 12 000** (in 1995). For more detailed information on this research, see *Tree species and provenance trials in northern Namibia: Australian tree species suitable for firewood and pole production* (Erkkilä 1995). The audiovisual documentation include 24 transparencies, *Tree species trials in stages - Ogongo Agricultural College and Okashana Training Centre* (Erkkilä 1996e), available at DOF and with OAC.

The Australian tree species and provenance trial in **Okashana** was visited and measured 23.3.2002 by Dr Antti Erkkilä and Ms Helena Nangutuwala. Apparently the trial was abandoned in 1997; in

1999 the fence around the trial area was not good enough to keep the cattle outside. During the visit several calves were grazing in the fenced trial area, a recently initiated practice. In general, the Okashana personnel had an impression that DOF is not anymore interested on the use of trial area (Mr Naftal Nakashwa, pers. comm., 2002, e-mail: nesokashn@iwav.na). The only tree species which a high survival rate in the replicated trial are *Terminalia prunioides* (height c. 0.1-1.4 m), and *Boscia albitrunca* (height c. 0.1-0.9 m). In the buffer zone the survival rate is 70% for *Sclerocarya birrea* (marula), and the average height is 0.5 m. In general, nearly all seedlings of *S. birrea* are healthy, and well-established, however, a few seedlings have been damaged by trampling cattle. It is interesting to compare marula seedlings planted at same time in the Okashana trial area, and near the *Eucalyptus* plantation in Onankali. Seedlings in Onankali are dying despite intensive watering after planting but seedlings in Okashana are healthy (no watering after planting). In Okashana, in the buffer zone only 2 *Colophospermum mopane* seedlings out of 19 planted seedlings are surviving.

The Australian tree species and provenance trial in **Ogongo** was visited 25.3.2002 by Dr Antti Erkkilä and Ms Helena Nangutuwala. Apparently the trial was abandoned in 1997. However, the trial area is still well fenced, and 1.3 m droppers are clearly visible. The trial area is covered by grass cover of 1.5 m. Apparently no weeding has been done since 1996 – it is well known fact that *Eucalyptus* seedlings are highly sensitive to grass competition. It is assumed that the poor maintenance has significantly influenced to the tree growth in trial. The scattered trees still growing in the trial area include *Eucalyptus camaldulensis*, *Acacia salicina*, *A. victoriae*, *Azadirachta indica*, and *Terminalia sericea*.

The Australian tree species trial includes a replicated experiment in **Onankali**, behind the nursery run by the Onankali Community Trust. The trial consists of 12 seedlots, *Casuarina* spp., *Eucalyptus* spp., *Acacia* spp. of Australian origin, and *Acacia erioloba* (indigenous). Seedlings were planted 17.1.1996, and measurements were conducted at least 21.8.1996. Planting, watering, weeding and fencing, and maintenance was contracted (by DOF) to Onakali Project (NGO supported by the Africa Group of Sweden), and supervised by Mr Erik Jessen, a qualified forester with long-term experience on tree planting in arid zones. Since the beginning of the establishment phase, the trial has been well maintained, and no domestic animals have entered to the trial area.

In the last growing season (2001) the whole trial area was ploughed by the local DOF Forest Guard, Mr Peter Shilombwelwa, in order to establish an agroforestry demonstration plot; beans and other crops, but no millet, were sown between the tree rows. The weed (*omwiidi* in Oshiwambo, *Cynodon* sp.?) appeared to be difficult to eradicate in the far end of the trial area (replications no 5-6), and therefore only the first replications (no 1-4) were ploughed in 2002; beans, pumpkins, water melon, and maize were sown. In the ploughed area the rain water penetration was improved, and the weed competition avoided. It would be optimal if these kinds of treatments were conducted for all the replications (no 1-6). According to Shilombwelwa trees in the first replications (no 1-4) grow faster also due to better soil fertility and moisture conditions, compared to the far end of the trial (replications no 5-6).

At the time of the visit (26.3.2002) by Dr Antti Erkkilä and Ms Helena Nangutuwala there were no droppers remained in the trial area. The data collection team, kindly assisted with regional and local DOF staff, placed a dropper in the beginning of each row, a total of $6 \times 12 = 72$ droppers were erected. Thereafter the remaining trees were measured.

The research result is a breakthrough in the history of trial establishment in Namibia, namely *Eucalyptus camaldulensis* seedlot 17297 proved to have an excellent growth, and stem quality in all six the replications. The locality is Mt Benstead Ck (NT), Lat 23 deg 34 min, Long 134 deg 21 min, altitude 500 m. **The average height of the trees is 8.2 metres in 6 years**, in other words the average annual increment has been 1.4 m, survival rate was 66%, and maximum height 11.9 m.

It should be noted that other seed sources (Petford, Katherine, De Gray), which have repeatedly ranked in the top few in tropical seasonally dry environments similar to northern Namibia, **may still provide greater growth performance**, as shown by Darrow (1983), for example. The result that 17297 Mt Benstead Ck in the Northern Territory has done the best may reflect the fact that this provenance more closely matches the environment at Onankali, elevation over 1000 m, compared with the other more tropical provenances of *E. camaldulensis*. Nevertheless, this may be the first time that a central Australian provenance of *E. camaldulensis* has been the best performer. These provenances are generally slow growers compared with more tropical provenances like Petford, De Gray and Katherine. At Chesa in NW Zimbabwe Petford, Katherine and De Gray provenances do the best achieving 2 m growth/ year, a rate that could be achieved at Onankali especially if there is subterranean water which the trees could tap into (Gunn, pers. comm., 2002).

4.4 Trial on propagation of *Pterocarpus angolensis* via truncheons

Trial on propagation of *Pterocarpus angolensis* via truncheons has recently been initiated in the Hamoye Forest Research Station. The establishment of *Pterocarpus angolensis* using cuttings and truncheons was tried in Hamoye already in 1960s (Esterhuyse, pers. comm., 1996), and in Kanovlei in 1990s (Erkkilä, pers. obs., 1994). **The consultant is sure that though *Pterocarpus angolensis* truncheons will shoot, rooting does not take place.** It is known that recently cut logs may shoot even when lying horizontally on the ground, for further information see *A monograph on Pterocarpus angolensis* (Vermeulen 1990), and Erkkilä and Siiskonen (1992, p. 128).

4.5 Recommendations

Mopane shrubland management

- **It is highly recommended to complete the report on Mopane shrubland management as soon as possible.** Since Mr Martinus Gelens, currently working at the Forest Science Division of International Institute for Geo-information Science and Earth Observation (ITC) (e-mail: gelens@itc.nl), was in-charge of trial design and data collection in the two first years, he should be the first author. The other authors should be the persons who have paid a major contribution to various stages of the research. **Mr Celestinus Ndongi (e-mail: treeplan@osh.namb.com) should be invited to provide input on the community involvement in this particular research. Mr Gelens would be in a position to help in data analysis, if needed.**
- The data collection should continue according to the numbering system created in 2000. The trees (or group of shrubs) which have been previously omitted or are newly regenerated shoots should be labeled as A, B, C, D.... **It is essential to indicate in each data sheet the date, month and year of data collection, as well as the person in-charge, and the other members of the team.** The DAPP personnel and community members should be interviewed. The person in-charge of data collection should make observations and recommendations, and produce a written (short) report, and sign it.
- **The fence surrounding the trial should be repaired, and the cattle moved out of the trial area - as soon as possible.** DAPP Tree Planting & Environment would require the necessary funds from DOF budget, as agreed between the two parties. The transfer mechanism of funds to DAPP Tree Planting & Environment should be improved.

Mopane chronosequential measurements on-farm

- During this consultancy it was not possible to track down the data sheets; neither there was any time to evaluate the field experiments. However, it is assumed that the field data sheets can be found, and that the data collection should continue. **The report should be written and results published.**

Australian tree species and provenance trials in Okashana

- *Sclerocarya birrea* (marula) seedlings in the NE side of the trial area - the buffer zone is one row of seedlings only - should be protected, and looked after. Otherwise, **the site should be used for a new experiment.**
- **All introduced tree species in the trial area should be destroyed (rf. Working Group on Alien Invasive Species).**
- Research and development concerning the production of *Hyphaena petersina* (makalani palm) should interest various partners; possible stakeholders are the Okashana Research and Training Centre, and the Ombuga Grassland Planting pre-feasibility project. **The possible new research initiative could test different provenances for basket industry.** Different regeneration methods could be incorporated as well. The spacing of 2 m x 2 m is recommended in the leaflet *Ilala: a guide to the cultivation and harvesting of the ilala palm*, compiled by Jane Lee.

Australian tree species and provenance trials in Ogongo

- It was orally agreed with Mr Osman Hamid, Technical Adviser and Head of Forestry Department of OAC, and Dr Antti Erkkilä that **Ogongo students will be used to measure the remaining trees in the Ogongo trial area** - as soon as possible. It should be made sure that the enumeration includes all planted seedlings; some of them may be only 0.1 m in height. Printed and electronic field data sheets were given to Mr Hamid in order to facilitate the data collection.
- **After the data collection is completed, all introduced tree species should be destroyed in the trial area (rf. Working Group on Alien Invasive Species).**
- **The trial area in Ogongo should be handed over to the OAC**, as agreed in the research contract signed 23.11.1994. However, the site is well suitable for new experiments, and especially for practical training of forestry students.

Australian tree species and provenance trials in Onankali

- The DOF and Ogongo staff and students, and a relevant delegation from Australia should be invited to the trial site, before a new experiment is started. **Thereafter all introduced tree species should be destroyed in the trial area (rf. Working Group on Alien Invasive Species).**
- It also suggest that a seed production area of one ha be established of *Eucalyptus camaldulensis* 17297 to meet anticipated future seed requirements for the country; initial spacing of 2.7 x 2.7 m with the ultimate aim to thin down to about 150 stems (Gunn, pers. comm., 2002).

Australian tree species and provenance trials: Ogongo-Okashana-Hamoye-Onakali – final report

- **It is highly recommended to compile a final report on Australian Tree Species and Provenance Trials.** Dr Antti Erkkilä (e-mail: antti.erkkila@forest.ioensuu.fi) would be available for this particular task, if needed – the estimated time to complete the final report is 7 days.
- Since Dr Antti Erkkilä was in-charge of trial design, seedling production, transport of seedlings, tree planting, and data collection, he should be the first author of the **published** report. The second author should be Mr Brian Gunn (e-mail: Brian.Gunn@csiro.au), and the third possible author could be Ms Helena Nangutuwala.
- **The relevant governmental office in Australia, and consequently also the Australian Tree Seed Centre should be contacted for improved *Eucalyptus camaldulensis* seedlot 17297.** The trial area in Okashana should be planted with seedlot 17297; spacing should be 5 m x 5 m, seedlings should be watered after planting depending on weather conditions. A row of *Hyphaena petersiana* should be planted along to fence, spacing 2 m x 2 m, to provide raw material for basket home industry. The experiment should test different combinations of agricultural crops. The site is suitable for beans but not yet for millet production (Shilombwelwa, pers. comm., 2002). The intensive soil preparation, weeding and growing nitrogen fixing legumes among the *Eucalyptus* trees would enhance the soil fertility, and improve the moisture condition through improved water penetration. **It is envisaged that the improved seed of *Eucalyptus camaldulensis* seedlot 17297 would allow coppice forestry and production of poles in 5 year rotation.** Seedling production and other work should be contracted to Onankali Community Trust. **Gradually, the unproductive Onankali *Eucalyptus* plantation would be changed to a highly productive Onankali Model Agro-Forest run by the local NGO.** There is a great possibility to get donor funding through GEF (contact NACSO on conservancies), EU-ACP (issues such as land management, research and training), GTZ (land management, integrated farming), EU-Budget-line for Tropical Forest, or Australian Government. The feasibility of the above-mentioned ideas should be discussed with relevant partners, including the Onankali Community Trust, Namibia Desert Foundation, and OAC. (Note: Research on *Terminalia sericea*, an indigenous fast growing tree species, should not be neglected).
- The following web page may have some relevant information in relation to farm forestry on low rainfall areas as well as possibly some technical information in relation to salinity, www.ifp.csiro.au.

Trial on propagation of *Pterocarpus angolensis* via truncheons

- Instead of planting truncheons the following experiment is recommended. **Stump heights 30 cm, 0 cm, -30 cm:** Fell *Pterocarpus angolensis* tree as usually, i.e. stump height 30 cm (control), fell at the ground level (treatment 1), fell 30 cm **below-ground** (treatment 2). **Felling season:** June/July (early dry season), October/November (late dry season, immediately prior the first rains), February/March (wet season). Measure the felled trees, and later any possible shooting. The stump of treatment no 2 (cutting below-ground) should be covered by soil (Kalahari sand) dug out around the stem. The assumption is that the stump covered by soil protects the sensitive dormant bud, and

shoot base against destructive ground fires. **If the treatment no 2 proves to be a successful regeneration method, the result is breakthrough in southern African forestry development.**

- **The above-mentioned research idea is based on indigenous technical knowledge.** In 1960s the local headmen in the area east of Eenhana in the Ohangwena Region were strongly against any logging operation (Pönninghaus, pers. com., 1996). It was believed that the punishment by God would follow the wasting of precious water resources, namely the sap pumping up from the recently cut stump of *Pterocarpus angolensis*. The logging operators were advised to limit the tree felling period for 4 winter months when the tree is still dormant, and to use the treatment no 2 instead of cutting trees above-ground.
- **The research proposal should be written and exposed to the international scientific community.**

5. SOURCES FOR FUTURE RESEARCH

5.1 Documents produced by A. Erkkilä

The book *Forestry in Namibia 1850-1990* written by Erkkilä and Siiskonen (1992) provides comprehensive information on Namibian forestry. However, the book does not describe all forestry activities, especially those ones carried out in 1960s and 1970s. This is due to the fact that the authors did not have access to the forestry files stored in the Grootfontein Forestry Office, neither to the files of private enterprises involved in forestry sector, e.g. Tsumeb Corporation Ltd. and Loxton, Venn & Associates. It is also important to note that the above-mentioned study was the first effort to describe forestry and related activities within the period of 150 years. However, only 11 months were allocated to complete the study. **The old forestry files dating back to 1950s, written in Afrikaans and in English, show that the forestry activities carried out in 1960s and 1970s were more intensive and systematic than reported by Erkkilä and Siiskonen (1992).** The other useful documents relevant to forestry development and forest research in Namibia are *Report on visit to Stellenbosch and Cape Town, South Africa 29.1.-2.2.1996* (Erkkilä 1996a), and *Report on visit to Pretoria, Belfast and Johannesburg, South Africa 24-29.6 and 11-16.7.1996* (Erkkilä 1996b) and *Transfer of the old forestry files to the National Archives of Namibia* (Erkkilä 1996c). *Pre-feasibility study on a commercial plantation project in eastern Caprivi* (Erkkilä & al. 1994) is a source document on tree planting in general, and commercial plantation forestry and trial establishment in special. This report includes (appendix 12/3) information on *Eucalyptus* spp. trial established in 1975, in a site 5 km from the Katima Mulilo Forestry Office towards Kongola – this is the only source of information available in Namibia concerning this particular trial.

The recently published interdisciplinary study *Living on the land: change in forest cover in north-central Namibia 1943-1996* (Erkkilä 2001) deals with issues such as agroforestry, deforestation, farming systems, human population, remote sensing and domestic use of wood in constructions on farms located in the communal areas of the Omusati, Oshana, Oshikoto and Ohangwena Regions. The unique set of aerial photographs from 1996, 1992, 1970 and 1943 (available through the Directorate of Surveys and Mapping) and satellite images from 1996, 1992 and 1981, amplified by ground truth data gathered in 1996, were used to monitor and analyze expansion of the settled area and its effects on forest cover in the Ondobe and Eenhana constituencies of the Ohangwena Region. The results indicate that deforestation was caused almost entirely by clearing of land for permanent agriculture. The clay-rich sandy soils on the lower part of uplands were occupied first; whereas the slightly more elevated, but less fertile, sandy sites have been occupied later. It was estimated that a population increase of one person led to about 1 ha of deforestation. The basic layout of a farm and the architecture of a household dwelling have remained about the same throughout the period 1943-1996. The quantity of indigenous wood in constructions of a typical farm represented an over-bark removal of about 45 tons, and the annual fellings for maintenance were 0.5 tons per capita. The annual consumption of indigenous wood in the whole Owambo area was estimated to be 600 000 tons, which is lower than the sustained yield. **The forest cover has changed towards on-farm tree cover, and the species composition in the agricultural fields has gradually changed towards trees producing edible fruits. The frequent change of homestead site has been an important factor in creating the characteristic agroforestry landscape of the Owambo area.**

5.2 Documents produced P.J. le Roux

Report on visit to the forestry areas in northern Namibia from 28 July to 8 August 1996 written by Mr P.J. le Roux, forester in-charge in Namibia from 1957 to 1961 and from 1969 to 1973, is an excellent source for information on past forestry activities, including research, in Namibia. **The report is highly recommended** – it contains relevant information, guidelines and recommendations concerning nurseries, tree planting, and growth of indigenous species, charcoal production, burning trials, dune stabilization, forest policies, and photographs taken by Mr Antti Erkkilä during the field visit in 1996. **According to le Roux the indiscriminate felling of trees during last 80 years has contributed to bush encroachment in Namibia.** The same issue has been highlighted by Erkkilä and Siiskonen (1992), and by Kojwang and Erkkilä (1996). Surprisingly, in other studies extensive tree felling is not recognized as a significant contributing factor to bush encroachment, neither the issue was mentioned in the Research Workshop held 12-13.3.2002 in Windhoek. The unpublished document written in Afrikaans by P.J. le Roux (1971) *Memorandum regarding the control over, and the felling of, indigenous trees on private farms in South-West Africa* (cited in Le Roux 1996) gives indication of the number of trees felled for mining timber for the mines at Abanab and Tsumeb from 1910 to 1970. In addition, initially the mines also used indigenous timber for fuelwood for their boilers. It is estimated that 4-5 million tamboti (*Spirostachys africana*) and other indigenous trees were felled before 1970 – virtually all suitable sized trees in the vicinity of Abenab and Tsumeb. Apparently, the felled trees were replaced by the so-called invader species. According to Le Roux (1996) research conducted decades ago indicated that there was no economical way to control or eradicate the invader species mechanically or chemically. The question arises whether any real progress has been made regarding this problem over the past 50 years? In 1996 Mr P.J. le Roux visited Namibia after absence of 23 years, and made a **considerable proposal on biological control of encroaching species** (see Le Roux, pp. 9-10).

The above-mentioned report by Le Roux (1996) contains observations and recommendations made by Messrs le Roux and Erkkilä (5.8.1996) concerning tree fellings in Onuno *Eucalyptus* plantation of the Ohangwena Region. It was recommended to fell trees and coppice shoots with a bow saw while the cut should be made at the slight angle, and not perpendicular to the stem, and NOT with axes, which badly mutilate the stem, and reduces the coppicing vigor. This recommendation was repeated by Dr Antti Erkkilä to Mr Simeon Hengari, Acting Chief Forester in Rundu (22.3.2002) – since, according to Mr Hengari, *Eucalyptus* trees are felled in the Kavango Region by axe, and consequently the coppicing is unsatisfactory.

The consultancy of Mr P.J. le Roux included presentation and discussion on Namibian *Forestry: Past, Present and Future*. The following staff members of DOF were present: H.O. Kojwang, Moses Chakanga, Stephen Muhuli, Uekemumuna, I. Jamieson, W. Piepmeyer, P. Thekwame, E. Ndaudonya, Nd. Kanime, and T. Mufeti. The presentation was recorded by a personal video camera (SuperVHS). After returning back to Finland in 1997, Mr Erkkilä provided a courtesy copy (VHS) of the recording to Dr H.O. Kojwang, Director of Forestry, DOF. The other personal video production includes dune stabilization activities in Walvis Bay.

5.3 Report on old tree species trials by E.H. Kreike

An inventory of trials with exotic tree species in northern Namibia, with special reference to provenance trials with Eucalyptus spp (Kreike 1992) is a good source for introduced tree species planted in northern Namibia. This document should be utilized in the plantation inventories in

order to find out the performance of different species and provenances. However, **the information to be gained for the future forest development is questionable** due to the various reasons: a) in any future *Eucalyptus* plantations only improved seed should be utilized, it is NOT recommended to use local seed due to the risk of inbreeding, and in general, due to the poor seed quality; in the last 30 years research has produced an excessive amount of research information on suitable *Eucalyptus* provenances for various growing conditions, b) **the spacing of planted *Eucalyptus* seedling was too close**, e.g. 2.7 m x 2.7 m; when the canopy is closed, trees do not any more react to thinning; **spacing should be 4 m x 4 m or 5 m x 5 m**, c) trials have been neglected long time ago. A **“good” example of unproductive land use is the *Eucalyptus* plantation in Onankali** – it gives a bad image of forestry potential in northern Namibia (the site was visited in 26.3.2002). The current function of the Onankali plantation is to serve as a windbreak and shelter to the communities nearby, and to produce a few poles to be sold, and to certain extent grass for cattle. In addition to Kreike (1992) an excellent source on past tree planting in northern Namibia is the above-mentioned document by Le Roux (1996).

5.4 Audiovisual material on past forestry activities

In 1996 Mr C.J. (Neels) Esterhuysen, Director: Forestry Support Services, the Department of Forestry and Water Affairs in Pretoria, kindly handed over to Mr Erkkilä **unique 8 mm films recorded by Mr P.J. le Roux concerning forestry activities in the late 1950s and 1960s in Namibia** – the films were developed but nobody had seen them ever before. These films were transferred to VHS in Pretoria. In 31.7.1996 a short introductory on past forestry activities, presented by Mr P.J. le Roux, was filmed in the Farm Jägerquelle in the District of Grootfontein (the owner of the farm in 1960s was Major Hubble, in 1996 Mr Joos van Zyl). This introductory was added at the beginning of the old documentary films produced by Mr P.J. le Roux in the 1950s and 1960s. This particular site near Grootfontein was selected for filming since during the early 1960s the diameter increment of the indigenous species was measured (see Overview on sample plots 1959-1990 in this report). The experimental site (numbered trees) could not be found during the 1996 visit, but **the available growth data is presented in the appendix 4 of the report by Le Roux 1996**. The filming for the video documentary was done by Mr Andy Botelle, Mokobo Video and Research, Windhoek. The original 8 mm film material and VHS copies were handed over to the National Archives of Namibia. The VHS copies were provided to DOF and the Embassy of Finland, Windhoek.

5.5 Old forestry files 1950-1990

In 1996 the old forestry files in Grootfontein were transferred to the National Archives of Namibia. Messrs A. Erkkilä, Forest Data and Information Specialist (1994-1996), and P.J. le Roux sorted files in Windhoek. More than 150 files with **potential importance for current forestry development in Namibia** were indicated with yellow papers with remarks by Mr P.J. le Roux, including:

- a) *Brandbestrydingsplan vir die Okavango bosse, Boomsoort proef – Okatana,*
- b) *Forest policy 1957,* c) *Germination trials Pterocarpus angolensis,*
- d) *Bosbou-vorderingsverlae Walvisbaai,* e) *Makambo – perseel,*
- f) *Colophospermum mopane,* g) *Brandbestrydings beplanning Ovamboland,*
- h) *Minerale Bestanddele van enkele inheemse bome en struike van S.W.A.,*

- i) *A list of charcoal producing farmers in Grootfontein, Tsumeb, Otavi, Otjiwarongo, and Outjo Districts,*
- j) *Survey data Kavango, pitsawing Kavango and Ovambo,*
- k) *Felling of indigenous trees and sale of firewood, permits and applications,*
- l) *Agriculture forestry permits to cut trees,*
- m) *Forestry permits to cut the wildpalm Makalani,*
- n) *Forestry permits to cut Albizia anthelmintica.*

The transferred files contained also contact-prints of 1964 aerial photographs. These photographs have a photo scale of 1 : 75 000, and they were used for mapping vegetation in a forestry inventory project in northern Namibia. The photography of 1964 has a poor visual quality and they were therefore not used by Erkkilä (2001) for monitoring changes in forest cover in the Ohangwena Region.

Some of the old forestry files were copied to be used at the DOF. A general source for information on past forestry activities in Namibia would be the annual forestry reports available in the Central Archives Depot, Pretoria and in the National Archives of Namibia, Windhoek.

The old forestry files, available now in the National Archives of Namibia, contain for example following important information (see Erkkilä 1996c):

a) Forest fires, fire protection, forest fire policy, maps indicating firebreaks

The old maps on firebreaks would be useful reference for current forestry activities in Kavango (Mr Simeon Hengari, Acting Chief Forester in Rundu, pers. comm., 22.3.2002). The following documents are attached to the report by Le Roux (1996):

- a1) Forest Policy: Development. Letter dated 24.4.1957.
- a2) Memorandum: Protection of Extensive Savannah South of the Okavango River. Aug. 1957. De Villiers P.C.
- a3) Fire Protection Plan for the Indigenous Forests of Kavango and Bushmanland. 1967/68. Notley H.M.
- a4) Letter: Fire Prevention in the Okavango. Notley H.M.
- a5) Forestry Development in Kavango. Unsigned c. 1967.

In 1960s firebreaks were cleared over large distances, firebelts were burnt and early burning was practiced. For example about 500 km of firebelts were cleared in the Kavango Region and in the former Bushmanland. Mr Willem de Villier worked 4.5 years as Forester in Rundu during the period 1961-1965. His main responsibility was fire protection and road construction for the same purpose. Other foresters working in Rundu include Mr H.L. du Plessis, Mr Smidt and Mr van Rhyn.

b) Previous harvesting and concessions

This information is very relevant for environmental monitoring.

c) Introduced and indigenous tree species: germination, growth and distribution

This information is a useful reference for current distribution of introduced species (see the poster *Namibia's nasty nine: alien invasive species* released 20.3.2002 by the Working Group on Alien Invasive Species, Namibia National Biodiversity Programme, composed by Carol Steenkamp and Pierré Smit, and funded by the German Ministry for Economic Co-operation (BMZ) through GTZ).

For example, next to the *Eucalyptus* provenance trial in Onuno, established in the 1970s, in the Ohangwena Region, a few *Prosopis* sp. were planted. *The Prosopis juliflora – Prosopis pallida complex: a monograph* (Pasicznik 2001), available from Dr Vesa Kaarakka, is an excellent source to this important source of fuel and other raw material, but disliked by many people as invasive, thorny weeds. Erkkilä (1996b) refers to a research project carried out at the National Botanical Institute of South Africa on sterilization of trees, including *Prosopis*. In contrast to views depicting *Prosopis* as a weed, *Prosopis* provides up to 70% of the firewood needs of rural populations in dry regions in India, being promoted as a useful and productive species for arid zone. The poorest farmers seems to acknowledge these trees for their benefits, but more wealthy people hate *Prosopis* as a nuisance, and a threat to the biodiversity conservation, and apparently also because of presence of long thorns and allergic pollen (see also Erkkilä and Siiskonen 1992, pp. 103-104). *Opuntia* sp. is also presented in the above-mentioned poster as one of the nasty nine invasive species. However, *Opuntia ficus-indica* (prickly-pear) could be utilized in arid areas for food, fodder and for breeding cochineal insects, *Dactylopius coccus* to produce carmic acid – a red dye. This declared problem species could turn to be a very useful, even cultivated species in Namibia.

d) Cutting permits in general, commercial farming area in especially

The old forestry files contain information in which farms (see the map showing commercial farms and their numbers) extensive cuttings were conducted during the past decades. **The assumption to be tested is whether the bush encroachment is more severe in the farms where destructive cuttings were conducted compared to farms where cuttings were more moderate.** The research would require ground surveys and the analysis of recent remote sensing data. Nevertheless, the subjective observation between Otavi and Tsumeb indicates that the slopes of the mountains (the dominant species is *Kirkia acuminata*) are fairly free of bush encroachment – in the past tree felling was not allowed in the slopes whereas on the plains the excessive cutting permits were given against recommendations made by P.J. Roux, the forester in-charge 1957-1960, and 1969-1973 (P.J. le Roux, pers. comm., 1996). CSIR in Pretoria has been involved in the bush utilization project carried out in Namibia during mid-1980s.

e) Dune stabilization in Walvis Bay

The dune stabilization in Walvis is vital to the national economy of Namibia. If the dune stabilization is stopped it is a matter of time before the lagoon could be filled with sand with all the

negative consequences regarding tourism, flamingos and other water birds, fish breeding areas and sand that deposits near the harbour, and **ultimately could threaten the present use of the Walvis Bay harbour - the economic lifeline of the country** (see Le Roux 1996).

e) Previous forest inventories

The old forestry files at the National Archives contain information on forestry inventories carried out in 1970s and 1980s in the northern part of Namibia. The old forest cover maps were transferred from South Africa to DOF in 1994, and are currently stored in the forest inventory laboratory at DOF (Mr Moses Chakanga, pers. comm., 2002). In 1996 the field data sheets of forest inventories conducted in 1970s were placed in a cardboard box at DOF Head Office – as reference material for possible future monitoring of woody vegetation. According to Erkkilä (1996c) the duplicates of the data sheets can be located in South Africa, through Dr Coert Geldenhuys.

5.6 Recommendations

- Valuable information on past forestry activities, documents and photographs may be obtained by contacting and consulting with forestry staff involved in past forestry activities. A systematic information search would require, for example, listing of all forestry personnel seconded from South Africa. A special “old timers” tour could be organized together with local tourist agencies.
- **Mr P.J. le Roux, forester in-charge in Namibia 1957-1961 and 1969-1973 holds an excessive collection of photographs on Namibian forestry.** In 1996 he was willing to donate photographs to the National Archives of Namibia. However, the relevant person at the Archives never contacted Mr le Roux for further consultation and instructions on documentation and handing-over procedures. Mr le Roux is still willing to cooperate in this matter with the National Archives of Namibia and DOF (Erkkilä, pers. comm., 2002). He is available also for consultation and discussions in Stellenbosch, South Africa; he is also willing to pay a visit to Windhoek if needed. It would be important to register, and perhaps to scan his photos on past forestry activities, if the method is seen advisable by the Namibian Archives. Nevertheless, the photos do not have much value without relevant historical information. It may be advisable to record the oral explanation with video camera. **All the photographs and documents should be transferred to the National Archives of Namibia** (e-mail: pjleroux@iafrica.com).
- The other foresters seconded from South Africa to Namibia may also hold important material relevant to Namibian forestry development and research. In 1996 Mr Erkkilä visited Mr Willem de Villiers in Belfast, South Africa, who showed his photo albums on forestry activities in the Kavango Region between 1961 and 1965. Mr de Villiers was very keen to cooperate with DOF, even in a voluntary basis. It is emphasized that **old photographs may be useful for innovative research material in monitoring changes in landscape and woody vegetation.**

6. PERMANENT SAMPLE PLOTS

6.1 Overview on sample plots 1959-1990

The permanent sample plots established in Namibia include the following sites, a) on the Farm of Jägerquelle (Erkkilä 1996b, Le Roux 1996), b) in Makambu, near Nkurenkuru (Geldenhuys 1977, 1996a, Le Roux 1996), c) Rundu (Geldenhuys 1977, Le Roux 1996), d) in the area next to the Tamboti Pan, east of Oshivelo (Erkkilä, letter to le Roux, see Le Roux 1996), e) in the Tsumkwe area.

The site in **Jägerquelle** (the owner of the farm in 1960s was Major Hubble, in 1996 Mr Joos van Zyl) was visited in 1996 but the experiment could not be found, however the available growth data is presented in the appendix 4 of the report by Le Roux (1996). During the early 1960s the diameter increment of trees was measured annually. The growth of following species was monitored over the period of 13 years: *Spirostachys africa* (tamboti), *Ficus petersii*, *Kirkia acuminata* (mountain syringe) and *Peltophorum africanum*.

In 1990 Mr Erkkilä visited the site near **Rundu** together with Dr Geldenhuys, and found out that this permanent sample plot was destroyed due to the agricultural activities (see Geldenhuys 1977). The lesson learnt from this sample plot is: PSPs should be selected very carefully, preferably far from the population centres.

The site next to the **Tamboti Pan** was visited 22.8.1996 by Messrs Joseph Hailwa, Moses Shikongo, Frans Natael and Antti Erkkilä (see Le Roux 1996, p. 27 and appendix 15). The sample plot was not fenced any more, however, the corner wires were easily found on the ground. Most of the species at the site were *Spirostachys africana* and *Terminalia prunioides*. The sample plot was measured apparently in 1973 – a total of 378 trees are listed in the file containing the following information: number of tree, species, diameter and height. The experiment contains 57 unreplicated plots of 25 m x 25 m. In 1996 Mr Erkkilä recommended that all trees at the plot should be measured and analysis on tree growth made. However, the site should be revisited in order to make any future recommendations. Nevertheless, in 1996 the following data sheets were handed over to the DOF for further actions: a) *File 17/5/5/2, Bosbou, Beskerming van Inheemse bome S.W.A.*, b) *Letter 17/5/5/2 by P.J. le Roux, n:207 to Staatsbosbouwer, Ondangwa*. In 1996 copies of the files were submitted to the National Archives of Namibia.

In 1980s Mr Roland Hilbert, forester in-charge in Grootfontein, established several PSPs. In the Tsumkwe area, near **Kanovlei**, savanna fire ecology and regeneration of *Pterocarpus angolensis* were monitored. Until 1994 this research initiative was one of the most long-term and systematic research in the country.

- Mr Roland Hilbert should be contacted in order to find further information, and finally joint publications should be written by persons involved in this particular research (e-mail: rap@kilionline.com or bhilbert@gmx.de).

6.2 Makambu permanent sample plots

The effect of different regimes of annual burning on two woodland communities in Kavango (Geldenhuys 1977) was published in South African Forestry Journal nr. 103. The experimental plots were laid out near Rundu and **Makambu**. The experiment was started in 1959. The

treatments were maintained well until the mid to late seventies but applied with uncertain frequency since 1975 (Geldenhuys 1996a). The foresters in-charge of the establishment and/or measurements of the trial include Mr P.J. le Roux (Geldenhuys 1977), Mr Johan de Beer, Mr Fourie, Mr Stefaans Thambanga – better known by name of Muhuli (Geldenhuys 1996a), and Mr C.J. (Neels) Esterhuyse (Erkkilä 1996b).

The site in Makambu was visited 1.8.1996 by Messrs A. Amon, W. Hausiku Haipupu and W. Mberema, P.J. le Roux, A. Erkkilä and Dr K. Korhonen (Le Roux 1996). During November 1996 the site was visited by Dr Coert Geldenhuys of South Africa, Dr Kari Korhonen of Finland, Dr Mike Müller, Deputy Director: Forestry Research, Mr Andrew Jamieson, DOF, and three members of the Rundu Forestry Office, including Mr Wilfred Hausiku Haipupu. The findings are reported in the report titled *Rehabilitation and remeasurement of the Makambu burning trials, Kavango, Namibia: a quick assessment* (Geldenhuys 1996a).

During the above-mentioned consultancy by Dr Geldenhuys (Nov 1996) the data of the June 1975 measurements of the woody vegetation on sample plots of 30 m radius with plot centre at about the centre of the treatment plots was left with the DOF in Windhoek. Dr Kari Korhonen, currently working at the Finnish Forest Research Institute in Joensuu, Finland, kindly volunteered to look for backup copies of the data files in his old portable computer. In March 2002 the above-mentioned backup files were copied to the two computers at the DOF Head Office and to one computer at the Rundu Forestry Office – the original diskettes and the report was tracked down at NFRC in Okahandja. Several copies of the above-mentioned report by Geldenhuys (1996) were redistributed during the field tour in March 2002, including the offices in Windhoek, Okahandja, Ongwediva and OAC.

Mr Andrew Jamieson, working at DOF 1996-1998, was interviewed in Windhoek 18.3.2002 together with Mr Vincent Louw, previously working at NFRC in Okahandja, but transferred to the Management Division at the Head Office August 2001. Mr Jamieson revisited Makambu early 1997 with 3 other persons from the Rundu Forestry Office. The team camped at the site for a week. New corner poles, partly painted white, were placed. However, during the reconnaissance survey conducted 22.3.2002 no new corner poles were observed. Mr Jamieson questioned the research results by Geldenhuys (1977) due to the fact that **annual** burning seems to be very difficult. In other words the perception that forest fires are annual is incorrect: there might be smoke everywhere but not fire. For example in 1998, the burning treatment in Kanovlei proved to be very difficult to complete – the sample plot simply did not burn. Mr Jamieson is available for further consultation if needed (e-mail: frau@iafrica.com.na).

The following team visited Makambu burning trial 22.3.2002: Mr Simeon Hengari, Acting Chief Forester of the Rundu Forestry Office, Ms Selma E. Elago from the Hamoye Forestry Research Station, Mr Wilfred Hausiku Haipupu from the Rundu Forestry Office, Ms Helena Nangutuwala from the Okahandja National Forestry Research Centre, and Dr Antti Erkkilä of Finland. Mr Hengari has been working at the DOF since 1.1.2000, and at the Rundu Forestry Office since November 2000.

The site can be found as follow: take the road from Rundu to Nkurenkuru (133 km), just before the village centre turn to the left to the road leading to Nepara, follow 2.5 km and turn to the right at the Nkurenkuru High School, and follow D3405 road 23.7 km until T-junction, turn to the right and follow the road 1.8 km, turn to the left and follow the road 3.2 km, your positions is now S 17°26.63' and E 18°27.64'. Look carefully for the track to the left and follow the route 4.8 km to

the trial (note: the junction of gravel road and 4x4 sandy track is difficult to see due to the farms nearby). On the right hand side of the track there are two old poles (point A: S 17°26.77' and E 18°25.17'). Option 1: walk 60 m to the right, direction north (perpendicular to the track) and you will be in the southeastern corner of the trial area, and in the corner of plot E5 (point B: S 17°26.74' and E 18°25.17'), walk 110 m and you will find next corner (point C: S 17°26.68' and E 18°25.17'). Option 2: follow the 4x4 sandy track from point A about 300 m metres and you will see two old fence poles marked with white paint, walk from there about 30 m north and you are on the border of the plot A5.

Mr Jamieson mentioned that while working on the trial area in 1997, he was confused due to the fact that the numbers painted on the trees indicated different individual trees than the numbers of 1975 file provided by Dr Geldenhuys (name of the file: Makambu5.wk4). He was in an opinion that between 1975 and 1996 new number must have been painted on the trees. However, according to Geldenhuys (1996a) there are two different sets of data:

a) **Marked trees** (numbers painted on the trunk and painted bands at point of measurement) for measurement of growth are scattered throughout the total treatment plot. In 1996 the field book containing measurements for the individually marked trees for the period 1961-1966 (according to Geldenhuys 1996a, the period is 1961-1967) was found in the Rundu Forestry Office and transferred to the DOF in Windhoek (Erkkilä 1996c). The numbers on the trees were visible in 1996, but more difficult to find during the visit of 22.3.2002. The data of tree measurements in 1971, and 1975 is apparently missing (Geldenhuys 1996a).

b) **Unmarked trees** (no numbers painted on the trees) which were measured in 1975 (file names: Makamspp.wk4, Makam-5.wk4, Makambu5.wk4). The data includes measurements of the woody vegetation on sample plots of 30 m radius with plot centre at about the centre of the treatment plots (Geldenhuys 1996a). Note that tree number was added into the file, but not painted on the trees at the time of measurement. The reason was to keep the sequence in which the trees were measured in the field and recorded in the Field book in order to facilitate the relocation of each tree and comparison of the 1975 measurements with future remeasurements. **Mr Jamieson should be consulted in order to find out if he was aware of two different data sets: marked trees and unmarked trees.**

6.3 Guidelines and recommendations

Proposal for remeasurement of Makambu PSPs (adapted from Geldenhuys 1996)

As a first step in the trial area the new corner poles should be erected, and the lines between the individual plots cleared. The pole on the south-western corner of a Treatment Plot should carry the reference number to a plot. The trial establishment should be done in cooperation with local people.

The plots should be measured according to the following procedure:

a) Marked trees (if feasible):

Remeasure the DBH (mm) and height (0.5 m, or 0.1 m if possible with suitable measuring equipment) of each marked tree. Note that once a tree is in the canopy, it usually does not grow much in height. The height measurement is therefore merely a measure of the height of the stand. Paint the tree number and the band at point of measurement with yellow paint (to distinguish them from the other measured trees). Determine the location of each tree, using distance and direction to the tree from the centre point.

b) Unmarked trees ≥ 5 cm DBH on 30 m radius sampled plot:

Establish the centre of a 30 m radius plot at the point marked during the June 1975 measurement. Try to relocate each tree of the 1975 measurement by identifying prominent trees (by species of rarer species, such as *Commiphora*, or by large stems of more common species) in both the plot and field data to follow the sequence of measurement (clockwise) as was used in 1975. If the centre pole cannot be found, then it will be more difficult to relocate the original trees, but then the centre point should be located at approximately the centre of the treatment plot.

Each tree should receive a painted band at point of measurement as well as the number introduced in the data file. Trees which were not measured before but which are ≥ 5 cm DBH at the time of remeasurement, should receive added numbers in the numerical sequence for the particular plot. The following additional information should be recorded for each marked tree:

- Exact location of each tree: An attempt should be made to determine the exact location of each measured tree, as for the selected 20 trees in the total treatment plot, using direction and distance from the plot centre to each marked tree. This data will be useful for studies of the effect of competition on tree growth, and of regeneration patterns around parent trees.
- Crown position of each tree: Geldenhuys (1977) showed considerable variation in the growth rate of individual trees within a site. Some of this variation may be explained by the position and condition of the crown of a particular tree in relation to those of surrounding trees. The crown of each marked tree should be categorized according to the following scoring system (this should be adapted to the procedure used in the forest inventory):

- 1 No direct light. Crown entirely shaded vertically and laterally
- 2 Some side light. Crown shaded vertically, but some direct side light (from gap or edge)
- 3 Full or partial overhead light. Crown adjacent to other crowns and partly to fully exposed vertically.
- 4 Emergent. Crown fully exposed vertically, and free from lateral competition from other crowns.

It is important to consider the crown position in relation to surrounding trees when the trees are in full foliage.

c) Woody stems <5 cm DBH on sub-plots within 30 m radius sampled plot:

Two to four smaller subplots (3.99 m radius each) for sampling understorey vegetation should be located at random, but marked permanently, and sampled on a similar basis as used in the forest inventory in Namibia. Provision should be made in the type of data collection for some means of comparison with the 1975 data. Stems should be recorded by species and height class, as used in the forest inventory.

Herbaceous and grassy vegetation:

As suggested by Geldenhuys (1977), some attempt should be made to record the species composition, cover and biomass of the herbaceous vegetation, in particular the grass species and their relevance in terms of grazing by both domestic stock and wildlife. Suitable sampling strategies will have to be developed from inputs by specialists in that field of research.

If all the measurements of the selected trees within the treatment plots could be found, then it will allow analysis of the fluctuations of growth during the period of measurement. Such a time series analysis of growth would indicate how tree growth is affected during periods of high and low rainfall. This again is important in terms of yield regulation during periods of high and low rainfall.

Recording of DBH and of trees which die between measurements would give the opportunity to analyse growth, ingrowth and mortality in a stand. This would indicate the dynamics of a stand, the reasons for changes in structure and biodiversity of the stands, and would provide for estimates of natural turnover in relation to harvesting levels.

The data recorded as proposed above can be analysed in different ways to establish the growth rates of the species and stands. If all or even many of the trees of the 1975 measurements could be relocated, then growth can be calculated directly as the differences in DBH between the two periods. If however, the individual DBH's of most of the individual trees cannot be determined for both periods, then growth could be assessed indirectly through the analysis of transition matrices. The changes in frequencies of stems in successive diameter classes between the two successive measurement periods are used to estimate growth.

- **The Makambu burning trial would be an ideal site for incorporation into the regional network of long-term plots for the study of tree growth and biodiversity changes (Geldenhuys 1996a).**
- The Makambu site could also be considered as a field station for other studies, such as study of the silvicultural management of regrowth woodland in the area nearby where the *Eucalyptus* trees were cleared. Such a study could be done in combination with a study of regeneration of woodland species in regrowth vegetation on either side of the Rundu-Grootfontein road.
- Makambu burning trial would be an ideal research site for a BSc holder interested in further studies. It would be ideal if the researcher is placed at the Rundu Forestry Office.

- **It would be also important to monitor off-forest and on-farm trees.**
- **It is important to realize that the establishment and maintenance of research sites can become expensive and a burden on limited manpower if not properly planned.**
- **FAO and other relevant institutions and scientists should be contacted to acquire further information before any new PSPs are established. Any initiative to establish PSPs should be coordinated with Environmental Observatories Network of Namibia (EONN). EONN concerns documentation and analysis of long-term large-scale ecological and socio-economic processes that are elucidated through multi-disciplinary research and monitoring over a network of institutional operated field observation sites. Contact Desert Research Foundation of Namibia (e-mail: nenschei@drfn.org.na).**
- **A suitable qualified person should attend Natural Forests and Savanna Woodlands Symposium III on *Multiple Use Management of Natural Forests & Savanna Woodlands* 6-9 May 2002, Kruger National Park. His or her duties should be, a) identify stakeholders in the field of sustainable forest and woodland management, b) contact relevant researchers, managers, practitioners and government officials, c) improve coordination and collaboration between DOF and relevant stakeholders, and d) acquire information on regional and international networks on PSPs. **This opportunity should be used to exchange information with Dr Coert Geldenhuys, specialized in the management of indigenous woodlands of southern Africa.****
- A fenced trial in the Oniipa constituency of the Oshikoto Region gives a fairly good indication of the natural regeneration potential in degraded savannas. The trial was established in 1967 next to the **Oshigambo High School** (17°47' S, 16°04' E) in order to study the impact of fertilisation on an overgrazed sandy site (Soini 1981). Previously the trial site had been heavily trampled by passing cattle, goats and donkeys and had no woody vegetation cover. The trial was abandoned in the early 1970s, but over the years the livestock-proof fence was maintained. In 1993 trees and shrubs in the fenced area, covering a rectangle of about 4.5 x 68.0 m, were enumerated by Erkkilä (2001, pp. 49-50). **It would be important to remeasure the trial area once again.**

7. STEPS FORWARD

The networking on forest research should continue on weekly basis.

- It is recommended that the researcher at the DOF Research Division dedicate a full day, e.g. Friday, for studies and information search in one of the libraries in Windhoek. This arrangement should be agreed with the Director of Forestry, and the agreement should be fully respected. In other words, the arrangement is meant to secure at least some time every week for research work. Throughout the year at least one morning, preferable full day, e.g. Monday, should be reserved for data analyses and writing research reports.
- The following ministerial libraries should be visited: Environmental Affairs Library, Forestry Library, Namibian Agriculture & Water Information Centre (NAWIC), M A N Muller Library at the NBRI (branch of NAWIC), National Planning Commission Library,

as well as non-ministerial libraries and archives: Namibian National Library, Namibian National Archives, UNAM, Ogongo and Neudam colleges, PON, Namibian Scientific Society (e-mail: nwgr@iafrica.com.na), and UN and EU information centres.

- **A report should be written on available sources which are relevant for forestry research and development in Namibia, including access to internet, CD-ROMs, databases, catalogues on research projects and information sources, and bibliographies.** Such a report should have recommendations how to improve forest information services, including the future development of library services at NFRC. Contact Mr Werner Hillebrecht (National Archives, e-mail: willebrecht@mec.gov.na) for comments and further information, and organize meeting with Ms Ellen Namhila, Director of Namibia Library and Information Service at the Government Office Park (e-mail: enamhila@mec.gov.na).
- Compile a report on Forestry in Namibia 1990-2005.

References and other sources consulted

Du Plessis, P. 2001. Strategy and action plan for promoting indigenous fruits in Namibia. Windhoek: Indigenous Fruit Task Team. CRIIA SA-DC. 48 p.

Erkkilä, A. 2001. Living on the land: change in forest cover in north-central Namibia 1943-1996. *Silva Carelica* 37. 118 p.

Erkkilä, A. & Löfman, S. 1999a. Forest cover change in the Ohangwena Region, northern Namibia: a case study based on multitemporal Landsat images and aerial photography. *Southern African Forestry Journal* 184: 25-32.

Erkkilä, A. & Tiilikainen, S. 1997. The use of remote sensing techniques in analysing forest cover in Northern Namibia. Directorate of Forestry, Ministry of Environment and Tourism, Namibia. 57 p.

Erkkilä, A. 1996a. Report on visit to Stellenbosch and Cape Town, South Africa 29.1.-2.2.1996. Directorate of Forestry, Ministry of Environment and Tourism, Namibia. 53 p.

Erkkilä, A. 1996b. Report on visit to Pretoria, Belfast and Johannesburg, South Africa 24-29.6 and 11-16.7.1996. Directorate of Forestry, Ministry of Environment and Tourism, Namibia. 69 p.

Erkkilä, A. 1996c. Transfer of the old forestry files to the National Archives of Namibia. Directorate of Forestry. 64 p. [A list of files transferred from the Grootfontein Forestry Office to the National Archives of Namibia].

Erkkilä, A. 1996d. Background information on forestry districts and their activities. In: Sartain, J. Report on the forest management and extension planning workshop, Midgard, Khomas Region, Namibia, 9-12 October 1995. Forestry Discussion Paper 1: 56-73. Directorate of Forestry, Ministry of Environment and Tourism, Namibia.

Erkkilä, A. 1996e. Tree species trials in stages - Ogongo Agricultural College and Okashana Training Centre. Directorate of Forestry, Ministry of Environment and Tourism, Namibia. [24 slides].

Erkkilä, A. 1995. Tree species and provenance trials in northern Namibia: experiments on Australian tree species suitable for firewood and pole production: a preliminary report. Directorate of Forestry, Ministry of Environment and Tourism, Namibia. [Draft].

Erkkilä & al. 1994. Pre-feasibility study on a commercial plantation project in eastern Caprivi. Helsinki University Knowledge Services.

Erkkilä, A. & Siiskonen, H. 1993. Changes in Land Use in Owambo, Namibia - Technical and Historical Approaches. Paper presented at the 1993 Annual Meeting of the African Studies Association, Boston, Massachusetts.

Erkkilä, A. & Siiskonen, H. 1992. Forestry in Namibia 1850-1990. *Silva Carelica* 20. Joensuu: Faculty of Forestry, University of Joensuu. 244 p.

Erkkilä, A. 1991. Forestry aid to Namibia. *Science, Technology & Development* 9(3): 60-70.

ETFRN 2001/2002. Innovative financing mechanisms for conservation and sustainable forest management. *ETFRN News* 35.

Flower, C., Wardell-Johnson, G. and Jamieson, A. (eds.). 2000. Management of mopane in southern Africa. Proceedings of a workshop held at Ogongo Agricultural College, northern Namibia, 26th to 29th November 1996. Windhoek: Directorate of Forestry. p. 12-18.

Franc et al. (eds.). Criteria and Indicators for sustainable forest management at the forest management unit level. *EFI Proceedings* 38.

Geldenhuys, C.J. 1996a. Rehabilitation and remeasurement of the Makambu burning trials, Kavango, Namibia: a quick assessment. Prepared for National Forest Inventory Project of Namibia. 13 p.

Geldenhuys, C.J. 1996b. Past, present and future forest management in the southern African region with special emphasis on the northern regions of Namibia. A paper presented at the Strategic Planning Workshop 9-12 October 1995 organised by the Forest Management and Extension Division of the Directorate of Forestry in association with the Department for International Development Cooperation, Ministry for Foreign Affairs of Finland. *Forestry Publication* 5. Windhoek: Directorate of Forestry, Ministry of Environment and Tourism, Republic of Namibia. 44 p.

Geldenhuys, C.J. 1977. The effect of different regimes of annual burning on two woodland communities in Kavango. *South African Forestry Journal* 103: 32-42.

Gelens, M.F. 1999. Mopane shrubland management in northern Namibia. In: Flower, C., Wardell-Johnson, G. and Jamieson, A. (eds.). Management of mopane in southern Africa. Proceedings of a workshop held at Ogongo Agricultural College, northern Namibia, 26th to 29th November 1996. Windhoek: Directorate of Forestry. p. 12-18.

- Gelens, M.F. 1996a. Participatory mopane shrubland management research. In: Mushove, P.T., Shumba, E.M. & Matose, F. (eds.). Sustainable management of indigenous forests in the dry tropics. Proceedings of an international conference, Kadoma, Zimbabwe, May 28 – June 1, 1996. Harare: Forestry Commission. p. 109-116.
- Gelens, M.F. 1996b. Mopane shrubland management trial: trial 94/3. Technical Report 1 (July 1994 to June 1995). Research Division, Directorate of Forestry, Ministry of Environment and Tourism, Namibia.
- Gelens, M.F. 1996c. Mopane shrubland management trial: trial 94/3. Technical Report 2 (July 1995 to June 1996). Research Division, Directorate of Forestry, Ministry of Environment and Tourism, Namibia.
- Gelens, M.F. 1996d. Mopane chronosequential measurements on-farm: trial 96/19. Progress report 1. Research Division, Directorate of Forestry, Ministry of Environment and Tourism, Namibia.
- Gelens, M.F. 1996e. Mopane chronosequential measurements on-farm: trial 96/19. Research Division, Directorate of Forestry, Ministry of Environment and Tourism, Namibia. [Protocol].
- Gelens, M.F. 1996f. Mopane coppicing ability: trial 96/20. Research Division, Directorate of Forestry, Ministry of Environment and Tourism, Namibia. [Protocol].
- Gelens, M. & Erkkilä, A. 1996. Articles on *Colophospermum mopane*. Directorate of Forestry, Ministry of Environment and Tourism, Namibia.
- Hailwa, J.S. 1996. Round wood use at homestead level in northcentral Namibia – Owambo, with special reference to Outapi constituency. BSc thesis, University of Wales. 70 p.
- Kaarakka, V. & Musnad, H. 1999. Forest research priorities for Namibia: main findings and recommendations. Directorate of Forestry, Ministry of Environment and Tourism, Namibia. Short-term consultancy on Forest Research Development for the Namibia-Finland Forestry Programme. 38 p.
- Kojwang, H. & Erkkilä, A. 1996. Directorate of Forestry challenges environmental degradation. Namibia Environment 1:106-109.
- Kreike, E.H. 1996. Recreating Eden: agro-ecological change, food security and environmental diversity in southern Angola and northern Namibia, 1890-1960. PhD thesis, Yale University. 456 p.
- Kreike, E.H. 1995. The Ovambo agro-silvipastoral system: traditional land use and indigenous natural resource management in northcentral Namibia. Forestry Publication 4. Windhoek: Directorate of Forestry. 86 p.
- Kreike, H.P.M. 1992. An inventory of trials with exotic tree species in northern Namibia, with special reference to provenance trials with *Eucalyptus* spp. Forestry Publication 3. Directorate of Forestry.

Le Roux, P.J. 1996. Report on visit to the forestry areas in northern Namibia from 28 July to 8 August 1996. A report prepared to the Directorate of Forestry, Ministry of Environment and Tourism, Namibia. [A video on the lecture held 1996 at the DOF Head Office was provided to Dr H.O. Kojwang, Director of Forestry].

Mitlöhner, R. 1993. Regenrüne Baikiaea-Trockenwälder in Ost-Caprivi, Namibia. *Forstarchiv*, 64 (6): 264-274.

Mushove, P.T., Shumba, E.M. & Matose, F. (eds.). Sustainable management of indigenous forests in the dry tropics. Proceedings of an international conference, Kadoma, Zimbabwe, May 28 – June 1, 1996. Harare: Forestry Commission.

Pasiecznik, N.M., Felker, P., Harris, P.J., Harsh, L.N., Cruz, G., Tewari, J.C., Cadoret, K. & Maldonado, L.J. 2001. The *Prosopis juliflora* – *Prosopis pallida* complex: a monograph. HDRA, Coventry, UK. 162 p.

Poso, S. & Waite, M-L. 1995. Calculation and comparison of different permanent sample plot types. *Silva Fennica* 29(2): 159-169.

Research in Namibia: a system analysis: an overview of the existing system of research in Namibia with pointers towards the significant components of a national research policy. 2001. Prepared for the Ministry of Higher Education, training and Employment Creation. Namibia Resource Consultants cc. [Email nrc@mweb.com.na].

Riehmer, H.B. 2001. Base line vegetation survey of the Kanovlei fire trials, in the former western Bushmanland. [Supervisor: E. Lusepani-Kamwi, DoF].

Schmid-Haas, P., Baumann, E., & Werner, J. 1993. Forest inventories by unmarked permanent sample plots: instructions. 135 p. ISBN 3-905620-30-8.

Shikaputo, C. 1994. Management plan for *Eucalyptus* woodlots grown in the northern region. Directorate of Forestry.

Shumba, E.M., Lusepani, E. & Hangula (eds.). 2000. The domestication and commercialization of indigenous fruit trees in the SADC region. Proceedings of a SADC Tree Seed Centre Network technical meeting held in Windhoek, Namibia, 13 to 14 March 2000 and co-sponsored by CIDA and FAO. SADC Tree Seed Centre Network.

The Forest is My Farm. 1996. A video produced by MOKOBO Video and Research, Windhoek, Namibia. Sponsored by the Directorate of Forestry, Ministry of Environment and Tourism, Namibia and the Department for International Cooperation, Ministry for Foreign Affairs of Finland. 31 minutes. [see Erkkilä (2001), Figure 49, page 80 - Oidimba].

Tokola, T., Löfman, S. & Erkkilä, A. 1999. Relative calibration of multitemporal Landsat data for forest area change detection. *Remote Sensing of Environment* 68: 1-11.