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« MOBILISATION ET RENFORCEMENT DES CAPACITES DES PETITES ET MOYENNES ENTREPRISES IMPLIQUEES DANS LES FILIERES DES PRODUITS FORESTIERS NON LIGNEUX EN AFRIQUE CENTRALE »

Guidance for a National Prunus africana Management Plan Cameroon

CIFOR

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1 Sommaire Exécutif

*Le Cameroun abrite une grande partie de l'aire de répartition de Prunus africana, arbre de montagne. Connu généralement sous le nom de "pygeum" ou "**dalehi**" qui en Fufulde signifie plante aux usages multiples, Prunus africana a des utilisations à la fois comme bois de construction, bois de chauffe ou médecine traditionnelle. Pour ce dernier usage, ce sont surtout les écorces qui sont commercialisées localement . Cependant, la plus grande partie des écorces de cet arbre est destinée aux entreprises pharmaceutiques étrangères qui produisent des médicaments traitant l'hypertrophie bénigne de la prostate. C'est une source importante de revenus pour les organisations communautaires et les entreprises locales. Prunus africana est une espèce qui est inféodée aux forêts de montagne de haute altitude, écosystème d'une grande diversité biologique de plus en plus menacé par les activités humaines. Il s'agit par ailleurs d'une espèce en voie de disparition dont les méthodes de récolte non durables ont conduit à des restrictions de son commerce international depuis 1995.*

Ce rapport présente un Plan de gestion pragmatique pour l'exploitation durable de Prunus africana à court et à long terme. Ce plan constitue une grande innovation pour le Cameroun. Il pourrait être aussi approprié pour d'autres pays en Afrique où le Prunus africana a un potentiel d'exploitation. Il a été développé au cours des deux dernières années en adoptant une approche scientifique basée sur l' évidence(la revue de littérature, une étude de base et des inventaires actualisés), une approche politique concertée (une étude sur la règlementation et la politique relatives à ce produit et des consultations continues avec le Ministère en charge des forêts et de la faune), la prise en compte des connaissances traditionnelles et la participation de différents acteurs de la filière de Prunus africana (récolteurs, forêts communautaires, pépiniéristes, propriétaires d'arbres et des plantations, petits et moyens exploitants et entreprises exportatrices, associations des commerçants des produits forestiers non ligneux, organismes non gouvernementaux impliqués dans la conservation et la foresterie, autorités traditionnelles, instituts de recherche du système national et international, partenaires au développement, etc.) ainsi que les compagnies pharmaceutiques internationales et les autorités CITES. Ce Plan de gestion résultant de telles consultations étendues bénéficie d'un consensus général de la majorité des parties prenantes.

Dans ce Plan, il est proposé un changement radical de la gestion de Prunus africana au Cameroun. Le système actuel d'attribution annuelle de permis multiples non basé sur des quotas et pour des zones géographiques non-spécifiques sera transformé en un nouveau système fondé sur les exigences de gestion durable dont les principaux éléments sont:

- *Le quota national, tout comme le niveau de prélèvement dans chaque site d'attribution des récoltes, sera assujetti aux résultats des inventaires sur la base desquels seront bâtis les plans de gestion par site;*
- *Etant donné les usages variés de l'arbre, une différenciation est faite entre l'exploitation commerciale à grande échelle de l'écorce et l'utilisation traditionnelle à petite échelle de l'arbre et de son écorce;*
- *Les principaux sites du Prunus au Cameroun ont été convenus, définis et consolidés en Unités d'Attribution du Prunus (UAP)qui couvrent 6 différentes zones de montagne;*
- *A l'image des concessions forestières pour le bois d'œuvre, des Unités pourraient être concédées à long terme à un seul exploitant après un appel d'offres mais uniquement pour l' exploitation du Prunus africana . Une Unité fera l'objet d'un zonage et comprendra:*
- *Domaine forestier permanent - exploitable par des entreprises ou des organisations appropriées et des communautés locales. Les aires protégées sont exclues. La seule exception possible parmi les aires protégées est le parc national (proposé) du Mt Cameroun.*
- *Domaine forestier non permanent (forêts communales, communautaire ou forêts privées) - exploitables uniquement par la commune ou le comité de gestion, respectivement.*
- *Dans les Unités d'Attribution du Prunus, les quantités exploitables sur une période de 10 ans seront strictement liées à la quantité déterminée par un inventaire à l'intérieur de l'Unité (approuvé par l'autorité scientifique CITES du Cameroun), lequel inventaire sera demandé et payé par le propriétaire de l'UAP ;*

- *Tous les inventaires seront conduits sur la base d'une « norme d'inventaire de Prunus africana » (qui sera clarifiée par la loi) spécifiant des méthodes standard d'inventaire et des équations qui permettent de calculer les quotas des quantités d'écorce à récolter et le rendement par Unité d'attribution dans les forêts permanentes, les forêts communales ou communautaires et pour le Prunus planté ;*
- *Le Prunus planté (sur des terres privées ou dans les plantations) est reconnu comme différent du Prunus « sauvage » (qu'on trouve dans les forêts naturelles) et sera récolté uniquement par le propriétaire, à condition que les arbres aient été enregistrés au préalable. Les quantités exploitables dans n'importe quelle année dépendront des données fournies par les propriétaires sur les quantités disponibles.*
- *Les techniques de récolte agrées et durables seront clarifiées et feront l'objet d' un suivi permanent à travers une recherche continue pour vérifier la fiabilité et la durabilité des opérations. Les techniques pourraient différer selon que le Prunus est planté ou issu des forêts naturelles. Ceci sera formalisé et rendu juridiquement contraignant. L'utilisation de récolteurs formés et agréés suite à une formation sur les techniques de récolte viable garantira que les techniques en vigueur sont effectivement utilisées.*
- *L'obligation de régénération rentre dans les exigences qui pèsent sur le concessionnaire de l'Unité d'Attribution.*
- *Les contrôles et la surveillance seront renforcés pour permettre aux autorités de faire le suivi depuis les limites de la forêt, sur les routes de transport et aux ports. La traçabilité sera renforcée par l'implication des autorités au niveau régional.*
- *Les procédures et les mécanismes de coordination entre l'organe de gestion et l'autorité scientifique ont été clarifiés, et la coordination entre les agents du Ministère en charge des forêts et de la faune à divers niveaux – central, régional et au port – a été améliorée.*
- *Les activités de surveillance couvriront tout commerce transfrontalier possible entre le Nigéria et le Cameroun.*

Dans le court terme (2009 à 2010), les acteurs de la filière sont convaincus que la durabilité de l'exploitation de Prunus africana peut être assurée par la combinaison des mesures énoncées ci-haut qui, dans leur ensemble, prennent en compte les aspects suivants :

- *La préparation de ce plan de gestion permet de répondre aux préoccupations de la CITES issues de la réunion de Lima de 2006.*
- *Le localisation des zones de collecte des stocks récoltés en 2007 a été faite pour s'assurer qu'ils étaient issus des zones où les inventaires ont eu lieu afin de répondre aux préoccupations de l'Union Européenne qui ont conduit à la suspension de ses importations venant du Cameroun en novembre 2007.*
- *On estime à 1078 tonnes la quantité d'écorces fraîches de Prunus disponibles annuellement. Les évaluations des stocks actuels disponibles sur la base des inventaires dans les forêts naturelles des Mt Cameroun Kilum Ijim, Mt Manengouba et Adamaoua Tchabal sont de 735 tonnes d'écorces fraîches par an, après ajustement pour tenir en compte les récoltes antérieures non durables. Environ 343 tonnes d'écorces fraîches pourraient provenir des espaces privés et des plantations des organisations communautaires de base (selon les données disponibles, les présomptions et par extrapolation).*
- *La quantité réellement exploitable disponible pour l'instant ne sera connue que sur la base des inventaires approuvés et les plans de gestion des Unités d'Attribution et après enregistrement du Prunus disponible dans les espaces privés.*
- *Aucune récolte ne sera autorisée dans des aires protégées afin de garantir la conservation des ressources génétiques et des stocks pour la régénération.*
- *Un nouveau système de permis a été conçu et largement approuvé par les différentes parties prenantes comme une alternative durable par rapport au système actuel.*
- *Un consensus s'est dégagé sur les techniques de récolte viable qui pourrait être révisées en fonction des nouveaux résultats de recherche. Ces techniques pourraient différer selon que le Prunus est planté ou non.*
- *Les procédures de contrôle par le gouvernement et les communautés sont définies.*
- *Les besoins de recherche en cours ont été consolidés, agréés et sont en train d'être pris en compte. L'ANAFOR va coordonner ces efforts et disséminer les résultats.*
- *La distinction entre le Prunus «sauvage» et le Prunus domestiqué a été incorporée dans le régime d'exploitation à travers un certificat d'origine.*

- *La mise en place des mécanismes de coordination entre les projets en cours sur le Prunus au Cameroun à travers la « plateforme Prunus». L'ANAFOR va jouer un rôle critique à ce niveau.*
- *Consensus sur la nécessité d'accroitre la sensibilisation, l'éducation et la participation des acteurs de la filière par rapport à la signification de la CITES et ses exigences et sur les réglementations nationales.*
- *La promotion de la domestication et de la plantation par les privés, les communautés et les communes pour accroître la production, couplée à un programme de régénération du stock naturel, en particulier dans les aires protégées, ainsi que des incitations du secteur privé pour planter dans les forêts naturelles, est appuyée par le secteur.*

Pour le long terme (les 3 à 30 années à venir) la gestion de Prunus africana au Cameroun continuera d'être basée sur l'attribution des quotas. Ceci sera en rapport avec la demande du marché. L'on s'attend à ce que des opérateurs économiques commencent à manifester de l'intérêt aux appels d'offres pour l'octroi des Unités d'exploitation de Prunus et progressivement mettent en œuvre des inventaires et présentent des plans de gestion des UAPs pour approbation par le Ministère des Forêts et de la Faune. Pendant cette période, le travail en cours pour le renforcement de la capacité de l'autorité scientifique (ANAFOR) devrait produire ses fruits. Les résultats des projets en cours tels que l'appui à la domestication de Prunus africana, l'appui à l'émergence des petites entreprises forestières, le changement du cadre juridique concernant les produits forestiers non ligneux et divers résultats de la recherche seront graduellement incorporés à la politique nationale pour une gestion plus durable.

2 Executive Summary

*Cameroon supports some of the largest populations of Prunus africana, an Afromontane hardwood tree. Known commonly as pygeum, its Fulfulde name of **dalehi** ('plant that has many uses') reflects its traditional multiple-uses for timber, fuel-wood and medicine. A local, low volume trade in its bark for medicinal use exists. Its bark is also the raw material in drugs used treat prostate problems and health supplements. It is a major income source for forest based communities and enterprises. Prunus africana is a key species in high altitude, montane mixed forest, vital to the biological diversity in a shrinking and increasingly degraded montane ecosystem 'hotspot'. However it is also an endangered species and fears of unsustainable exploitation have lead to international trade in the species being restricted since 1995.*

This report presents a pragmatic management plan for the sustainable exploitation of Prunus africana in the short and long term. This plan is innovative for Cameroon. It is also relevant for all countries in Africa where Prunus potentially could be exploited. It has been developed over the last two years by taking a scientific, evidence based approach (literature review, a baseline study, and current inventories), a negotiated policy approach (a regulatory and policy study and ongoing consultations with the Ministry of Forestry and Wildlife), using indigenous knowledge and the participation of actors from all stages of the Prunus africana sector in Cameroon (harvesters, community forests, nurseries, tree and plantation owners, small and medium exploiter and exporting companies, associations of non timber product traders, conservation and forestry non-government organisations, traditional authorities, national and regional level government, research organisations and international development organisations) as well as international pharmaceutical companies and CITES authorities. The resulting Plan has the general consensus of the majority of stakeholders.

A major change in the management of Prunus africana in Cameroon is proposed. The current annual, non-quota based, multiple permit based system for largely non-specific geographic areas will be transformed to more sustainable system. The key elements are;

- *The national quota for commercial, large scale exploitation of any part of Prunus africana in any given year consists of the total of the amount calculated as available in inventories and management plan for specific "Prunus allocation units" and the total of all registered planted Prunus africana.*
- *Given the very different usage of the tree, a differentiation is made between commercial, large scale bark exploitation and small-scale, traditional use of the tree and its bark.*
- *Planted Pygeum (on private land or in plantations) is recognised as different from 'wild' Prunus, (found in natural forest) and is only harvestable by the owner, upon registration of the trees. Exploitable quantities in any given year will depend upon data provided by the owners on the quantity available.*
- *The major landscapes of Cameroon containing Prunus africana have been agreed, defined and consolidated into Prunus Allocation Units that cover six montane areas.*
- *Similar to timber concessions, Units can be leased, after an open bidding process, to a single exploiter in the long term, but solely for the exploitation of Prunus africana. A Unit will be zoned and comprise;*
  1. *Permanent Forest domain – exploitable by enterprises or appropriate local community organisations, or relevant Council. Protected areas are excluded. The sole exception among protected areas is the (proposed) Mt Cameroon National Park.*
  2. *Non-Permanent Forest domain (Communal, Community or Private forests) – only exploitable by the governing CBO or Forest Management Institution or owner respectively.*
- *In PAUs, exploitable quantities over a 10 year period are strictly related to the quantity determined by a PAU inventory (approved the Cameroon CITES authorities), to be commissioned and paid for by the holder of the Prunus Allocation Unit.*
- *All inventories will be conducted using a 'Prunus africana Inventory norm' (to be clarified by law) with standard methods and equations for calculating harvestable yield quotas for PAUs in Permanent forests, communal or community forests and planted prunus.*

- *Acceptable, sustainable harvesting techniques will be clarified– with monitoring and ongoing research used to verify sustainability. Techniques will differ according to whether Prunus is owned or wild. This will also be formalised and legally binding. The use of trained and certified harvesters ensures the techniques are implemented in practice.*
- *A regeneration obligation is part of the PAU.*
- *Controls and monitoring are strengthened to enable authorities to monitor from the forest edge, on transport routes and at ports. Traceability is enhanced by using regional level authorities.*
- *Coordination procedures and mechanisms between the Cameroon Management and Scientific Authorities have been clarified, and coordination between regional, central and port based agents of the Ministry of Forestry and Wildlife has been improved.*
- *Monitoring activities include any potential cross-border trade with Nigeria.*

In the short term (2009 to 2010), actors in the chain are convinced that the sustainability of Prunus africana harvesting can be assured by this combination of measures, that jointly address the following issues:

- *The CITES 2006 Lima meeting concerns are addressed by the production of this Management Plan.*
- *The location of Prunus africana stock harvested in 2007 was traced, enabling the concerns of the European Union that lead to its suspension of imports in November 2007, to be addressed.*
- *An estimated 1078 tonnes of wet weight bark is known to be available annually. Estimates of current available stocks from inventories in natural forests, adjusted for prior and unsustainable harvesting, indicate that some 735 tonnes wet weight of bark may be available annually from the main prunus producing areas of Mt Cameroon, Kilum Ijum, Mt Manengouba and the Adamaoua Tchabals. Approximately 343 tonnes of wet weight bark may be present in privately and community based plantations (based on current data, assumptions and extrapolations).*
- *The actual quantity available for exploitation will only be known once inventories and Management Plans for PAUs are conducted and approved, and the quantity of Prunus africana on private land is registered.*
- *No harvesting in protected areas ensures the conservation of genetic resources and stocks for regeneration.*
- *The distinction between natural 'wild' and domesticated 'on-farm' Prunus has been into embedded into the exploitation regime using a certificate of origin.*
- *A new permit system has been devised and broadly agreed by stakeholders as a sustainable alternative to the current system.*
- *A consensus on an appropriate scientific and practical inventory method has been reached and will be formalised.*
- *A conservative harvesting technique and harvester certification has been agreed to address previous unsustainable practices.*
- *Revised monitoring and control procedures by the government and communities are agreed which address past failures.*
- *Necessary ongoing research needs have been consolidated, agreed and are being addressed. ANAFOR will coordinate this and disseminate results.*
- *Enabling coordinating mechanisms are being set up between ongoing projects and initiatives on Prunus africana, via the Prunus Platform. ANAFOR plays a critical role here.*
- *Awareness raising, education and involvement of actors in the chain on the meaning and requirements of CITES and national regulations is agreed.*
- *The promotion of domestication and planting by private, community and communes to increase stocks, coupled with a regeneration program for stock in the wild, particularly in protected area and private sector incentives to plant in natural forest is supported by the sector.*

For the long term (the next 3 to 30 years) management of Prunus africana in Cameroon, further exploitation will continue to be based on quotas. These will emerge in response to market demand as exploiters bid for Exploitation Units and gradually undertake inventories and present PAU Management plans to the Ministry of Forestry and Wildlife for approval. In this period, the ongoing work to build the capacity of CITES Scientific authority (ANAFOR) should also bear fruit. The results of ongoing projects which further support the Prunus africana sector domestication, support to small enterprises, changes in the legal framework of no timber forest product, domestication activities, ongoing research) will also show results and become gradually incorporated into national policy as appropriate.

3 Abbreviations

ACS	Adaptive Cluster Sampling
AFRIMED	Societé Africaine des Medicaments
ANAFOR	Agence National d'Appui au Développement Forestier/National Forestry Development Agency
ASL	Above Sea level (elevation in meters)
ASSOFOMI	Association of Oku Forest Management Institutions
ASSOKOFOMI	Association of Kom Forest Management Institutions
BfW	Austrian Development Service
CBO	Community Based Organisation
CBD	Convention on Biological Biodiversity
CEXPRO	Compagnie Commerciale pour l'exportation des Produits Forestiers
CF	Community Forest
CIAT	International Centre for Tropical Agriculture
CIFOR	Centre for International Forestry Research
CIG	Common Initiative Group
CITES	Convention on International Trade in Endangered Species of Wild Fauna
DBH	Diameter at Breast Height
DF	Department of Forestry, MinFoF
DFID	Department for international Development
DGA	Directeur General Adjoint
DHP	Diamètre à Hauteur de Poitrine
DPT	Department of Promotion and Transformation of Forest Products, MinFoF
EU	European Union
FAO	Food and Agricultural organisation
FMI	Forest Management Institution /Institution du Gestion du Foret
FMO	Forest Management Officer
FMU	Forest Management Unit
GFA	German Consulting Firm
GIC	Groupe d'Initiative Commune/Common Initiative Group
GTZ	German Technical Cooperation
ICRAF	World Agroforestry Centre
IER	Integrated Ecological Reserve
IITO	International Tropical Timber Organization
IRAD	Institut de Recherche Agricole pour le Développement/Agricultural Research for Development
ISSC-MAP	International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants
KFW	German Development Bank
LBG	Limbe Botanic Garden
MCBCC	Mount Cameroon Biodiversity Conservation Centre
MCP	Mount Cameroon Project
MINEF	Ministry of the Environment and Forestry/Ministère de l'environnement et Forêt (now MinFoF)
MINFOF	Ministère des Forêts et de la Faune/Ministry of Forestry and Wildlife
MOCAP	Mount Cameroon Prunus Management Common Initiative Group
MU	Memorandum of Understanding
NGO	Non Governmental Organisation
NTFP	Non-Timber Forest Product
NW	North West Region
NWFP	Non Wood Forest Product
ONADEF	Office National de Développement des Forêts (now ANAFOR)
PAU	Prunus Allocation Unit
PC	Plants Committee, CITES
PD	Provincial Delegate now called Regional Delegate
PFNL	Produits Forestiers Non Ligneux
PLANTECAM	Compagnie pharmaceutique Française du groupe Fournier
PMP	Prunus Management Plan
PSFE	Forest Environment Sector Programme
RIGC	Projet Renforcement des Initiatives de Gestion Communautaire des ressources forestièrres et fauniques/capacity buidling for Community managed forest and fauna resources initiatives
SC	Standing Committee CITES
SME	Small and Medium Size Enterprises
SMP	Simple Management Plan, Community Forests
SNV	Netherlands Development Organization
SRG	Scientific Review Group, CITES
STR	Significant Trade Review
SW	South West Region
SWEP	South West Environmental Project (GTZ)
SWRSF	South West Regional Forest Service (prior to MinFoF Regional Delegation)
SWEP	South West Environmental Project (GTZ/DED/KfW/WWF/WCS)
TRAFFIC	Wildlife Trade Monitoring Programme (IUCN and WWF joint programme)
WHINCONET	Western Highlands Nature Conservation Network

4 Objective

The objective of this document is to set out a pragmatic plan for the sustainable exploitation and use of *Prunus africana* in Cameroon. It proposes institutional, technical, legal and operational procedures for the sustainable management and harvesting and monitoring of *Prunus africana* in Cameroon in the short and long term. It identifies priority issues and the appropriate management scale.

The Plan was conceived and developed participativley drawing on meetings and discussions from 2007 to date, to ensure the broad consensus on the problems and solutions of the multiple stakeholders involved in the *Prunus africana* chain both nationally and internationally. This includes the Ministry of Forestry and Wildlife (MinFoF), the National Forestry Development Agency (ANAFOR), economic operators and private sector, community forest institutions, nature and conservation organisations, development agencies, research and scientific institutions.

The process of developing this management plan also enables stakeholders to communicate their planned management approach to organisations such as the Convention on International Trade in Endangered Species (CITES) and the European Union.

4.1 Approach and methodology

In September 2008 CIFOR supported the Cameroon CITES Management and Scientific authorities by attending the CITES Review of Significant Trade Recommendations meeting held from 8-11 September in Kenya. During this meeting a report entitled 'Evaluation of the harvest of "Prunus Africana" bark on Bioko (Equatorial Guinea) : Guidelines for a management plan'' (Clemente Muñoz et al., 2006) was presented as a excellent guide for other countries wishing to develop a Management Plan. An outcome of this meeting was a '*Prunus africana* Action Plan' (see **Error! Reference source not found.**) which outlined the steps needed meet the recommendations of CITES[1]. A national *Prunus africana* Management Plan is one of these steps. The Minister of Forestry and Wildlife made a specific request in October 2008 to the FAO as leader of the GCP/RAF/408/EC Project '*Mobilisation et renforcement des capacités des PME impliquées dans les filières PFNL en Afrique Centrale'* to support the development of this Management Plan. The FAO then commissioned CIFOR to elaborate a draft management plan. The partners in this project, FAO, CIFOR, SNV and ICRAF, have been collaborating with the Ministry of Forest and Wildlife, private sector, research and community based organizations in the *Prunus africana* market chain in the North West and South West of Cameroon since 2007. For more details see http://www.fao.org/forestry/43055/en/.

This document is inspired by the Bioko Guidelines (Clemente Muñoz, Navarro-Cerrillo et al., 2006) and is based on a review of published literature, reports and unpublished data (mainly from NGOs and two projects; the Mount Cameroon Project and the Bamenda Highlands Forest Project), baseline and inventory data on *Prunus africana* in Cameroon. Extensive use was also made of consultations and meetings with stakeholders in the *Prunus africana* chain from 2007 to 2009;

- Field visit, Rapid Prunus inventory & Prunus workshop, Oku, 30-31 March 2007 (SNV, MOCAP, ASSOFOMI, ASSOKOFOMI)
- MinFoF Status of *Prunus africana* consultation and observation mission to NW, SW and Adamaoua September- October 2007 (MinFoF)

[1] "Insuring sustainable Management and trade of *Prunus africana* in Cameroon", Proposal to CITES, September 2008, ANAFOR and MinFoF

- Prunus stakeholders meeting, Oku, 27-29 June 2007 (ASSOFOMI, ASSOKOFOMI, WHINCONET, Cameroon Biodiversity Conservation Society, SNV)
- Field visit on the situation of *Prunus africana*, Kupe Manengouba Division, June 2007 (SNV)
- Prunus stakeholders meetings, 12 July 2007, Fundong (ASSOKOFOMI, WHINCONET)
- Prunus stakeholders meetings, 17-18 July 2007, Kumbo, Oku (ASSOFOMI, WHINCONET)
- Prunus platform meeting, 12 October 2007, Yaoundé (MINFoF, ANAFOR, IRAD, SNV, FAO, CIFOR)
- Prunus Platform follow up, 13 November 2007, Fundong (ASSOKOFOMI, Whinconet, SNV)
- Prunus baseline study field research, North West and South West Cameroon, November 2007–January 2008 (CIFOR)
- Prunus problem analysis & state of chain workshop, Bamenda, 22-23 November 2007 (50+ actors including MinFoF & ANAFOR)
- Prunus platform Meeting, Yaounde, 16 January 2008 (50+ actors)
- Mission to Mbi FMI Traditional harvesting of *Prunus africana*, Bolem Ilim, 5 January 2008 (SNV)
- Training Workshop on Domestication of *Prunus africana* and other Agroforestry Tree Species, Belo, 29– 31 May 2008 (ICRAF)
- Prunus platform – inventory meeting of scientific advisers, Yaoundé, 27 August 2008 CIFOR, SNV, IRAD, ICRAF, University Yaoundé, University of Dschang, MINFOF, ANAFOR)
- CITES Workshop on Implementation of Review of Significant Trade Recommendations for *Prunus africana*, Naivsaha Kenya, 8-11 September 2008 (MINFOF, ANAFOR, CIFOR)
- Presentation to stakeholders, PROMOTE, Yaounde, 9 December 2008 (SNV, CIFOR, FAO, MOCAP)
- Prunus management plan meeting, Yaounde, 20 February 2009 (MINFOF, ANAFOR, GTZ, CIFOR)
- Prunus platform inventory meeting, Yaounde, 11 April 2008 (ANAFOR, SNV, FAO, CIFOR, MINFOF, GTZ)
- Prunus management plan Drafting meeting, Yaounde, 26 February 2009 (40+ actors)
- Importers-Exporters meeting on the Prunus management plan , Yaounde, 15 April 2009 (MinFoF, Synkem, AFRIMED, CEXPRO, Africapyhto, ANAFOR, CIFOR, ICRAF, Solvay)

These data sources were combined create a management plan which proposes a quota on the basis of inventories, verifies harvesting techniques and contains realistic control and monitoring regulations. The maps were created from CIAT-CSI SRTM PROCESSED SRTM DATA (Version 4.1 in decimal degrees and datum WGS84, derived from USGS/NASA SRTM data) (Jarvis et al., 2008). A first version of the Plan was presented in a drafting and validation workshop with stakeholders on 26 February 2009 and a subsequent workshop on 15 April 2009, with further feedback and data added until June 2009. The next step is for CIFOR and the FAO project to hand this draft Management Plan to the authorities in Cameroon for its finalisation and adoption.

CIFOR cooperated extensively with the German Technical Service (GTZ) in the preparation of this Plan. GTZ supported MINFOF through their Pro-PSFE program that provides support to the Cameroon Forest Environment Sector Program. GTZ also assisted the Ministry of Forestry and Wildlife to implement activities set out in the *Prunus africana* Action Plan, by commissioning a study in December 2008 'Setting up of a sustainable management system for *Prunus africana* in Cameroon' (Ndam et al., 2008). GTZ also cooperated on data collection and facilitation during and after the Drafting meeting.

5 Context

Cameroon supports some of the largest populations of the Afromontane hardwood pygeum (*Prunus africana),* a multiple used tree used traditionally for timber, fuel-wood and medicine. Its bark is also the raw material for the pharmaceutical industry producing drugs to treat prostate problems and health supplements. It is a major income source for forest based communities and enterprises. Also known as 'Pygeum', it is a key species in high altitude, montane mixed forest, vital to the biological diversity in a shrinking and increasingly degraded montane ecosystem 'hotspot'. However it is also an endangered species and fears of unsustainable exploitation have lead to its international trade being restricted since 1995.

This section provides background on *Prunus africana* to understand how policies and legislation have regulated and promoted *Prunus africana*. Knowing the trade circuits and uses helps to assess demand, whilst knowledge of the ecology of how and where *Prunus africana* grows allows demand to be equated with supply. The economic importance and social importance of *Prunus africana* is important in determining how it is and can be managed.

5.1 Policy background

Cameroon became a party to the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1981. The Convention was enacted into Cameroonian law by Decree No 2005/2869/PM of 29 July 2005 "Fixing the modalities of the application of certain dispositions of the CITES Convention in Cameroon'', and Decision N° 0104/D/MINFOF/SG/DF/SDAFF/SN of 2 March 2006 designating ANAFOR as the CITES Scientific Authority for plants, and Arrêté No 067/PM of 27 June 2006, prescribing the organisation and functioning of the Inter-Ministerial Committee of Coordination and Monitoring of the implementation of CITES.

CITES is an international agreement between governments to ensure that international trade in specimens of wild animals and plants does not threaten their survival. *Prunus africana* was listed as a CITES Appendix-II species in 1995. This listing means *Prunus africana* is not threatened by extinction, but may be so if trade is not regulated, as there were concerns that bark entering the international market all is from wild harvest. Recent studies have since shown (Awono et al., 2008; Foaham et al., 2009) that it is domesticated to a larger extent that previously realised in Cameroon.

At the 12th CITES meeting (Leiden, May 2002), the Plants Committee selected *Prunus africana* for a Significant Trade Review (STR). The significant trade review process aims to identify problems and solutions in implementing the Convention and should act as a safety net by ensuring that species do not decline because of international trade while they are listed in Appendix II. The review process can result in individual exporting countries being assisted to undertake field studies as well as to develop the technical and administrative capacity necessary to implement the requirements of Article IV, if these are lacking. Without this review process the alternative would be to transfer the species to Appendix I where no commercial trade is allowed. CITES prepared a guidance manual for to aid the determination of a scientific non-detriment findings in 2002.

The European Union (EU) has its own CITES Regulation, which is legally binding on its 27 Member States [Council Regulation (EC) No 338/97 of 9 December 1996 on the protection of species of wild fauna and flora by regulating trade therein]. Under this Regulation, imports of *Prunus africana* into the EU of – listed in Annex B – are covered by the provisions of Article 4. Bark imported by the EU is assumed not to have a harmful effect on the conservation status. This must be determined by the Scientific Authority of the importing member country, and by the Scientific Review Group

(SRG), made up of the scientific experts of the member countries. In July 2004, the SRG suspended trade with the Democratic Republic of Congo, due to unsustainable quantities harvested, and requested information from other range states – Equatorial Guinea, Tanzania, Cameroon, and Madagascar – on how they were managing the resource. Failure to provide these data could lead to suspension of trade with the EU. In December 2004, the SRG analysed the information received and agreed to allow imports from Equatorial Guinea and Tanzania, lift the trade ban on imports from the Democratic Republic of Congo, and to analyse any application for exports from Cameroon, Madagascar, Kenya, or Uganda. The SRG decided in March 2005 to provisionally allow imports from Cameroon and Madagascar. In June 2005 a request was made for further data from Cameroon on how the quota presented was calculated.

At the 16th meeting of the CITES Plants Committee (Lima, 3-8 July 2006), the STR was presented. It contained five main recommendations. Firstly, that *Prunus africana* is maintained under CITES Appendix II listing. Secondly, that the terms "extract" and "powder" are clarified for reporting purposes. Thirdly, that independent, peer reviewed ecological studies and matrix population modelling are conducted in Kenya, Tanzania, Madagascar, Equatorial Guinea and Uganda and that neither research nor managed, sustainable harvests were likely in Burundi and the DRC due to political instability. Fourthly, that when a bark harvest quota is set by exporting countries (such as Cameroon and Equatorial Guinea), that EU importing countries adopt the quota level set by the exporting Range State. To date, no EU importing country has implemented this measure. Fifthly, that range States and international agencies support and monitor cultivation of *Prunus africana* as wild harvest is seen as a short-term measure and a transition to cultivation into agroforestry or plantation production is necessary. A *Prunus africana* Working Group was established at the CITES 2006 Lima meeting to guide the relevant countries on the implementation of the STR recommendations and subsequently classified *Prunus africana* trade from Cameroon of 'urgent concern'. The Committee adopted the following general recommendations at international level to be implemented by the Range States (with no time limit specified):

- Effectively foster implementation of management plans in Range States;
- Coordinate complete studies of the populations of *Prunus africana* across the whole of its range;
- Coordinate the future studies in the range area with methods used on Bioko for evaluating *Prunus africana* production in natural ecosystems;
- Ensure the quality of studies and follow-up of management plans for the species;
- Encourage international cooperation projects that promote the use of *Prunus africana* in agroforestry systems and plantations, using proper genetic diversity and optimizing propagation and agroforestry cultivation techniques. A management model for Non-Timber Forest Products formed the basis for the methodology, designed to prepare the necessary guidelines for implementation of a Management Plan for the species on Bioko (Equatorial Guinea). The integral methodology aims to aid evaluation of national situations, to know whether bark harvest is suitable or whether it is affecting the conservation status of the species, and to propose corrective measures, as needed, to achieve sustainable use. The study was devised as a pilot project, covering a pre-selected area under 150,000 ha in Equatorial Guinea; it could give rise to a survey model and be applicable to other countries.

At the same meeting, a report of a pilot study in Bioko, Equatorial Guinea was presented (CITES reference PC16 Doc. 10.2.10) which developed a survey and management plan as a model which could be applied to other countries and areas. The 'Evaluation of the harvest of "Prunus Africana" bark on Bioko (Equatorial Guinea) : Guidelines for a management plan'' (Clemente Muñoz et al., 2006) was accompanied by recommendations to the Plants Committee that at an international level measures be directed to international organizations, countries and industries with a stake in imports, exports and trade in products derived from *Prunus africana* bark and that CITES should effectively foster implementation of management plans in range countries. Also that CITES should coordinate the promotion of *Prunus africana* population surveys, encourage international cooperation to advance the use of *Prunus africana* in agro-forestry systems and plantations, including proper genetic diversity and optimizing propagation and agroforestry cultivation techniques; coordinate methods used on Bioko Island for evaluating *Prunus africana* production in

natural ecosystems with other methodological proposals in CITES and ensure the quality of studies and follow-up of management plans for the species.

The STR also made the following recommendations in July 2006, specifically that Cameroon should:

Within 3 months:

- In consultation with the CITES Secretariat and the Chair of the Plants Committee, reviews current export quota and establishes a conservative reduced quota for export of *Prunus africana* parts and derivatives.
- Clarify the presence of a working facility to process and export extract, in addition to bark and powder and inform the Secretariat of what parts and derivatives they plan to export (bark, powder, extract).

Within 1 year:

- Complement work already carried out on Mount Cameroon, in other areas subject to harvest, carry out a inventory of standing stock, establish estimates of sustainable off-take, taking into account the need to conserve large seed producing trees, and establish a scientific monitoring system of the harvested and un-harvested *Prunus africana* populations.
- Establish a revised conservative export quota based on the inventory of standing stock and the estimates of sustainable off-take.
- The Management Authority should collaborate with the Management Authority of Nigeria to enhance the monitoring of trade in Prunus between Cameroon and Nigeria.
- Provide a timetable to carry out peer reviewed ecological studies and appropriate population modelling of *Prunus africana* in order to establish a long-term management plan for the sustainable use of this species.

Within 2 years:

- The Management and Scientific Authority should report the final version of the long-term management plan and progress made against that plan, to the Secretariat.

Since the CITES Lima meeting in 2006, a broad wish to continue harvesting and exporting has existed among actors in the Cameroonian sector. Many actors participated in activities, research and programmes which have directly or indirectly contributed towards meeting the CITES Lima recommendations. These include:

- A mission to research current status of the main prunus productions regions by MinFoF Department of Forests and ANAFOR in September 2007 and the preparation of the terms of reference for a national inventory
- The Universities of Dschang and Yaoundé, IRAD and Bioversity International, Austrian financed project studying the genetic diversity of *Prunus africana*
- ANAFOR support from International Tropical Timber Organisation (IITO) for capacity building of the Cameroon CITES scientific authority
- FAO-SNV-CIFOR-ICRAF EU financed project to support small and medium enterprises n the non timber forest sector - which includes the *Prunus africana* market chain in the North west and South West of Cameroon,
- Forest Governance Facility and SNV support for Prunus harvesting training with community forest associations in Kilum Ijum in the North West
- The Netherlands Development Organisation's (SNV) capacity building support to Community Forests Associations in Kilum Ijum
- Project RIGC supporting the development and implementation of Community forests Simple Management Plans
- Participation of a Cameroonian delegation at the meeting of the CITES Plants Permanent Committee in July 2008
- Dr Kristine Stewart's long-term research on *Prunus africana* regeneration in Kilum Ijum from 1998 to 2008.

- The Western Highlands Conservation Network (WHINCONET) developed a project for the World Bank Marketplace Development to improve the functioning of the Prunus chain
- The participation of a Cameroonian delegation at the workshop organised by the CITES Plants Committee in Kenya in September 2008
- GTZ supporting MINFoF through the Forest Environment Sector Programme (PSFE), to set up a sustainable management system for *Prunus africana* and as part of the SW Environmental Program, which includes setting up national parks on Mt Cameroon and Takamanda, both prunus production areas.

Despite these activities, the "reasoned recommendation" and "scientific non-detriment finding" have been difficult to establish, due to a lack of basic information and absence of a system to collect and analyze information that is accurate and sufficiently robust to make informed decisions. Cameroon was unable to fully meet the requirements of Lima or convince the SRG. The European Commission SRG subsequently informed Cameroon in October 2007 of its negative advice on the import of *Prunus africana* to European Union member states. The Ministry of Forestry and Wildlife of Cameroon responded by creating two Ministerial Circulars (see **Error! Reference source not found.**) in November 2007 outlining management measures, setting procedures for gathering statistics and stating administrative requirements. As the recommendations of Lima 2006 were not met, trade to the EU remained suspended in 2008, including for 646.5 tons in stocks from harvest in 2007.

Other range states also had problems to meet the Lima recommendations, despite a delay in the deadline to December 2008. The CITES Working Group therefore organized a workshop (in Naivasha, Kenya from 8-11 September 2008) to enhance the skills of CITES Management and Scientific Authorities of the seven priority countries, which includes Cameroon as one of the biggest exporters. The workshop included sessions on how to conduct non-detriment findings, collecting baseline data, formulating quotas and developing management techniques; and assisted in the development of communication channels and collaborative mechanisms between the CITES implementation authorities of the priority range States, the importing countries, the CITES Plants Committee and the CITES Secretariat. During this meeting Cameroon provided a report on the Management of *Prunus africana* in Cameroon. An action plan was developed in September 2008 to meet CITES recommendations entitled 'Ensuring sustainable Management and trade of *Prunus africana* in Cameroon'.

5.1.1 International Standards

The *International Standard for Sustainable Wild Collection of Medicinal and Aromatic* Plants (ISSC-MAP) was developed by the Medicinal Plant Specialist Group of the Species Survival Commission, IUCN, the German Federal Agency for Nature Conservation / Bundesamt für Naturschutz (BfN), WWF Germany, and TRAFFIC (Medicinal-Plants-Specialist-Group, 2007). It aims to meet the needs of industry, governments, certifiers, resource managers, and collectors to understand whether wild collection activities for medicinal and aromatic plants are sustainable, and how to improve collection and resource management operations that are detrimental to the long-term survival of these resources. Implementation of the ecological elements of ISSC-MAP in CITES and the Convention on Biological Biodiversity (CBD) is one of the priority implementation scenarios identified for ISSC-MAP. Thus the ISSC-MAP provides NTFP best practices (Leaman, 2008) and it aims to provide information for national regulations on the management of NTFPs. The objectives of this Standard are:

- To provide a framework of principles and criteria that can be applied to the management of MAP species and their ecosystems;
- To provide guidance for management planning;
- To serve as a basis for monitoring and reporting; and
- To recommend requirements for certification of sustainable wild collection of MAP resources.

The FAO has produced a regional guideline based on the ISSC-MAP '*Guidelines on Sustainable Management of NTFPs in the Central African Region'* (2008) which provides practical guidance for the allocation of permits for NTFPs. It recommends that the national authority in charge of NTFPs plans in space and time, based on the evaluation of resources, and in accordance with a transparent and participatory procedure, the granting of exploitation permits for NTFPs. In the case of threatened NTFPs, the national authority in charge of NTFPs bases the attribution of an exploitation permit on results of an appropriate inventory and consequently fixed quotas. The inventory of NTFPs is the prerogative of the state. However, the state can sub-contract this activity and take charge of controlling its implementation and results.

The attribution of exploitation permits for NTFPs should be subject to the following minimum norms and procedures;

a) requirement of prior accreditation as a professional exploiter of NTFPs subject to conditions that are more flexible than in the case of exploitation of timber
b) their attribution by the competent authorities
c) Definition of a simple content of affordable cost with minimum provision for an application dossier. This dossier shall consist notably of the following elements:
    i. an application,
    ii. a certified copy of the certificate of professional accreditation,
    iii. a tax certificate,
    iv. an attestation of payment of taxes on previously granted permits,
    v. a note of information on modalities of collection, storage and transportation of the produce concerned,
    vi. definition of reasonable deadline for the treatment of applications, stating the legal consequences of silence from the competent administration and open recourse,
    vii. the putting in place of a way of attribution guaranteeing transparency and profitability of the practice,
    viii. the possibility of attribution of non-threatened NTFPs,
    ix. promotion of professionalization of the trade and of investment,
    x. promotion of involvement of local communities and indigenous people;
    xi. In respect of the principles established by the Convention on Biological Diversity (CBD), prior consent given by the local communities and indigenous people is required because use of their knowledge and traditional practices is envisaged.

The competent authority indicates in the NTFP exploitation permit:

a) The identity of the permit holder,
b) The date of issue and expiration. The duration should vary as a function of the type of produce and the segment of the activity considered,
c) The exploitation zone, described in as much detail as possible,
d) The authorised products, and in the case of threatened NTFPs, the attributed quotas,
e) The right or prohibition of the holder to surrender or give it on rent.

Within these conditions and in accordance with modalities to be laid down by each state, the competent authority ensures that each exploitation permit is accompanied by a 'Cahier des Charges' containing general clauses and specific clauses.

5.2 Legal context

Commercial exploitation of *Prunus africana* in Cameroon began in 1972, and regulation started in 1974 (Decree No. 74/357 of 17 April 1974). Plantecam (formerly SODEXMEDI) received a permit to exploit Prunus on Mount Cameroon in October 1976, following three failures. Plantecam then obtained yearly permits to exploit at least 500 tons of Prunus per year for the years 1976±1983 and obtained five-year permits to exploit 1300 tons a year for 1986±1991 and 1991±1996. Additionally, three permits were issued to Cameroonian companies, but were not exercised. Other legal measures included the prescription of technical debarking rules in 1986; the requirement to plant 3 hectares of Prunus per year from 1986 and 5 hectares per year from 1992; the amendment

in 1994 of the Forestry law of 1981. The 1981 regulation (Law No. 81/13 of 27 November 1981) for obtaining a permit from the Minister of Agriculture was set up following comments upon the technical and financial details of the exploitation by the Provincial Chief of Forestry. The Law of 1994 (Republic of Cameroon, 1994 and its decree of application, Decree No. 95/531/PM of 23 August 1995) refined this procedure by requiring the Provincial Chief of Forestry to attach a technical report specifying the method of harvesting and the quantities of each species to be exploited.

Prunus harvesting and export have been regulated[2] as a 'Special Forestry Product' since 1994, through a system of annual, non-renewable, tonnage based exploitation permits for dried bark harvested nationwide and/or from specific regions zones allocated by auction. Qualifications are described in the Forest, Faunal and Fisheries Regime (Law No 94/01 of January 20th, 1994) and in the use of this regime (Decree No 94/436 of August, 23rd 1994). Permits are granted by an Inter-Ministerial Committee, based on technical reports from Provincial Chiefs of Forestry which should provide a ''reasoned recommendation'' of the species, quantities, exploitation areas and harvesting modalities. A ''Regeneration Tax'' of 2% of the quota value is payable to the Government, by permit holders, in three or two instalments, one of which is an advance. Since 2006, support and promotion of regeneration activities is the responsibility of the National Forestry Development Agency (ANAFOR). Felling of trees, without special permission, is illegal. The delivery of a license is accompanied with a report book describing clearly the harvesting practices according to the vegetative structure to be extracted. Prunus seized after having been illegally harvested (without a simple management plan or sold to a person without a permit) is auctioned at a public sale. The buying price is usually below the current market price. The buyer, who does not need a permit, pays the Treasury and an additional 12% of the buying price goes to the MinFoF delegation making the seizure.

There have been a number of bans on Prunus exploitation due to unsustainable exploitation. In 1991-1992 there was temporary national partial ban on exploitation. November 1999, the Ministry of Forestry and Wildlife of Cameroon issued an 'Arrete' which specified control systems, and the governor of the South West province imposed a complete ban on harvesting. In May 2005 the Divisional Delegate of Bui (Ref E26/PS/126 Prefectural Order N° 17/2005) suspended all exploitation of Prunus from the "Oku forest" until further notice. In May 2006 the Sub Divisional Delegate of Oku (Ref E26.03/GSB/19/S.1/288 Sub-Prefectural Decision N° 3) suspended all exploitation of Prunus from Oku sub division until sustainable harvesting provisions were put in place. In December 2006 the Fon (traditional chief) of Oku suspended all exploitation of prunus from Oku sub division until further notice. This resulted in a reduction in quantity of Prunus reported as being 'illegally' exploited i.e. exploited from Community Forests although not in planned in the Simple Management Plan for either the period or area in question).

5.3 Trade

Over the past 40 years, the trade in *Prunus africana* bark harvest from Cameroon has changed from subsistence low volume use as a local medicine and for timber and fuel-wood, to a high volume, international trade predominantly driven by the European and American pharmaceutical industry and the 'botanicals' health product sector. Comprehending the past and predicted requirements of consumers is a critical factor in creating a sustainable match between demand and supply.

5.3.1 International trade

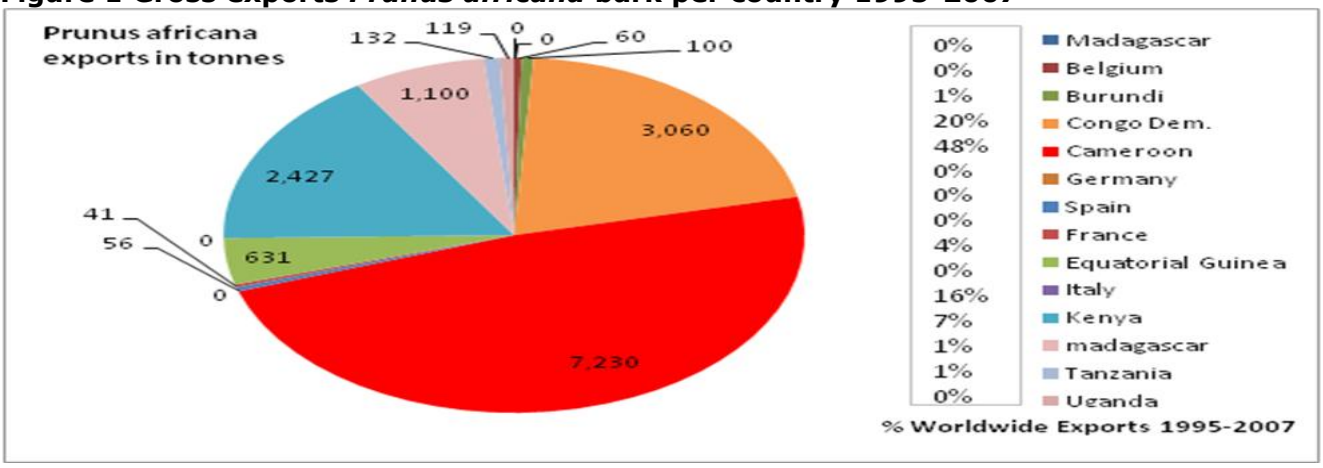
International interest in the species began in the 1700's when European travellers learned from South African tribes how to soothe bladder discomfort and treat "old man's disease" with the bark. Bark extract has been used in Europe since the mid-1960s to treat men suffering from benign

[2] Decree No. 74/357 of 17 April 1974; Law No. 81/13 of 27 November 1981; Decree No. 83/169 of 12 April 1983; Law No. 94/01 of 20 January 1994 and its decree of application, Decree No. 95/531/PM of 23 August 1995

prostatic hyperplasia or hypertrophy (BPH) and currently, *Prunus africana* is the most commonly used medicine in France for BPH. Trade has grown as Prunus has emerged as the main raw material for the international pharmaceutical trade in BPH treatments. At least 40 brand-name products currently use *Prunus africana* bark extract, which are marketed directly in 10 countries and globally through the internet (Pomatto, 2001; George Wittemyer, 2008). Its economic importance is indicated by Cameroon's annual export of some 7300 tonnes since 2005, providing annual export revenues of about 1320 million CFA (2,738,027 US$). It is also one of the major income sources for forest based communities in the Highlands areas of Cameroon (Ewusi et al., 2001; Ntsama, 2008).

Nearly half of the world's bark supply to date has come from Cameroon. Cameroon was the world's largest exporter of Prunus with 38% of the market share from 1995 (when WCMC trade records commenced) to 2004 and 48% since 2004, when Kenya stopped exporting (see Figure 1**Error! Reference source not found.**). Cameroon is one of the major sources of all parts of *Prunus africana* (Barks 29%, 31% extract, 34% powder and 6 derivatives and 1% dried plants from 2000 to 2007). The main countries importing Cameroonian Prunus since 2000 have been France (53% of imports), Spain (31%), and Madagascar (11%), with India USA, Belgium and China all at 1% (see Figure 3).

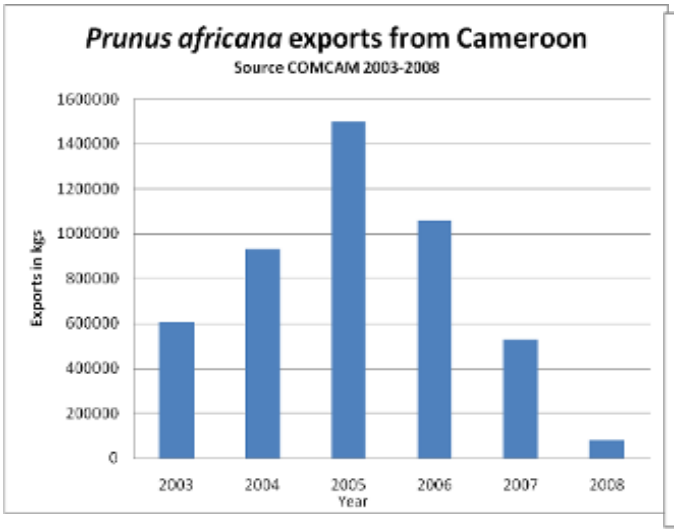
Figure 1 Gross exports *Prunus africana* bark per country 1995-2007

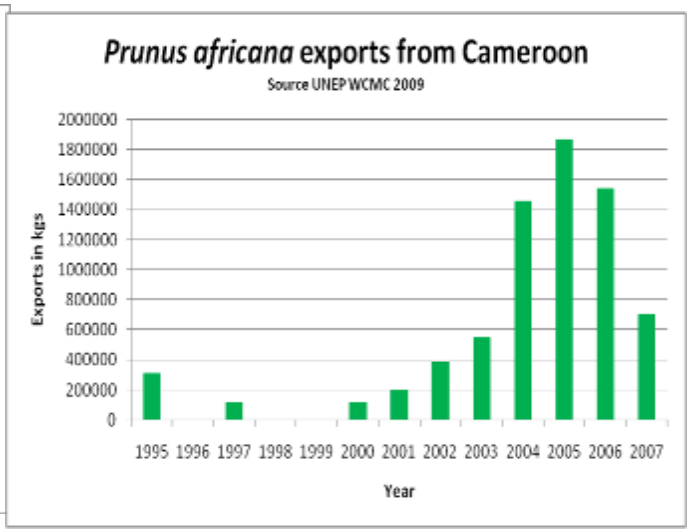


Source UNEP WCMC

The UNEP WCMC database (WCMC 2009), MinFoF national database COMCAM (MinFoF 2008), interviews with community forests and MinFoF regional delegates and the annual MinFoF Decisions on Special Forestry Product quotas all provide data on the extent of production and export of *Prunus africana*, which are presented in Figure 2 and Figure 3. The data is not complete for all years and there are some inconsistencies between amounts in some years.

Figure 2 *Prunus africana* production in Cameroon





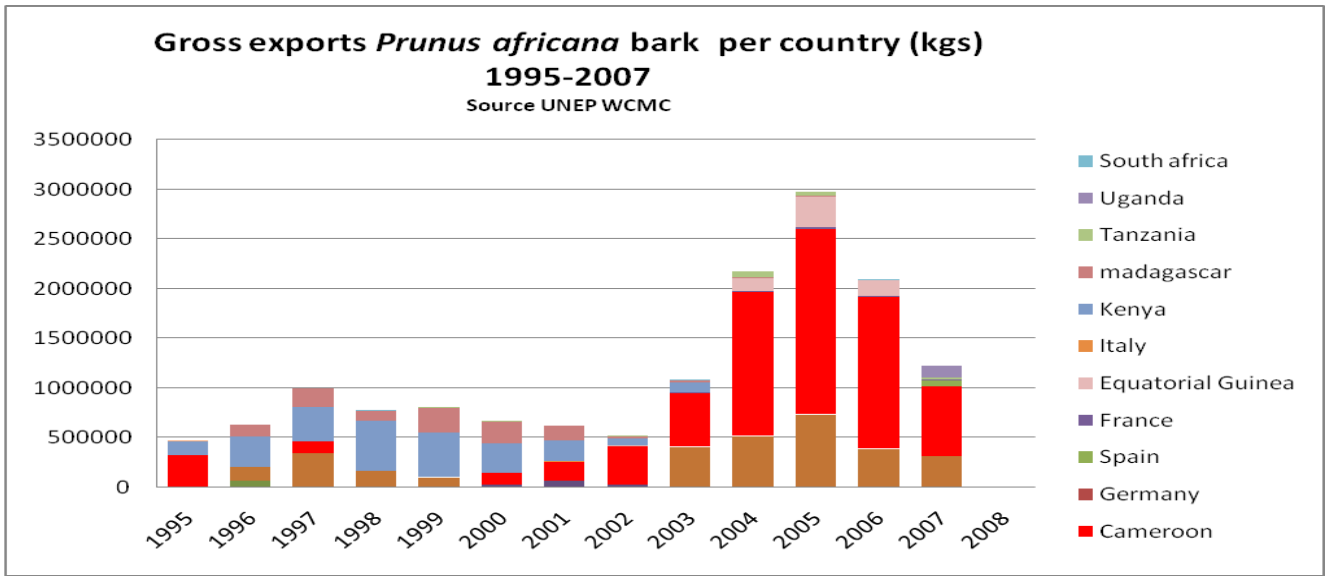


Figure 3 *Prunus africana* production and export figures

In 1972 Plantecam, a subsidiary of the French company Laboratoires Debat, obtained a monopoly of the trade in *Prunus africana* bark and dominated the market from 1974 to 2000. In 1985 the Ministry of Forestry and Wildlife of Cameroon issued additional licences for *Prunus africana* bark exploitation to 50 entrepreneurs (Cunningham and Mbenkum,1993). In in the five–year permits of 1986 and 1992, Plantecam was permitted to fell 10 000 and 12 000 trees, respectively. Only the bark was taken from the felled trees. This practice was later banned in 1993 (Ndibi et al., 1997). By 1994 there were 70 permit holders in the North West Region; each allowed 100 tons of bark. In 2000 up to 50 companies obtained licenses. Since 2003, over 20 companies have been active in the sector, with intermediary 'buyam sellams' (Awono and Ingram 2008), selling to permit holding enterprises. From 1985 to 1992, the majority of bark sold to Plantecam was from the Bamenda Highlands in the North West (Cunningham and Mbenkum, 1993). On average over the last 5 years, five companies a year have been permit holders. The major players are indicated in Figure 4.

Figure 4 Major permit holders Cameroon

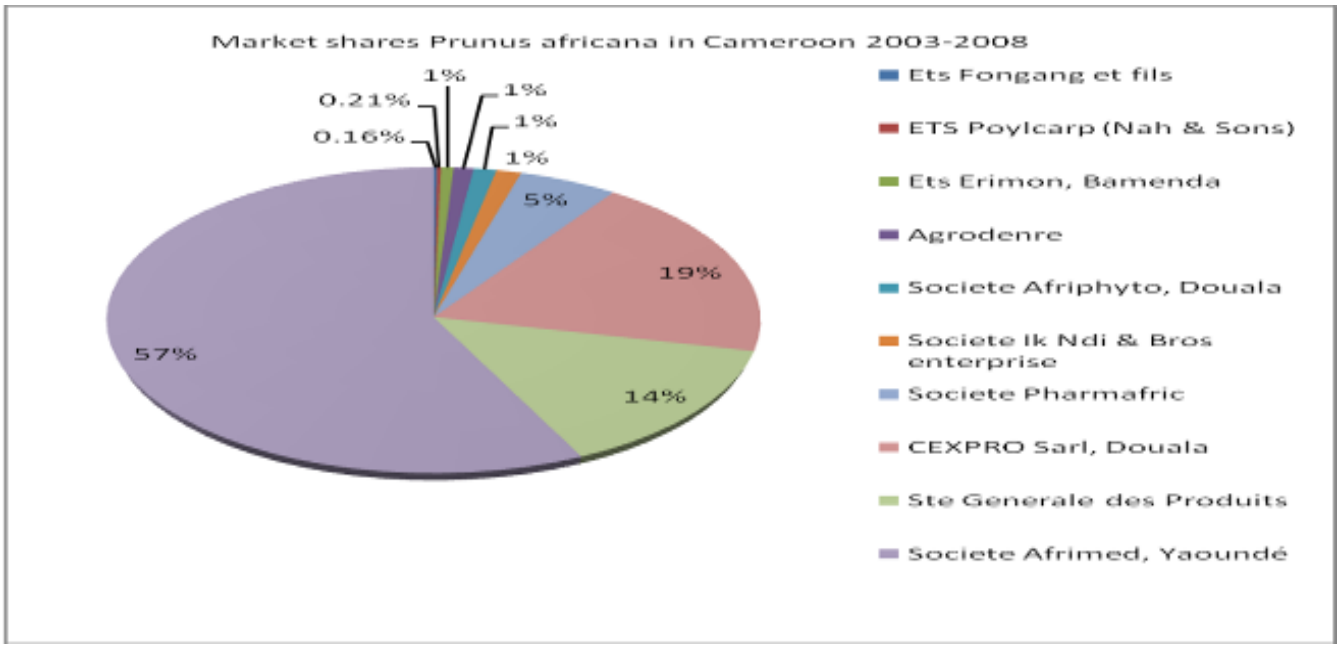

Market shares Prunus africana in Cameroon 2003-2008
1%
0.21%
1%
0.16%
1%
5%
19%
57%
14%
Ets Fongang et fils
ETS Poylcarp (Nah & Sons)
Ets Erimon, Bamenda
Agrodenre
Societe Afriphyto, Douala
Societe Ik Ndi & Bros enterprise
Societe Pharmafric
CEXPRO Sarl, Douala
Ste Generale des Produits
Societe Afrimed, Yaoundé

Table 1 Prunus Permit holders in Cameroon

Enterprise	2003	2004	2005			2006				2007				2008				2002-2008	
			Quota	Exploited	Market	Quota	Exploited		Market	Quota	Exploited	Area[1]	Market	Quota	Exploited	Area	Market	Total Qty	Total Mkt Share %
			Tonnes	Tonnes	%		Tonnes		%	Tonnes	Tonnes		%	Tonnes	Tonnes		%		
Agrodenre				15.1	1		All	40	3			All						55	1
CEXPRO Sarl	52	213		340 SW 0	19	180	NW SW	15 34	1	200	162		13					782	14
							All	285	19									285	5
Ets Effa JBP & Cie		X		x		√												0	0
Ets Erimon		X		x		50	NW	35	2		x	L			x			35	1
Ets Fongang et fils				x		50	NW	9	1	50		L, S, W, NW, SW, A, C	3					9	0
ETS Koguep G.										44			3					0	0
Ets Nguennag Emmanuel						20												0	0
ETS Poylcarp							NW	12	1									12	0
Ets Tay & Freres						√												0	0
Medou Njembe et Fils						40						NW, SW						0	0
Nah & Sons Enterprise						√		x										0	0
Ngadema Daniel						√						A, SW						0	0
Ste Afrimed	553	553		1169 SW 274	66	520	NW SW	10 43	1	550	125	L, W, NW, W, A, C	35	150	0	TM	30	2506	45
							All	709	47									709	13
Societe Africaphyto				50	3	√	NW	14	1	160			10	100	0	TM	20	64	1
Ste Bois et Metal						50									x			0	0
Societe Catraco						10		x			x			50	46	TM	10	0	0
Societe ENEC						√												0	0
Societe Equato Bois						√												0	0
Societe Ik Ndi & Bros Enterprise		14		38	2	√	All	9	1		9	All						70	1
Societe ITTC						√				50		L	3					0	0
Societe Margo						√				20			1					0	0
Ste Mukete Plantation						10						L,NW,A, C						0	0
Societe Pharmafric						170	All	120	8	170	80	All	11	100	80?	TM	20	280	5
Societe Prodegon GIE						√				20			1					0	0
Societe Saco						√						A, SW						0	0
Ste Generale des Produits		150		150 SW 14	9	340	All SW	335 14	22	300	150		19	100	o		20	785	14
MOCAP			100[3]	87		70		0		40			3						
Total	**605**	**930**		**1762** NW 863 SW 228	**100**	**2000**	NW SW	**1497** 796 91	**100**	**1604**	**525** 97	**NW**	**100**	**500**	**126?** 6	NW	**100**	**5591**	**100**
No permit holders	2	4		6		10		10		11	5			5	1				

[1] Regions; All = All provinces, NW = North West, SW = South West, A = Adamaoua, L = Littoral, W = West, TM = Tchabal Mbabo x= unknown quantity

[3] Figure from MinFoF Buea – reported in Ntsama 2008 [4] Data from MinFoF North West Regional Delegation, February 2009

Although incomplete data is available to show the proportion of Prunus coming from each Province, records maintained in some regions provide an indication of the sources and corroborate data from the NW community forests and Mt Cameroon in the SW that they are two of the most important sources of *Prunus africana*. Collection of this data on a regional level was not a requirement of MinFoF.

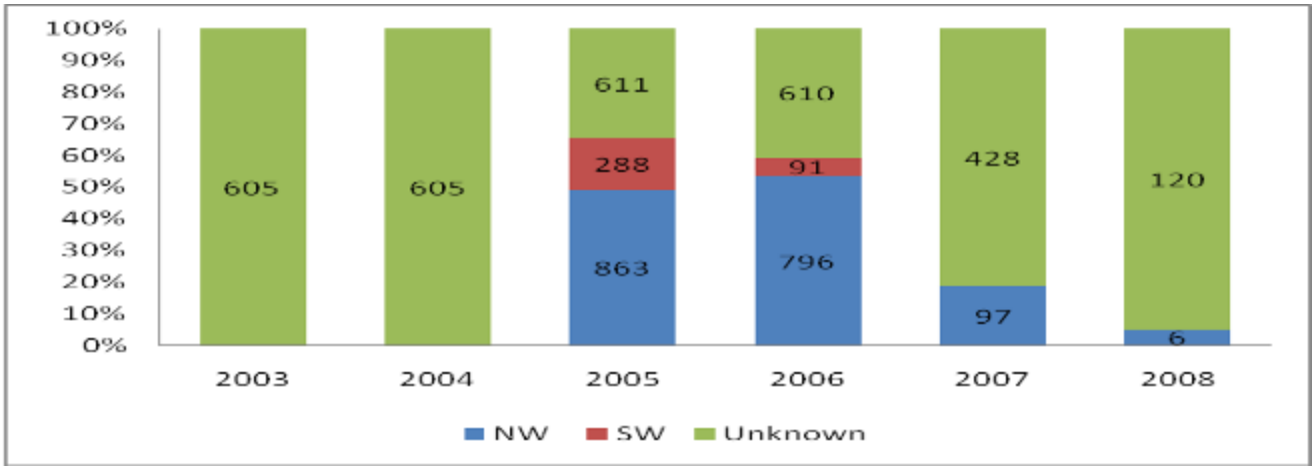


Figure 5 Source of Prunus per region in tonnes (2003-2008)

5.3.2 National trade

In Cameroon, *Prunus africana* has multiple uses, ranging from its timber used for tool handles and as poles in construction and fencing (Tangem, 2008), to a fuel wood, particularly for charcoal (Stewart, 2003; Ingram and Nsawir, 2007). Prior to 1972 *Prunus africana* bark was harvested on a small-scale local medicinal use in the North West and South West, in much the same method still used today taking small approx 10 x 10 cm patches from living trees (Ingram, Niba Fon et al., 2007). The most reported trade in the tree is its bark used as a traditional medicine. Increasing scarcity in natural forests appears to have changed usage such that it is used less often as timber or charcoal, and more for its higher value, local medicinal use, than two decades ago (Pers com. ASSOKOFOMI and ASSOFOMI Delegates, June 2007). Prunus harvested for use as fuel or charcoal tends to be directly sourced by individuals from forests or privately owned stands and is not traded any more commercially (Pers comm. ASSOKOFOMI and ASSOFOMI Delegates June 2007).

The commercial trade in *Prunus africana* for cash on a national level generally concerns its bark. This national, internal trade was the main trade in *Prunus africana* for medicinal use in Cameroon until the Plantecam factory opened in 1972 (Cunningham et al., 2002). Although no official figures are available, research (Awono et al 2008; Ingram, 2007) indicates that the trade is small scale and low volume. A rapid assessment of markets in Bafoussam, Bamenda, Kumbo and Dschang in December 2007 indicated that an average 1kg of dried *Prunus africana* bark was available for sale by vendors of traditional herbs and spices in each market. Between 2 to 5 vendors had permanent stalls in these markets. The main sources of *Prunus africana* were cited as the North West 'Oku' and Southwest "Mt Cameroon', if sources were known at all. Turnover was reported as low (up to 6 months to sell stocks). In villages which have a reputation as centres of traditional medicine, such as Oku, Fundong and Belo in the Northwest, Wonya Mavio and Lebialem in the Southwest, higher turnover was reported by traditional medicine practitioners with all the product sourced locally, often from trees in or near villages or at the edge of the forest. About 80% of herbalists in the Southwest are reported to use *Prunus africana* as one of 24 commercialised plants, out of a cornucopia of over 177 plants used (Nfi et al., 2008).
There is also a trade in bark for veterinary use, which also which appears to be mainly local and small scale (Nfi et al., 2001; Stewart, 2003).

5.4 Development context

This section presents the economic importance of the trade in *Prunus africana* to the livelihoods of those involved in the sector in Cameroon.

5.4.1 Income and employment

The contribution of *Prunus africana* to local communities and individual households in the main producing areas of the North West and South West of Cameroon has been significant over the last three decades. Figures are available mainly for community-based exploitation since the liberalization of the market in 2000.

Cunningham and Mbenkum carried out a study in 1993 of the trade of *Prunus africana* taking into consideration legal and illegal exploiters and destruction of the wild stock by unsustainable practices. Ewusi in 1998 reported conflicts between members of the Mount Cameroon communities (local Prunus harvesters) and the workers of the forestry services, MCP and Plantecam Medicam because of the scramble to make maximum benefits from the *Prunus africana* trade. These conflicts led to continued illegal activities until November 1996. The then Mount Cameroon Project facilitated a process of conflict management in an attempt to solve these problems by developing partnership between local communities, Ministry of Forestry and Wildlife and business, for sustainable harvesting and upon the premise that long term resolution required an increased benefit to local communities. After the MCP's intervention, local *Prunus* harvesters in Mapanja who had been involved in illegal harvesting of *P. africana* decided to form a union with the authorization and support of their chief. This example was followed by the Bokwoango *P. africana* harvesters. The chiefs of these two communities realized that the scramble for *P. africana* bark and frequent conflicts in their communities posed a problem that required timely intervention. The local harvesters elected an executive and drew up rules and regulations to bind the union. A mixed team was also formed made up of representatives from the harvesters' union, community elders, including women. This study indicated that since the Bokwoango *P. africana* harvesters' union existed; the socio-economic changes in this community were encouraging compared to the situation prior to the union.

These Unions merged to become MOCAP, which in 2007 employed over 150 young men and women directly in field bark harvesting activities, with some 50 women involved in related petty-trading activities (Ekatie et al., 2006). As an average harvester is young, male and married, and supports on average 7 others in a household, the indirect effects of this income are significant. For example, in 9 of the 14 villages associated with MOCAP around Mt Cameroon, revenues from Prunus harvesting for 125 harvesters were significant, on average 5500 a day, with 3100 CFA a day as profit. This is despite price fluctuations ranging between 60 to 215 CFA per kg per year, with an average price of 167 kg over this period. *Prunus africana* accounted for between 70 to 90%, with an average of 80%, of household income for these harvesters in 2 villages and was the highest source of income; although all harvesters had at least two other sources of income, mainly agricultural, their dependence n this source of revenue was substantial. Building sanitation facilities (51%) to foods and medicines (40%) (Chupzei 2008). Prunus incomes are used for a range of basic needs, from education of children 71% of harvesters,

MOCAP's benefit sharing mechanism resulted in an annual average income for 9 villages ranging from 142,330 (Woteva) to 776,842 CFA (Mapanja), being influenced by the number of harvesters in each village (Ntsama, 2008). Revenues from Prunus harvesting are shared by the 9 active MOCAP member villages, with 15.4% of revenue (260 FCFA/kg for prunus sold through the MOCAP group) goes into a village development fund, financing mainly sanitation and community buildings in the villages, out of which 90% is equally shared among member villages, 7.5% among resource custodians (chiefs) and 2.5% given as compensation to host village (Tieguhong et al. 2008). Non-member villages get 31% less, and prunus is sold by individuals, not by the community (Tieguhong et al., 2008).

The exploitation of Prunus has had a positive and significant effect on poverty alleviation for harvesters in villages around Mt Cameroon, but that at the same line it does causes significant damage to environment, such that in the long term, if sustainable management is not practiced, the exploitation of Prunus in the wild will provide decreasing revenues and therefore not contribute in the long term rural poverty alleviation (Ntsama, 2008).

From 1985 to 1992, most of the bark sold to Plantecam originated from the Bamenda Highlands. By 1994 70 permit holders were each transporting 100 tons of *Prunus africana* bark. Special permit holders were supposed to have a monopoly over bark harvesting in a designated area, but these boundaries are ignored. This benefited the farmers, who could negotiate higher prices but in so doing allowed an open-access situation where was in the interests of each permittee to fell trees because if he didn't, someone else would. In the North West Province, there was a big increase in bark exploitation, including the theft of bark from trees on private land. In rural areas, farmers were paid 30-70 FCFA per kg of bark. Plantecam purchased from 104 FCFA/kg for poor quality, high moisture content bark to 270 FCFA/kg for dry, high quality bark. In the North West in 2005 at least 500 tonnes was exploited, over 250 tonnes of which was 'illegal', in 2006 an estimated 1000 tonnes and in 2007 an estimated 500 tons was exploited. Although both the Associations of Community Forests in Kilum Ijum, Bihkov, ASSOFOMI and ASSOKOFOMI have a benefit sharing mechanism for income from Prunus sales (50% for village development projects, 35% for forest regeneration and 15% for FMI sustenance) (WHINCONET 2005), none of the CFs harvesting prunus in the period 2004-2008 paid their dues to the Associations. Only one CF Association (Bihkov), has produced a report and accounts with details of benefit sharing. Out of the 18 CFs harvesting prunus, over 6 failed to renew their SMPS when the majority expired in 2006 and 2007 and at least 4 exploited prunus 'illegally' when it was not specified in their management plans. At least 117,145,000 CFA was reported as income for the CFs (Ingram 2008). At least 3 of the CFs had major internal conflicts in the period 2004-2008 due to mismanagement of funds, and no less than 5 failed to produce their annual reports in this period. Thus while it is uncountable that income was generated, its sustainability in some of the CFs is very questionable (WHINCONET, 2005; Nsom et al., 2007; Stewart, 2007) and it is arguable if the benefit sharing mechanisms outlined in all the 18 North West CFs management plans where the majority of Prunus harvesting occurred were put in place and the communities actually benefited from this massive generation of revenue as foreseen.

The trade circuit flows from the main production areas of the North West Highlands, Mt Cameroon and Adamaoua, through stores in the towns such as Bamenda and Buea to drying sheds and factories in Douala and Bafoussam where basic processing drying and cutting are performed, prior to exporting. The powder or extract is then re-exported to other European countries, the USA, India and China. The average price per kilogram at harvester level was 180 CFA in 2007, although this varied from an average of 50 CFA kg outside of Community forests, to 80 CFA in community forest and up to 160 CFA in the SW with MOCAP. Harvesters receive on average 67% of the total forest edge, price The price at export (Free on Board) varies between 750 to around 1050 CFA a kg. The trade value of the chain in Cameroon 2007 is estimated 315 million CFA (630 million[4] US$) for 646.5 tones.

The market chain in Cameroon benefits about 60,000 people indirectly including community forests and associated communities of Mt Cameroon harvesting company (MOCAP). Prunus provides employment for up to 700 people; comprising some 500 plus harvesters on a seasonal basis, over 28 exploitation permit-holding small scale enterprises and about 5 small and medium sized exporting enterprises (Ingram and Nsawir, 2007). It also provides a sporadic source of income for at least 400 individuals with planted Prunus and at least 51 community organizations, including councils, with small plantations.

[4] Le cours du dollar a été calculé à 500F cfa

5.4.2 Use

In Cameroon Prunus has been traditionally used as a versatile, multi-use tree with a number of both cash income and subsistence uses. It is used for axe, hoe and tool handles. The Nso clan use its timber for ceremonial spear shafts. It is used as the center pole to support roofs or for bridges and was long used for fuel wood for heating and cooking, a preferred species because it burns hot with little smoke (Stewart, 2003). Evidence of the fungicidal and termicidal properties of *Prunus africana* heartwood extractives has been found that supports this traditional use (Mburu et al., 2007).

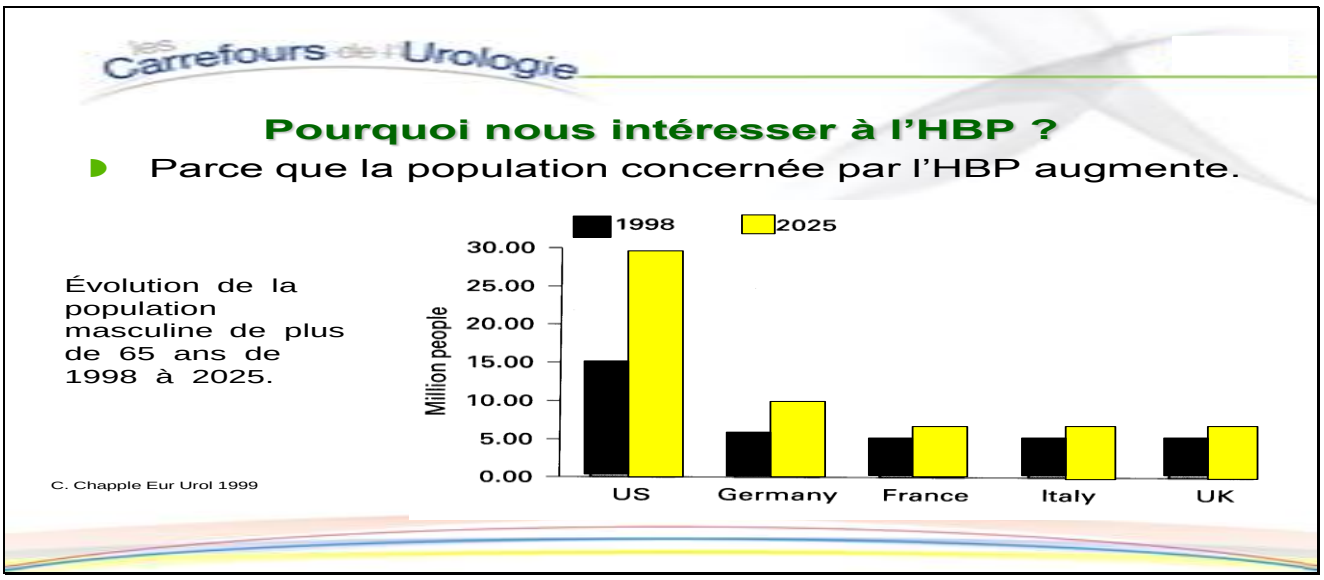
5.4.3 Health value

The presence of the cyanogenic glycoside amygdalin in the bark, leaf and fruit of this species was first documented in 1962. Since then, a growing interest in the use of bark extracts to treat BPH has prompted numerous studies of the bark's secondary chemistry, with many double-blind clinical studies pointing to its efficacy for reducing symptoms of benign prostatic hypertrophy, chronic prostatitis, sexual/ reproductive dysfunction and obstruction-induced contractile dysfunction (Cunningham et al., 1993; Laird et al., 1996; Hall et al., 2000; Dawson et al., 2001; Anon., 2002; Cunningham, 2006). Pygeum extract has been approved in Germany, France, and Italy as a remedy for BPH. The active constituents of *Prunus africana* bark extract include phytosterols (e.g., beta-sitosterol) that have anti-inflammatory effects by inhibiting production of pro-inflammatory prostaglandins in the prostate. It also contains docosanol, which reduces levels of testosterone and leutinizing hormones, pentacyclic triterpenes (ursolic and oleanic acids) that have anti-edema properties, and ferulic acid esters (n-docosanol and tetracosanol), which has effects on the endocrine system and reduce prolactin levels and block the accumulation of cholesterol in the prostate. Prolactin is purported to increase the uptake of testosterone by the prostate, and cholesterol increases binding sites for dihydrotestosterone (DHT) (Anon., 2002; Altavahealth, 2008). The fatty acids of the extract have similar properties to those of saw palmetto.

Botanic alternatives to *Prunus africana* extract, that are often also used in combination, include extracts from the berry of the Saw palmetto *Serenoa repens*, stinging nettle roots *Urtica dioica* and Pumpkin L. spp. C*ucurbita pepo* seed oil.

The medicinal value of *Prunus africana* used in pharmaceutical products in Europe is underlined the fact that in France it has been the active ingredient of the major registered medicine to treat BPH for over 30 years. It is also sold in Switzerland, Austria, Spain and Italy. In the US market it is sold mainly as a botanic health product. The *Prunus africana* market was worth US$ 200 million to European and American pharmaceutical companies in 1999. In 2001, 19 different medications included *Prunus africana* extract in Europe and at least 8 products in the USA (Pomatto 2001). There is a growing need for the medication with the number of patients increasing from about 85,000 patients in the year 2000 to around 102,000 patients by the year 2007 and an continued growth foreseen (Pomatto, 2001; CITES, 2008), see Figure 5 and Figure 6.

Figure 6 Evolution of male population aged 65 years + in developed countries



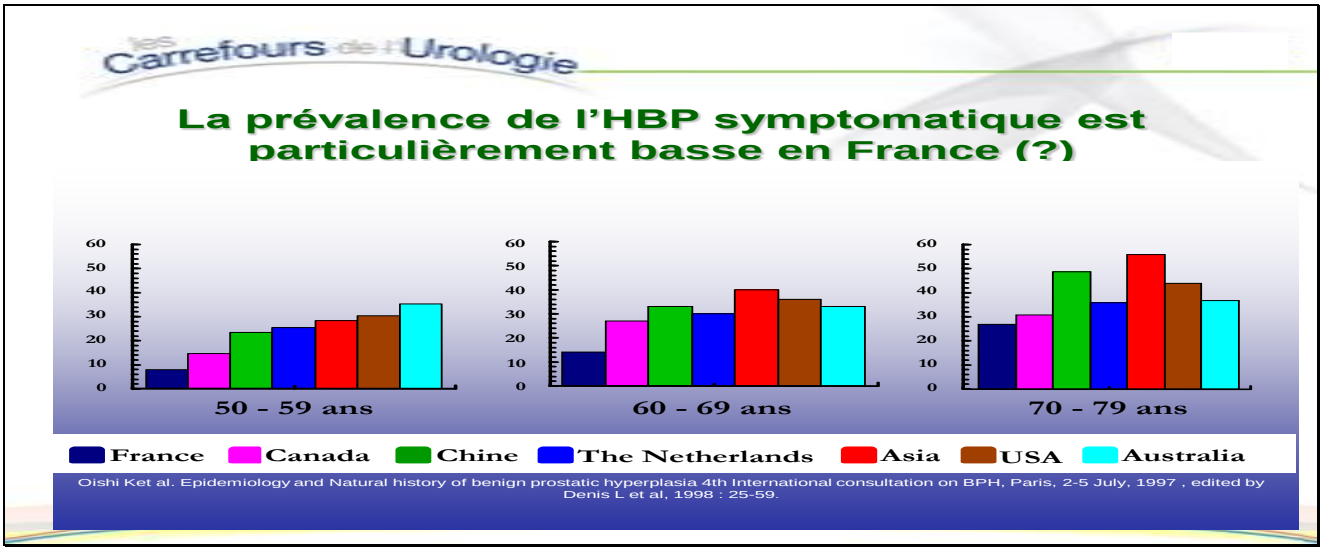


Figure 7 Prevalence of BPH symptoms in developed countries
(Source; Kaplan SA, et al. American Urological Association Congress 2007, abstract 1508)

The use of *Prunus africana* bark, leaves, berries and root in traditional medicine in the North West and South West of Cameroon has also been recorded, with over 45 human medicinal uses and 11 veterinary uses (Cunningham and Mbenkum, 1993; Nfi, Mbanya et al., 2001; Cunningham et al., 2002; Stewart, 2003; Cunningham, 2006; Nfi, Jiofack et al., 2008). Reports from staff of the Bioversity Project indicate that Prunus is not used or even known locally for either its traditional medicinal or commercial uses by the populations adjacent to forests in Adamaoua.

This data indicates that *Prunus africana* has significant medicinal importance in Cameroon both for humans and, to a more limited extent for animals. Its international importance as a medicine is also clear. Although there are both botanical and synthetic chemical substitutes, *Prunus africana* has for the last 30 years been one of the preferred most favoured treatments for BPH in Europe and there is stable to increasing consumer demand as botanic health product as the target population ages.

5.5 Ecological context

This section illustrates the ecological environment in which *Prunus africana* is found in Cameroon. Understanding where, why and how *Prunus africana* grows is the first step in its management.

5.5.1 Biology

The reproductive biology of *Prunus africana* is known mostly from Munjuga *et al*. (1999) from Central Kenya. Experiences in Cameroon however confirm the majority of this biological data. The flowers are white and hermaphrodite, with 17 flowers on average per raceme. Wilting starts with petals, anthers, then pistil and lastly sepals. The presence of two styles in the same flower has been observed and some flowers have none (Tonye, 1999). The anthers are cream coloured and their number per flower is varied with a mean of 32 anthers, arranged in 3 circular rows attached to base petalous tube. The pollen is sticky, light, spherical and elongated, measuring 35μm in diameter. At anthesis, anthers dehisce by longitudinal slits. After anthesis, the pollen's viability can be above 90%. The stigma is raised above the anthers, notched on one side and yellow in colour, with a mean diameter of 0.76 mm. The style is greenish in colour, with a mean length of 4.02 mm. There are two ovules in ovary but only one notched stigma. The stigma appears to be receptive one day before and two days after anthesis. Although having a short flowering time, the flowering period has been observed continuously throughout the year (Stewart 1999). Many pollinators visit the inflorescence, the most frequent being hymenopteras (Apidae and Anthophoridae), bees (21% to flower pollination), hoverflys 6%, ants 2% and sunbird *Nectarinia* spp. 11.2%. The majority of visits were from 07 a.m. to 11 a.m. and 3 p.m. to 5 p.m. for bees and for birds from 09 a.m. to 12.00. Flies do not have a distinct time for visits (Munjuga *et al.*, 1999). *Prunus africana* is reported as both self-fertile and out-crossing with out-crossing being proportionally higher than self-pollination. Ndam (1998) indicated that seedlings from clustered parent trees were more vigorous than those from isolated parents, justifying cross-pollination as the normal breeding system.

5.5.2 Ecology in Cameroon

Prunus africana (Hook f) Kalkman (Rosaceae) is often referred to by its former name, *Pygeum africanum* or Pygeum. It is an indigenous species to Africa where it is endemic to many high conservation and catchment value mountain forests. *Prunus africana* is classified as a 'vulnerable' species (IUCN, 2006) due to low densities, its shrinking and increasingly degraded montane ecosystem and the high levels of trade.

The ecology of *Prunus africana* in Cameroon and across Africa is well studied (Cunningham and Mbenkum, 1993; Acworth et al., 1996; Dawson and Powell, 1999; Hall et al., 2000, Maisels 1999). It is a tall (from 6-40m for the largest specimens in Mt Cameroon and Adamaoua), long lived, dense wooded evergreen tree patchily distributed in montane forests, forest remnants or forest margins, found between 600-3000 m above sea level. Further south, where cooler latitudes compensate for altitude, it occurs at lower elevations (Hall et al 2000, Letouzey, 1978; White, 1983). In Cameroon inventories indicate that Prunus occurs between 600 and 3000m, but the highest densities were found from 1700 and especially above 2000m in Adamaoua (Belinga, 2001; Chapman, 2004), from 2400 to 3000m in Kilum Ijum (Maisels et al., 1999; Foaham, Dagobert et al., 2009), on Mount Cameroon from 900 to 2500m, with highest densities from 1800 to 2400 (Foaham, Dagobert et al. 2009;(Ndam et al., 2000) and Mt Manengouba also from 1600 to 2400m. Similar to experience in other African countries (Hall et al 2000), it is most abundant in natural forests in Cameroon in afromontane upper forests (broadleaved mixed,

montane forest belts and Prunus moist montane, gallery forests) and near grassland borders. Local knowledge indicates that it has some fire resistance as it is found close to forest edges, but not in savannah grasslands and scrub where bush fires are common. A light demanding species, under good conditions it can grow to 14 m high and 37 cm diameter at breast height in 18 years. In Adamaoua massive specimens of almost 2000 cm dbh have been noted (Pers comm. Dr. Avana, University of Dschang, December 2008). This characteristic means that natural forest disturbance coupled to fruit dispersal into canopy gaps or on forest margins are important to landscape level population biology of *Prunus africana* and accounts for the scattered distribution of this species in Afromontane forests.

It reproduces primarily from seed and is generally single stemmed, developing multi-stems when saplings are browsed or cut. Although young trees resprout, for example if browsed by forest antelope or goats, large trees have weak resprouting capability. In 1993 Iverson (quoted in Ndibi 1997) was unable to say if *Prunus africana* grows from stumps and coppices. Early in 1996, when examining ten trees felled on the eastern slope of Mount Cameroon (Bova area) about 20 years ago, Ndibi found that no re-growth by 1997. Some coppice production (resprouting) has been noted to occur when surface roots are damaged and has been observed occasionally after felling or harvesting during inventories (Cunningham 2002, Ingram 2007). Fruit production starts when trees are around 15 years old and increases with tree age, with high fruit production years alternating with low fruit production years (Stewart, 2001). The fruit is a bitter, almond tasting drupe <10mm in diameter, eaten by a wide range of animals, including many endemic species to the montane Highlands (Stewart 2003; Maisels & Forboseh, 1999; (Fossey, 1983). Seeds are semi-recalcitrant and germinate when up to 4 months old, losing viability quickly if not stored in a moist atmosphere, such that few seeds older than 6 months old are viable. Germination rates of 60-80% can be attained if planted within 50 days (Mbuya et al, 1994). Ripe fruits germinate well in partial sunlight after a short (4 hr) drying period in an airy, shaded place. The seeds are most probably dispersed by birds and primates and their leaves are a preferred food sources for a range of endemic birds, frugivores (Farwig et al., 2006), red colobus monkeys (Chapman and Chapman, 2002; (Maisels and Forboseh, 1999), gorillas (Fossey, 1983) and black and white colobus monkeys (Fashing, 2004), despite containing high levels of cyanogenic glycosides. Wubet et al (2003) note the presence of arbuscular mycorrhizae in the roots of *Prunus africana*. This has important implications for reforestation as mycorrhizal association is important for mineral nutrition and optimal growth of *Prunus africana* and the potential of this species for reforestation, land rehabilitation and agroforestry or forestry production (Haselwandter, 1997).

The annual mortality of adult-sized *Prunus africana* trees in natural populations is 1.5% per year (Stewart, 2001). Based on a 15 year study of tree growth and mortality in Afromontane forest in South Africa (van Daalen, 1991), mortality rates of trees >10 cm diameter at breast height (dbh) averaged 0.71% per year. The mortality of *Prunus africana* trees ranges from 0 to 50%, with an average of 17%, in commercially harvested wild populations inventoried in Cameroon, where on average 48% have been harvested. This is significantly higher than natural mortality rates are assumed, which has implications for sustainable harvesting. The link between mortality rates and unsustainable harvest practices, with several years lag, was also highlighted by Meuer (2007) and Stewart (2007) and is substantiated (although data is incomplete) in
Figure 8. Recent research (Stewart 2001, 2007 and in press) shows that the largest trees suffer the most mortalities and crown size reduction after harvest and that they contribute the most to the population growth rate because they produce the most seeds. Mortalities of these trees and the reduction of their crowns have important implications for future regeneration.

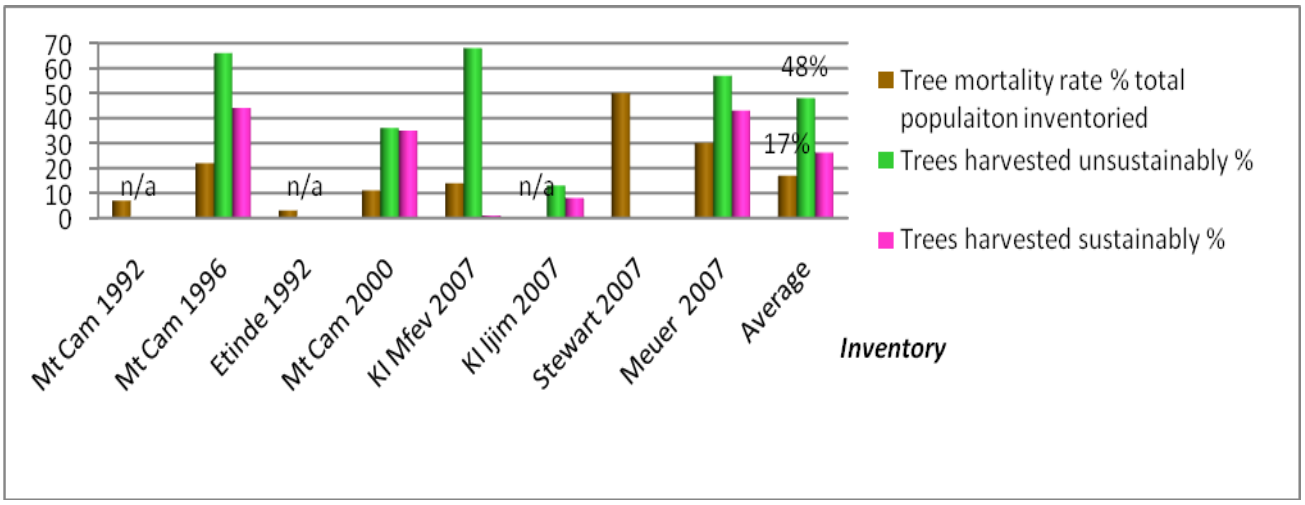


Figure 8 Tree mortality and unsustainable harvest

A reverse J shaped curve could be expected for tropical forest tree populations, where the smallest size classes would have the most individuals and their number decreases with dbh (Peters, 1996). The unbalanced size distribution noted in Cameroon (Cunningham and Mbenkum, 1993) may be due to the majority of Cameroon populations inventoried already having been harvested. In particular on Mt Cameroon, the large scale felling of 22,000 trees in 1986 and 1992 has produced an unusual shaped curve for the most intensively harvested areas. Of data sets available, shown in
Figure **9** to Figure 17, only one study shows the class distribution of purely un-exploited Prunus which does follow a more classical distribution curve (Sunderland et al., 1997). Common findings are the larger number of smaller individuals, and in 50% of the cases a peak of classes between 30 and 50 cm dbh. Where a high number of trees is lacking in the smallest size classes up to 30 dbh, and the percentage of trees in the largest classes are unusually high, this deviation may be due to the species attribute of producing mast years, or because of reduced regeneration and increased mortality due to excessive harvesting (Stewart, 2001). It can however equally be biased by the methodology, as trees of smaller size classes are not as obvious as bigger ones and may therefore be overlooked.

Figure 9 Size class structure of *Prunus africana* Mt Manengouba (CIFOR 2008)

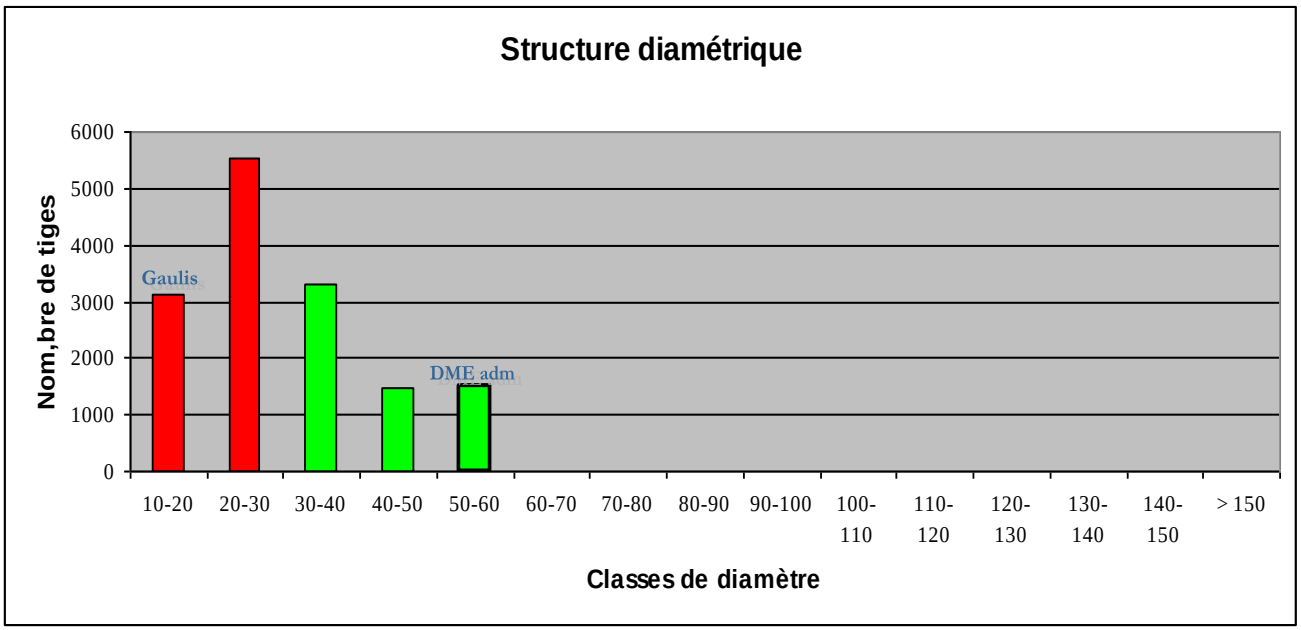


Figure 10 Size class structure of *Prunus africana* Kilum Ijim (CIFOR 2008)

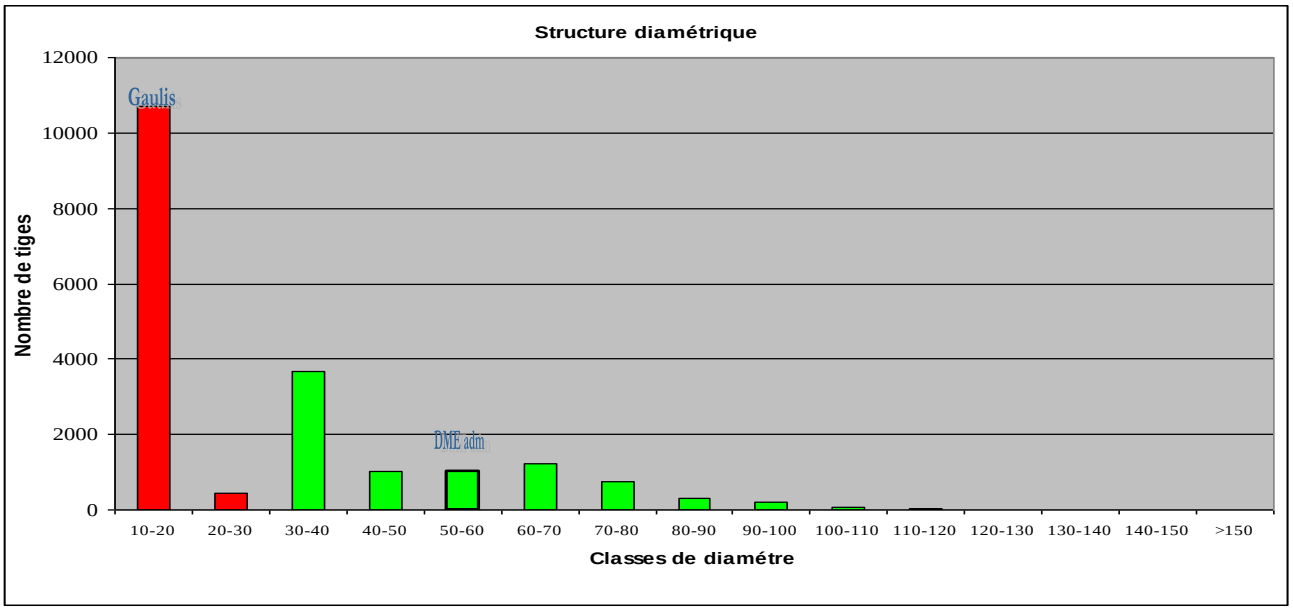


Figure 11 Size class structure of *Prunus africana* on Kilum Ijum (Whinconet 2007)

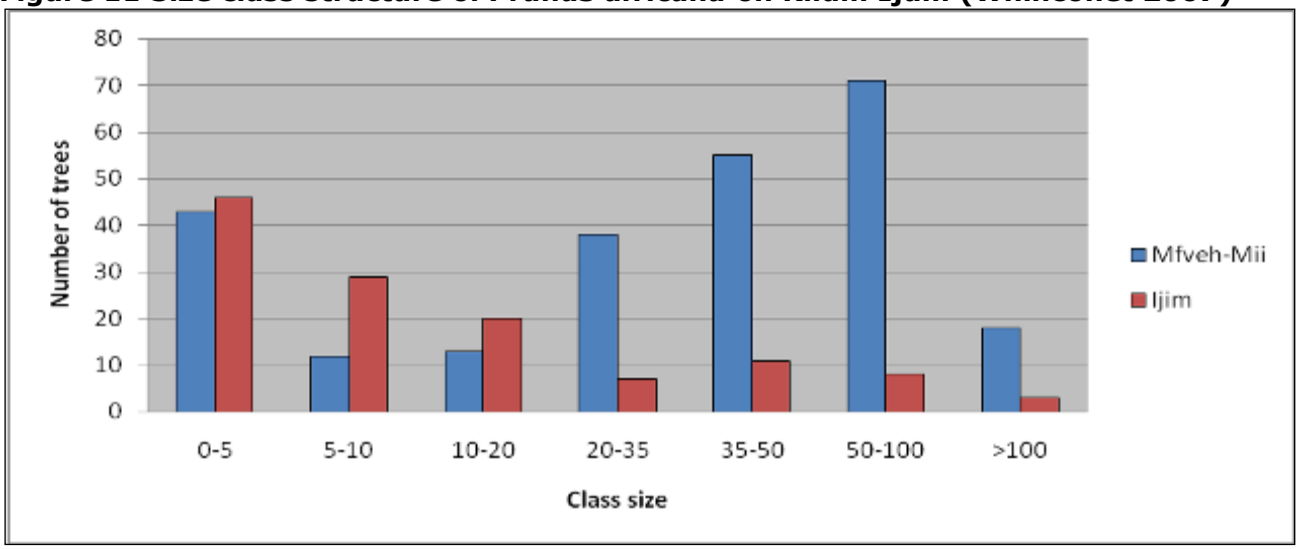


Figure 12 Size class structure changes of *Prunus africana* on Kilim Ijim (Stewart 07)

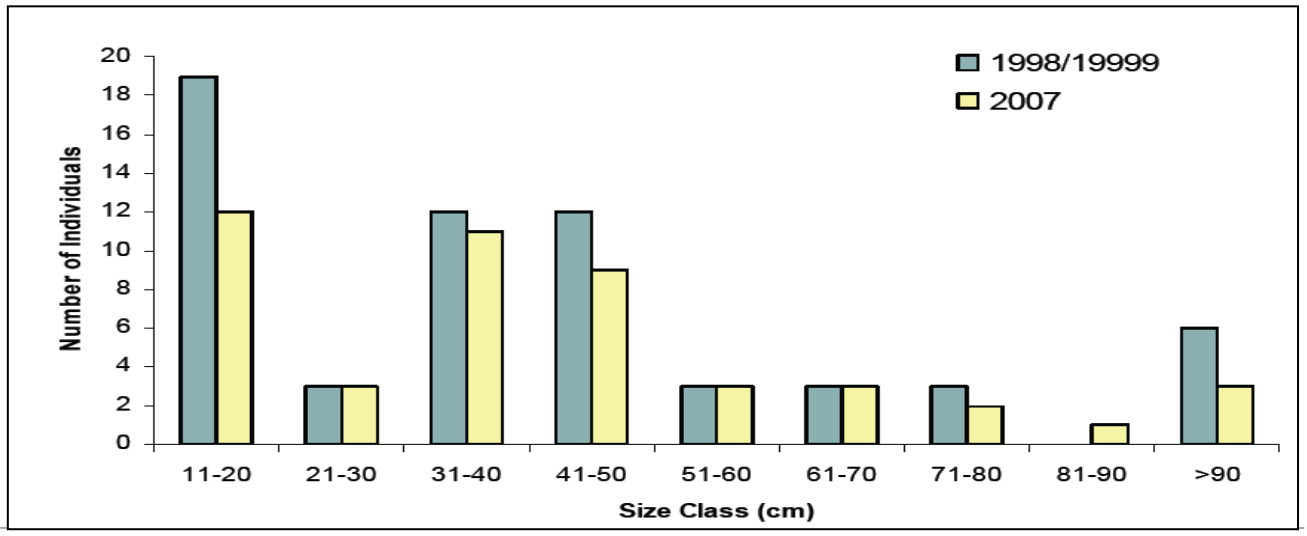


Figure 13 Size class structure of *Prunus africana* BIHKOV CF (Tah 09)

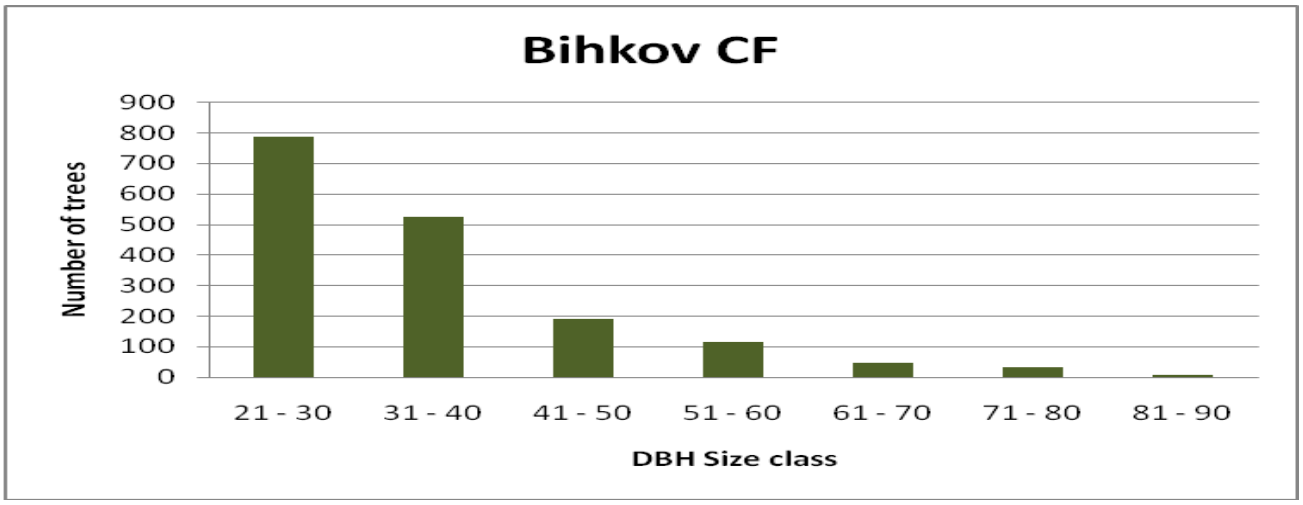


Figure 14 Size class structure of *Prunus africana* on Mt Cameroun (CIFOR 08)

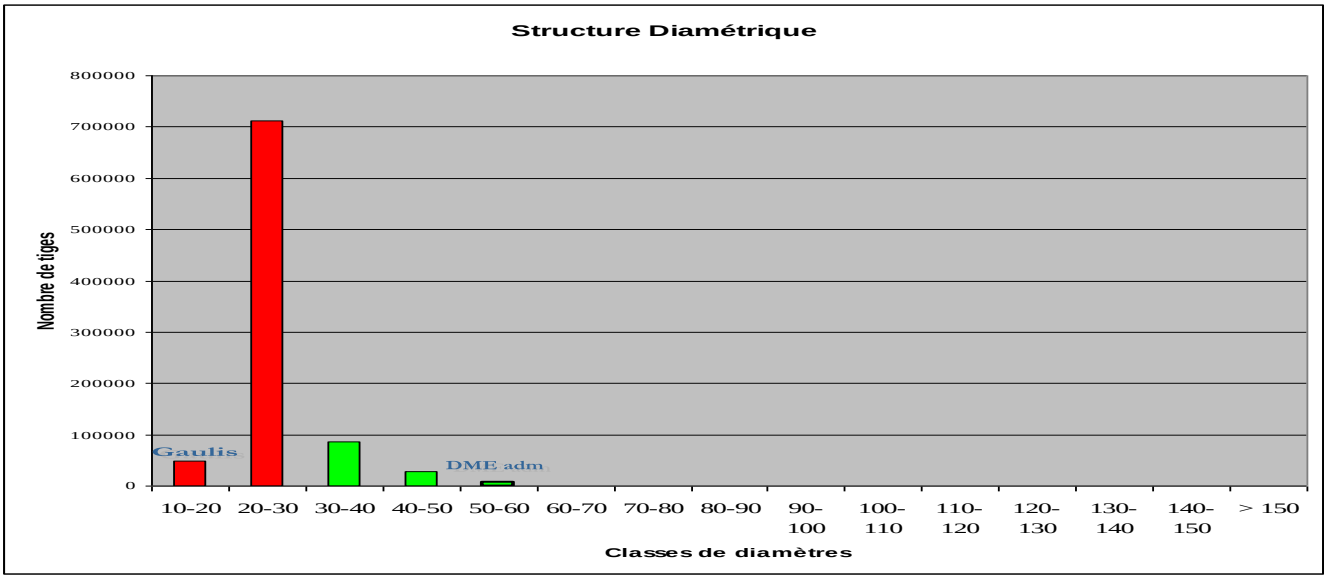


Figure 15 Size class structure of *Prunus africana* at Mt Cameroon (Meuer 2007)

Figure 16 Size-class distribution of unexploited *Prunus africana* on Mount Cameroon (Sunderland and Nkefor, 1997)

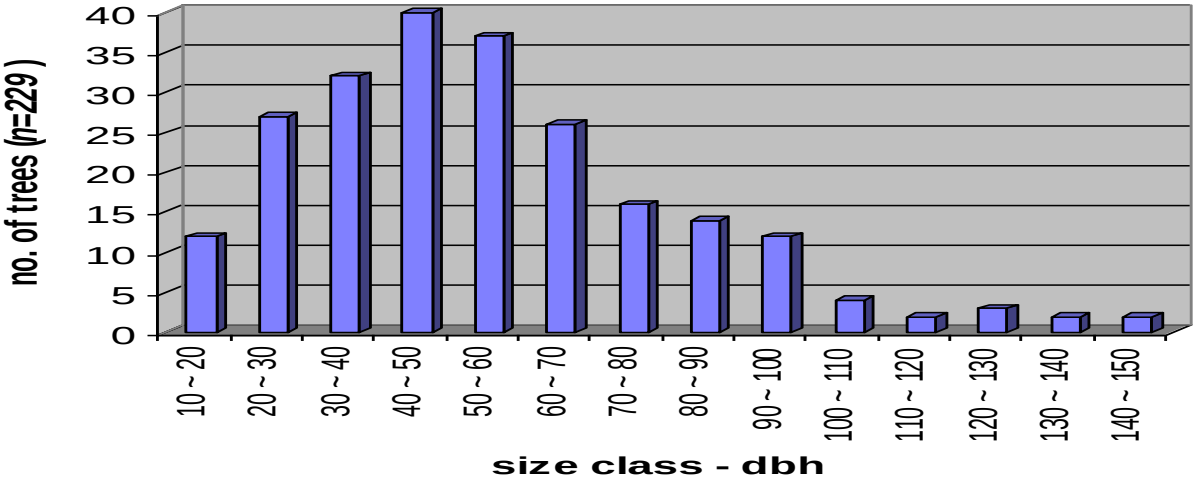
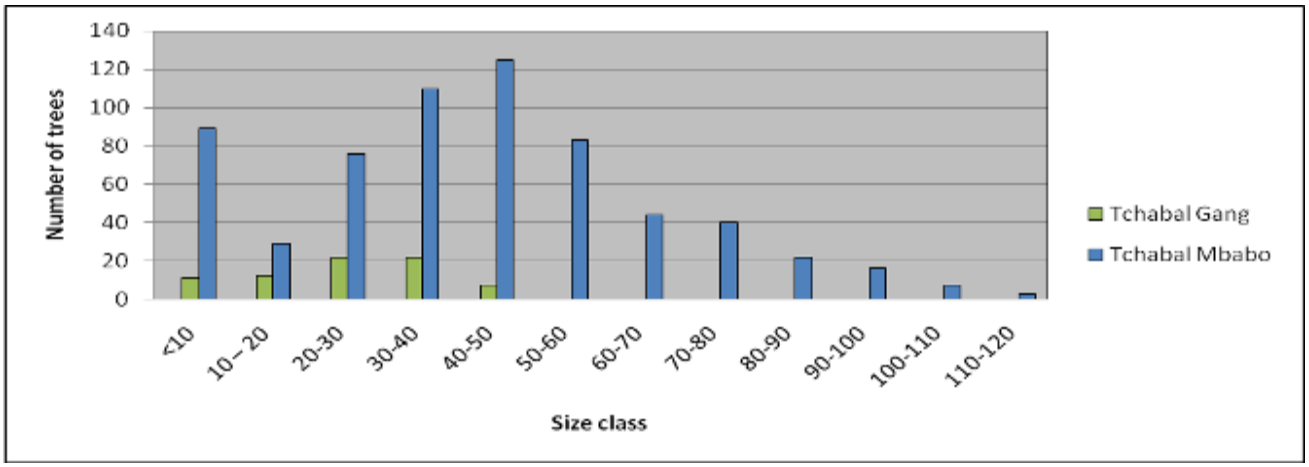


Figure 17 Size class structure of *Prunus africana* Adamaoua (adapted from Belinga 2001)



Studies of bark harvest and regeneration rates, mainly from Cameroon, indicate that bark thickness varies both with age, ecology and size. Thicknesses of bark in Cameroon vary significantly for trees above 30cm dbh with an average of 1.1 cm in Tchabal Mbabo and 7,6 cm Tchabal Gang Daba (Belinga, 2001). On Mt Cameroon the average bark is thinner at 1.5 cm, ranging from 1.1cm to 1.7cm across size classes (Acworth, 1997; Tonye et al., 2001). This may be related to repeated harvesting. In general this data is consistent with results from Guinea Equatorial (0.6 to 1.6cm and 0.8 to 1.5 cm across diameter class respectively, (Sunderland et al., 1999; Navarro-Cerrillo et al., 2008). Tree height to first branch, as to be expected, also varies with diameter and age and location, with gallery and savannah edge gallery producing smaller average sizes, ranging from 8 to 15 meters in Mt Cameroon and in Adamaoua from 9 to 18m (Acworth 1997; (Belinga, 2001).

Halls et al's work (2000) indicates annual growth rates of 1 to 1.9m annually, with flowering individuals approx 10 years old of 4 meters, but of decreasing increments beyond 30cm dhb, such that very large trees of 80-0 dbh may be hundreds of years old. Data on growth rates specific to Cameroon with large sample sizes is scarce. The variation in diameter and height of *Prunus africana* trees of the same age in the same locality is high, with the largest 18 year old trees being 37.6 c m DBH and 13.5 m high with bark 14 mm thick (Cunningham, Ayuk et al., 2002). Seedlings will grow to 30 cm in height (about 6 months after sowing or rooting (Tsobeng et al., 2008). The minimum age for harvesting (30 dbh) has been reported as 13 years (Franzel

et al., 2009). The Whinconet inventory (2007) made a link between approximate age classifications and diameter classes, based on the indigenous knowledge of forest users and harvesters, shown in Figure 18. These data tally approximately with Cunningham's data.

Figure 18 Age and Diameter Classes Kilum Ijim

Diameter class size DBH	***0-5***	***5-10***	***10-20***	***20-35***	***35-50***	***50-100***	***>100***
Nomination/Use	seedling	Sapling	Pole	Small tree	Medium tree	Large tree	Very large
Age (years)	2-5	5-10	10-15	15-35	35-50	50-65	70+

The range in genetic diversity between West and East African Prunus is well known (Dawson and Powell 1999, Muchugi, 2006), which is reflected in chemical differences in bark extract from Cameroon, Kenya, Madagascar and the DRC (Martinelli, Seraglis and Pifferi, 1986).

Photo 1 Measuring DBH, Mt Cameroon

Photo 2 Measuring DBH, Oku

5.6 Ecology, forest type and national distribution

Given the long history of exploitation for traditional and commercial use in Cameroon, there is a substantial amount of indigenous knowledge of the locations and ecology in which *Prunus africana* is found. Such knowledge is held typically by members of local communities, particularly traditional medicine practitioners, forest users such as hunters and beekeepers, community forest managers and patrols, and by commercial exploiters. However there are regions in Cameroon, notably in Adamaoua, where Prunus is not used traditionally and harvesting takes place by agents external to the region. Information on distribution was obtained from a number of meetings held with stakeholders in 2007 and 2008 (Ingram 2008; Prunus platform meeting reports SNV 2007 and MinFoF 2007).

There is also a substantial amount of data on the species distribution from scientific research. In 1995 MinFoF identified 64 sites nationally where *Prunus africana* is distributed. This resulted in reconnaissance field trips in 1999 and 2000 by the Office National de Développement des Forest (ONADEF) (Ndam et Yogo, 1999, ONADEF, 2000a & 2000b) and eventually in the inventory in Adamaoua in 2001. Cartography based on remote sensing and subsequent field surveys prior to 1995 by ONADEF has provided a national distribution map of dominant vegetation types (Figure 20). This map is based on national land cover maps created between 1999 to 2008 at a scale of 1:150,000, from which can be inferred the regions in which *Prunus africana* is potentially distributed. Figure 21 and Figure 22 highlight Cameroon's montane ranges, accentuating the elevation in which Prunus is commonly found, i.e. over 900 m altitude and typically between 1500-3100 m, and areas with over 900 mm mean annual rainfall, these are superimposed with the typical vegetation cover where Prunus is known to occur (Hall, O'Brien et al., 2000). The original 64 sites can therefore be classified into six major montane landscapes; Mt Cameroon, Adamaoua, the Bamenda Highlands in the northwest region, the Littoral and Bakossi Mountains, the Western Highlands, and the Central Highlands region.

The vegetation of Cameroon is well mapped (see Figure 20), in particular the montane areas have been well described (see Maisels & Forboseh 1999, Cheek et al. 2000, Cabel and Cheek 1998, 1998, ENGREF 1987, Letouzey 1985, Maisels & Forboseh 1999, Nsom and Dick 1992, Jones 1994, McKay 1995, McKay & Coulthard 1995, McKay & Young 1995, Tame & Asonganyi 1995, Thomas 1986, 1987, 1989, White 1983).

Photo 3 Prunus africana montane escarpment forest north of Yangare, Tchbalal Gangdaba

Chapman 2004

Detailed forest stratification maps are also available for the three regions inventoried from 2007-2008 by CIFOR and are based on aerial photos from 1991 to 1998, at a scale of 1/20000 to 1/500000 and landsat images at a resolution of 90m. Field survey results were matched with interpretations of images based on Letouzey's (1968 and 1985) phyto-geographical studies (Foaham, Dagobert et al., 2009). For the entire Southwest region similar data is also available from the PSFE website. Distribution in the Tchabal area of Adamaoua was confirmed in the MinFoF inventories (Belinga, 2001), through botanic surveys indicating extensive stands (Chapman, 2004) as well as reports on distribution in the neighbouring Mambilla Plateau (Chapman et al., 2004) and during research work by the IRAD/University Dschang/Bioversity project (Tientcheu, 2007).

Table 2 and Figure 20 combine the scientific and indigenous knowledge to show the forest types and ecology in areas where *Prunus africana* is commonly found in Cameroon.

Photo 4 Prunus africana forest, Emfevh Mii, North West

In the South West and North West it occurs in the wild mainly in dense tropical sub-montane and montane mixed forests (Ndam and Ewusi 2000, Foaham et al 2009). Highest densities are found in forest savannah transition zones and in secondary forests (Maisels Ndam 1998). In the North West around Bamenda, Fundong, Kumbo, Ndu and Oku, and in the South West around Buea, it is also found on mixed farm/agro-forest, mosaics and in small plantations (Foaham et al 2009). In Adamaoua Prunus occurs in mainly in montane gallery forests (Pouna & Belinga, 2001). The Gotel Mountains in Nigeria are in the same Adamaoua montane range as the Tchbals and border onto the approximately 21 km^2 of plateau that includes Chappal Wade (1525-1830 m) and Gangirwal (1830 m - 2400 m), the highest point in Nigeria. The most extensive forests there are on the west facing slopes, extending from about 1300 m - 1800 m covering approximately 46 km^2. Forest vegetation persists upwards into the plateau grassland along the banks of streams, the highest patch is at 2300 m (Chapman, Olson et al., 2004).

Table 2 Forest stratification and Prunus distribution in Cameroon

Region	Type	Altitude	Description	Common species
North West Dom, Nkor, Mt Oku, Kilum Ijum Forest	High altitude forest afro-subalpine prairies high altitude swamps	3011 2700	Podocarpus latifolius/ *Prunus africana*/ Rapanea melanophloeos forest, in thinner soils Alchemilla fisheri ssp cameroonensis. Rare endemics in waterlogged areas. In burnt areas, Adenocarpus mannii, Hypericum lanceolatum, near forest edge, Gnidia glauca succession or Pennisetum clandestinum dominated turf.	*Prunus africana*, Maesa lanceolata, Podocarpus latifolius, Gnidia glauca, Rapanea melanophloeos, Solanecio mannii, Kniphofia reflexa, Succisa richotocephala, Juncus sp. nov, and Eriocaulon sp. nov
	High altitude montane mixed forest	3000 2400	Two forest types in succession to mature forest: Gnidia/ Maesa lanceolata woodland, by Erica mannii and Gnidia glauca.	Maesa lanceolata Pittosporum viridiflorum, Solanecio mannii, Rapanea melanophloeos, *Prunus africana*
	Lower altitude montane mixed forest	2400 2100	Fairly open forest major understory shrub, herb layer	Carapa grandifolia, Syzygium guineense, Maesa lanceolata; *Prunus africana*, Pavetta sp Acanthaceae and Labiatae
	Montane woodland	2400 1800	Ericaceous woodland dominated by Erica mannii and widespread open woodland dominated by Gnidia glauca, with herb layer of bracken and grasses, fringe between grassland and montane forests.	Erica (Phillipia) mannii, Gnidia glauca, Maesa lanceolata, Hypericum revolutum. Pteridium aquilinum
	Mature alpine bamboo	2700 2400	Dense monospecific alpine bamboo Arundinaria alpina thickets, also in association with mixed montane forest, forming a distinct vegetation type	Maesa lanceolata, Gnidia glauca, Pittosporum viridiflorum
	Open woodland/ scrubland and degraded grasslands	2800 1800	Degraded grassland between which are is srub and at the very lowest altitudes, Hyparrhenia spp. areas are regularly burned by graziers to prevent the scrub-woodland- montane forest succession.	Gnidia glauca, Maesa lanceolata, Hypericum revolutum. scrub dominated by Sporobolus africanus and Pennisetum clandestinum.

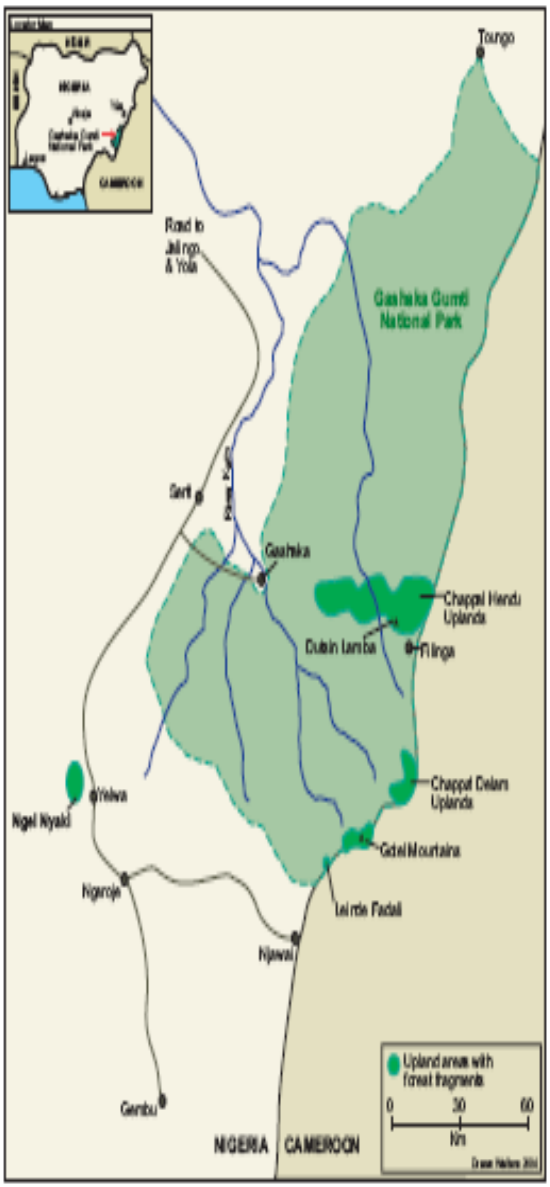
Region	Type	Altitude	Description	Common species
South West Mt Cameroon, Mt Muaengouba	Sub alpine grassland	4095 3000	Species poor, tussock grasses and dwarf/knarled trees	Tussock grasses, lichens and foliose
	Montane grassland	3000 2000	Species poor, rich temperate geners, tall tussock grass dominates, scatted fire resistant trees	
	Sub-alpine rain forest /montane scrub	2400 1800	Species poor, open forest, discontinuous canopy, trees 1-15m, open shrubs, herbs, clomers, ferns in fire protected hollows, stranglers dense epiphytes, few climbers	*Prunus africana*
	Upper montane rain forest	1800 1600	Species poor, open forest, discontinuous canopy, small trees 20m, stranglers dense epiphytes, cover, few climbers.	*Prunus africana*
	Lower montane rain forest	1600 800	Species rich, evergreen, closed or discontinuous canopy 25-35m, cloud cover, rich very in ferns epiphytes, patches meadows and shrub lands,lLianas, buttressing and cauliflory less common.	Acanthaecae, tree ferns, *Prunus africana*
	Lowland rainforest	800 >0	Species rich, evergreen, tall continuous canopy 25-35m, large emerged trees, rich in lianas & wood climbers, Buttressing and cauliflory common.	
Adamoua Plateau Tchbals & Mts Gotel	Montane stream fringing	2100 2000	Stream source forests, less diverse than lower forests lower, tallest trees reaching only 20 m in height at 2000 m elevation, and only 9 m at 2300 m.	*Prunus africana*, S. guineense subsp. bamendae-
	High dry forest /Montane escarpment forests	2000 1700	Two types. 2. A.gummifera- Nuxia congesta forest and 3. Pouteria altissima dominated forest. Tchabal Mbabo represents unspoilt examples of West African montane / submontane and transition forest. Not rich in species numbers, but rich ecosystems in biodiversity value. Mbabo has more extensive stands of *Prunus africana* and more developed forest ecotone than GGNP.	*Prunus africana*, Entandrophragma angolense, Eugenia gilgii, Millettia conraui, Syzygium guineense, Podocarpus latifolius forest
	Submontane escarpment/ gallery forests and Hyparrhenia savanna	2100 1500	Escarpment and gallery forests valuable continuum from lowland to montane ecosystems, and as a reservoir of rare species such as the IUCN Threatned Dombeya cf ledermannii.	*Prunus africana*, P. altissim, Dombeya ledermannii a., Hyparrhenia
	High dry forest	800 +	Typical high forest with Khaya senegalensis, Daniella oliveri, Isoberlima doka, Cedrela odorata, Combretum sp, Burkea africana, Lophira lanceolata, Prosopis sp, Syzygium guinense, Terminalia laviflora and T.macroptera	*Prunus africana*
	Submontane gallery forest	2000 1500	Submontane gallery forest, species rich, with taller trees than montane galleries.	Dominated by Pouteria cf altissima, Pterygota cf mildbraedii, Ficus spp., Albizia gummifera, Bersama abyssinica, Croton, macrostachyus, Schefflera abysinica. Millettia conraui, Nuxia congesta, Cola sp., Phoenix reclinata, *Prunus africana*, Rauvolfia vomitoria, Palisota cf hirsuta Acanthus
	Woody savanna transition forests	1700 1500	Transition zone between lowland and montane forest is very rare in West Africa. Tchabal Mbabo transition forest is best example in area.	Dominated by hyparhenia sp, Andropagon
	Upper & lower montane gallery forests	+/- 1500 800	Bare rock with gallery forests in depressions and between mountains containing *Prunus africana*, and some herbaceous savanna	*Prunus africana*, Albizia gummifera – Nuxia congesta

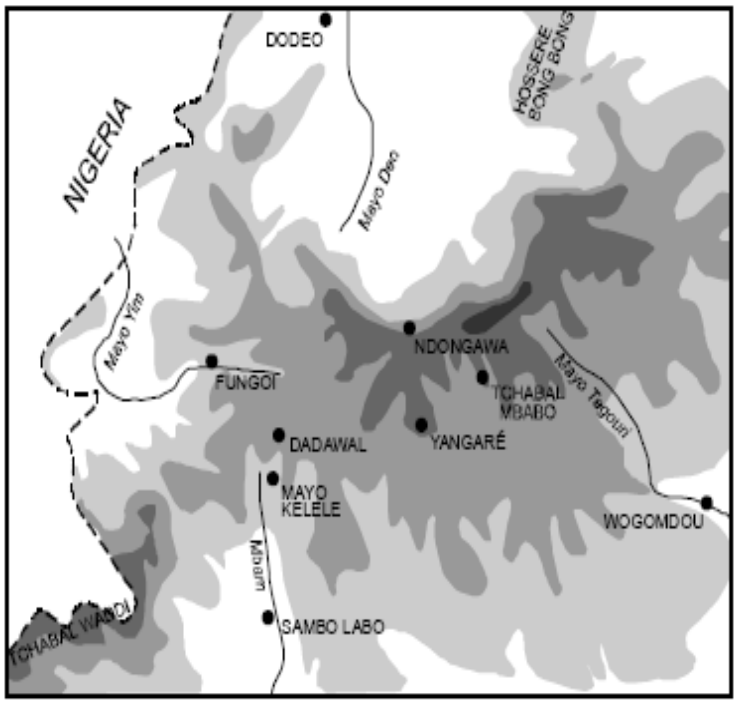
Region	Type	Altitude	Description	Common species
	Plains	800 400	Forest savannah and shrub species and few, if any, incidences of Prunus.	Isoberlinia tomemtosa, Isoberlinia doka
	Samlekti valley	700 >0	Forest and some pastures.	Dominated by Isoberlinia tomemtosa, Isoberlinia doka

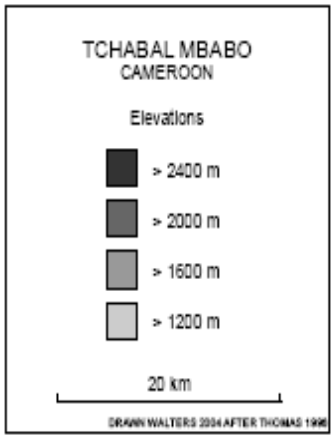
(Adapted from Maisels & Forboseh 1999; Ewusi and Ndam 2004; (Belinga, 2001; Chapman, Olson et al., 2004; Chapman et al., 2007)

Physical threats in all the forest areas where *Prunus africana* is found, apart from over-harvesting, include encroachment by agriculture, cattle and goat grazing and fire damage. The latter two are particularly prevalent at Mt Oku (Cheek, Onana et al., 2000; Cunningham, Ayuk et al., 2002; WHINCONET, 2005) and in Tchabal Mbabo (Chapman et al., 2003?; Chapman, Olson et al., 2004). A more subtle threat to forest ecology may be reduced seedling dispersion due to declining frugivore numbers, many of which have been noted are less common in the montane forests than previously.

Figure 19 Map of Tchabal Gangdaba, Cameroon
(Source Chapman 2003 and 2004)







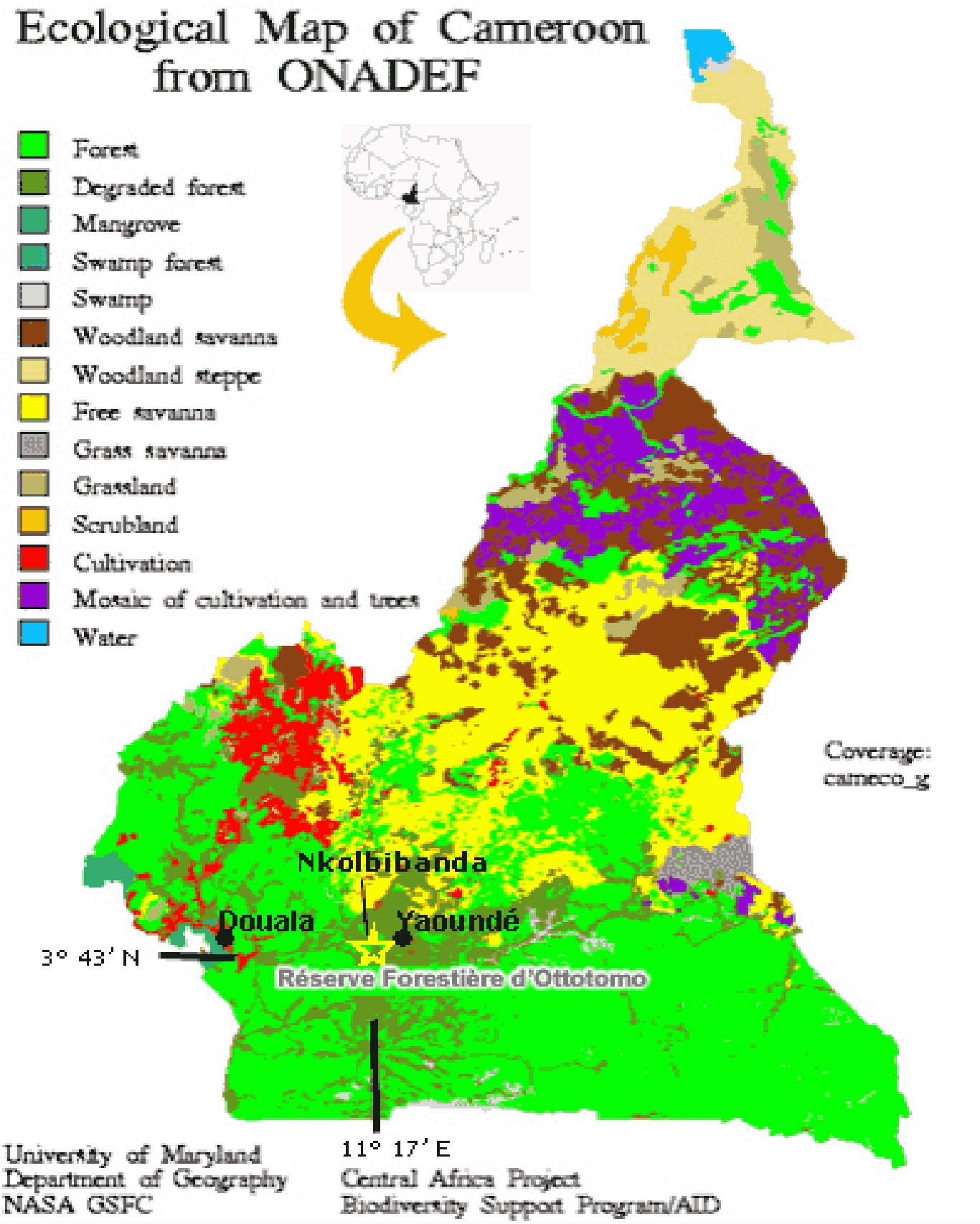
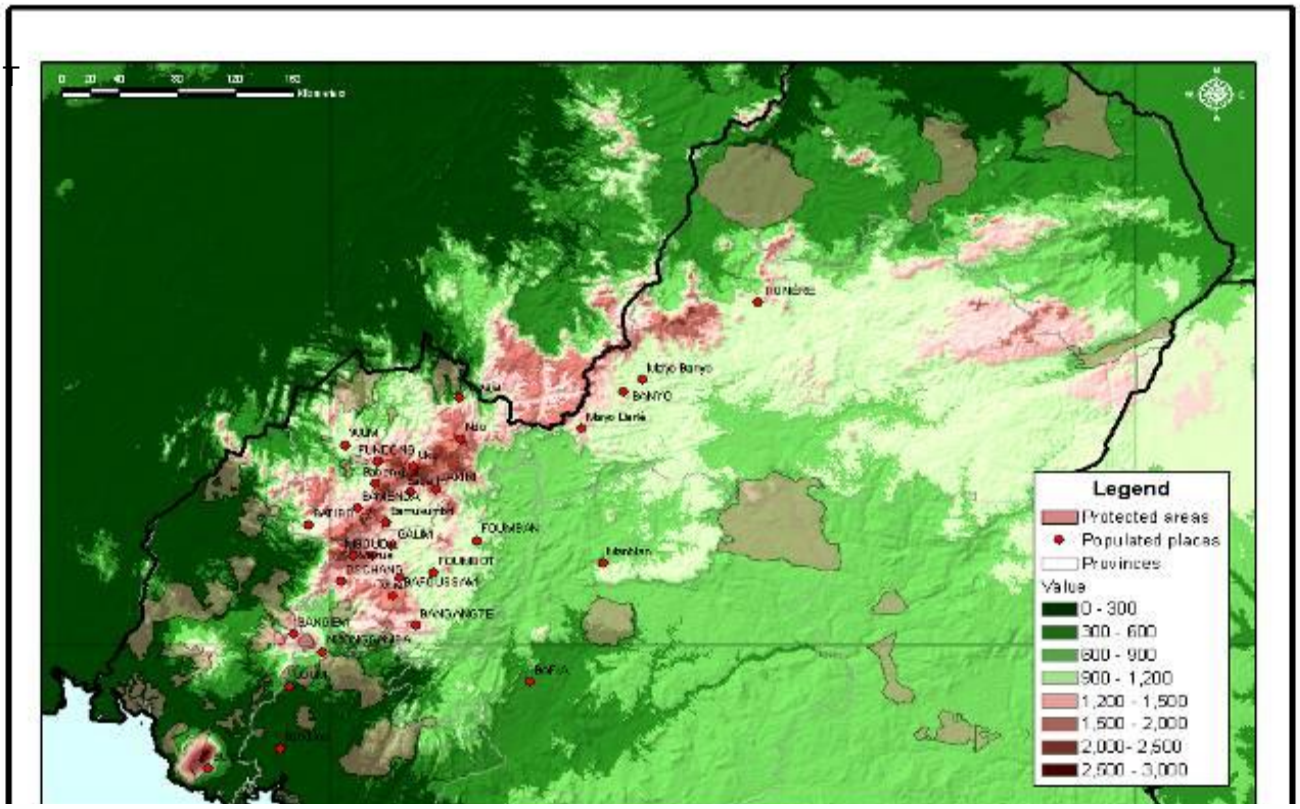


Figure 20 Ecological map of Cameroon

Figure 21 Montane range of *Prunus africana* in Cameroon
Source: CIAT and CIFOR 2009



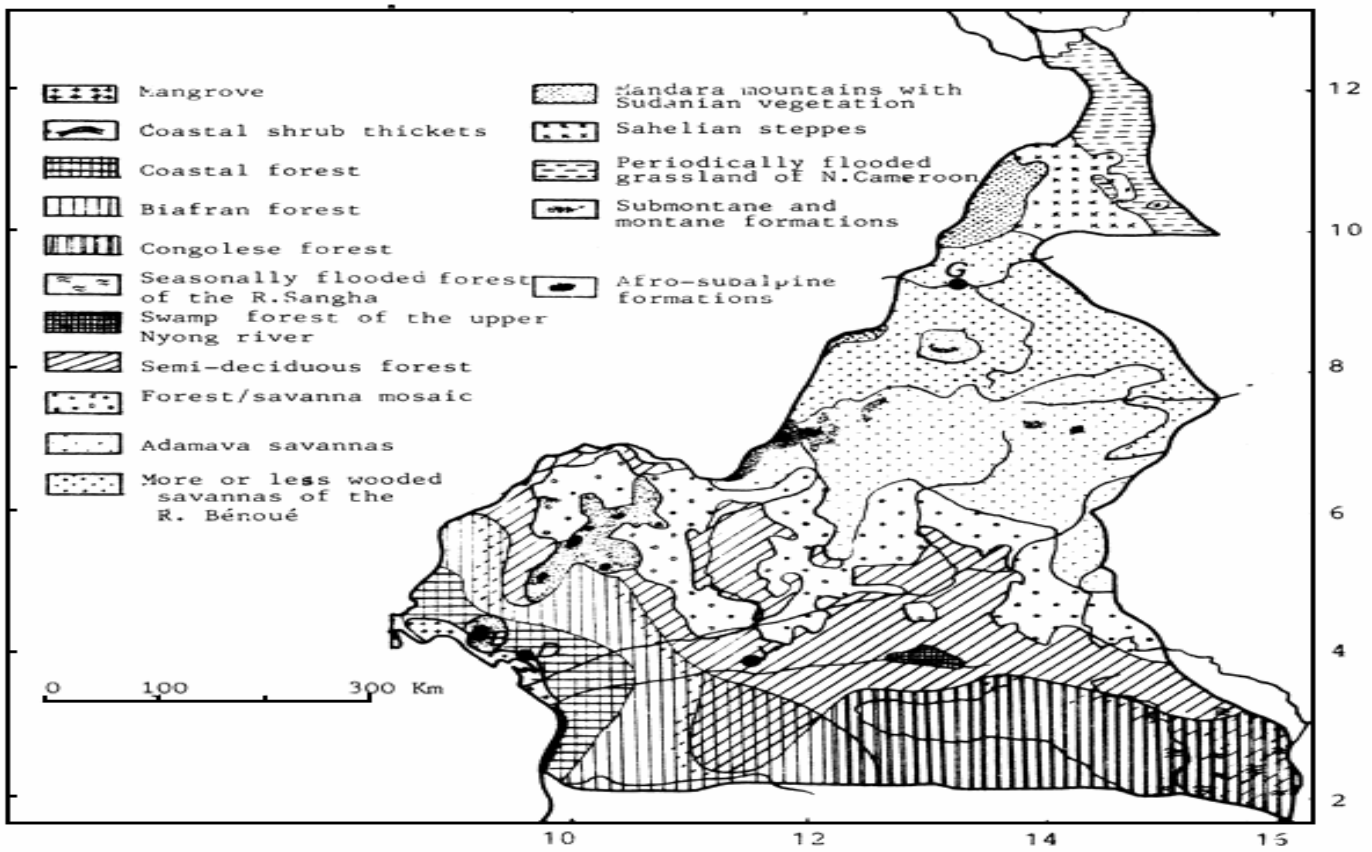


Figure 22 Land cover montane zones Cameroon (Source: Letouzy, 1965)

6 *Prunus africana* populations and inventories in Cameroon

At least fourteen bodies of work have been carried out on populations of *Prunus africana* in Cameroon, comprising inventories, plot monitoring, rapid assessments, regeneration studies and surveys. This research has been carried out in four of the six major montane landscapes. To date, only the CIFOR 2008 study (Foaham, Dagobert et al., 2009) has used the same inventory methodology for more than one location (Kilum Ijum site in the Northwest and Mt Cameroon and Mt Manengouba sites in the SW region). The lack of a common methodology, both in Cameroon and internationally for this species, highlights the need for a common inventory methodology, which is addressed in Section 11.

This section describes these studies and their results, which are summarized in Table 3 and Figure 30. Whilst the lack of consistency means that studies cannot be compared, these studies do provide critical data on the local quantities and status of *Prunus africana* populations in Cameroon, including density, tree size, stocking levels, phrenology, post harvest regeneration and mortality rates of *Prunus africana* trees in the distribution area. This data forms the basis for developing zones for permitted harvesting.

6.1 Mount Cameroon

The Mt Cameroon area has been the most intensively studied area since 1992, reflected in the five inventories and studies conducted. Mount Cameroon is an active volcano 45 km long and 30 km wide, on a SW – NE axis on the coast of the Bight of Biafra, situated 3°57' and 3°47' North and 8°58' and 9°24' East. Situated in the South-West region of Cameroon, it is the highest peak in West and Central Africa, culminating at 4097 m above sea level. It is the only place in Africa where forest extends unbroken from sea level up to the tree line at 2500 m altitude. Its slopes are covered with lowland evergreen forest, sub-montane and montane forest, montane shrub and high altitude grassland all of which are characterized by a high level of plant endemism, with 45 endemic plants occurring only in the Mount Cameroon area (Cheek et al., 1996) and an equally rich wildlife.

- Prunus inventory, SWRSF, 1992: This study was the first to raise concerns about sustainable exploitation of the species. It was commissioned by the Ministry of Forests, and Plantecam (major exploiting company) and performed by the South West Regional Forest Service. A transect method was used with 18 blocks of ¼ ha each sampled in 7 transects. Each transect ran from the savannah-forest boundary to each of the 7 selected upper villages around the mountain. The number of Prunus trees was counted, their diameters measured, height estimated; bark thickness measured, bark recovery following past exploitation assessed, and natural regeneration assessed. The results raised awareness on the ecology and revealed that Prunus was patchily distributed with high concentration (63%) in the savannah Forest zone, and considerable reduction with a descent of the mountain, 24% between 900 and 1200 m altitude and 13% further below (Ewusi et al., 1992). The density was estimated at 5.5 stem / ha with 3.5 being exploitable. The placement of transects was guided by the knowledge of Plantecam harvesters weakening the sampling due to lack of randomization (Cunningham & Mbenkum, 1993). The number of Prunus trees, their sizes and bark thickness reduced with altitude. Tree bark recovery was noted and regeneration processes was encouraging in open areas. Neither the inventory data nor the data analysis resulted in a quota for harvesting.

- Systematic inventory of Prunus on Mt Etinde, Limbe Botanic Garden, 1992: The area covered was 5 ha distributed in 2 plots of 1/ha located at 5 different altitudes. This study revealed the patchy characteristic of the species with 88% concentration at 1800-2400 m altitudinal band, and a density of 17 stems / ha. Below this range the density drastically dropped to 3.5 stems / ha and became negligible below 900 m altitude (MCP, 1996). This method, guided by existing knowledge on Prunus distribution, made the sampling weak as it excluded a statistically randomized approach. No sustainable quota was made. The quality of harvested trees was not noted.

- Prunus regeneration assessment LBG-MCP and University of Wales Bangor, UK, 1994 -1995. Although not an inventory, it assessed the regeneration of *Prunus africana* on Mount Cameroon and noted the conversion of primary forest into secondary forest and farmland, the fragmentation of Prunus parent tree populations and differences in vegetation cover with proximity to Prunus trees associated with trampling. The plot covered two sets of six 1 m x 2 m sub-plots established in 18 sites in the Mapanja forest. One set of sub-plots was established under the crown of Prunus parent trees and another set away from it. Parent trees were either single or clustered and were found in three different habitats: agricultural fallows, secondary forest and primary forest. Regeneration and population dynamics of Prunus seedlings in the sub-plots were monitored in 1994 and 1995. Prunus regeneration was very patchy throughout (occurring in 30% of the studied sites). The mean numbers of seedlings per m^2 increased with disturbance: 1.31 ± 0.72, 0.32 ± 0.17 and 0.17 ± 0.08 in 1994 and 1.45 ± 0.67, 0.70 ± 0.20 and 0.52 ± 0.20 in 1995 for fallow, secondary and primary forest respectively. One year-old regenerated Prunus seedlings rarely exceeded a height of 30 cm. Recruitment often exceeded 100% and mortality was over 90%. The high density of regeneration found in fallows was limited by high herbaceous competition. In primary forest the density of regeneration was low and further limited by insect attack. The zone under the crown of clustered Prunus parents in the secondary forest constituted the most suitable environment for natural regeneration. Recommendations included the development of a participatory Prunus management committee composed of villagers, exploiters and forestry staff to ensure sustainable harvesting, development of agroforestry systems using Prunus and study of regeneration-related issues (Ndam 1998).

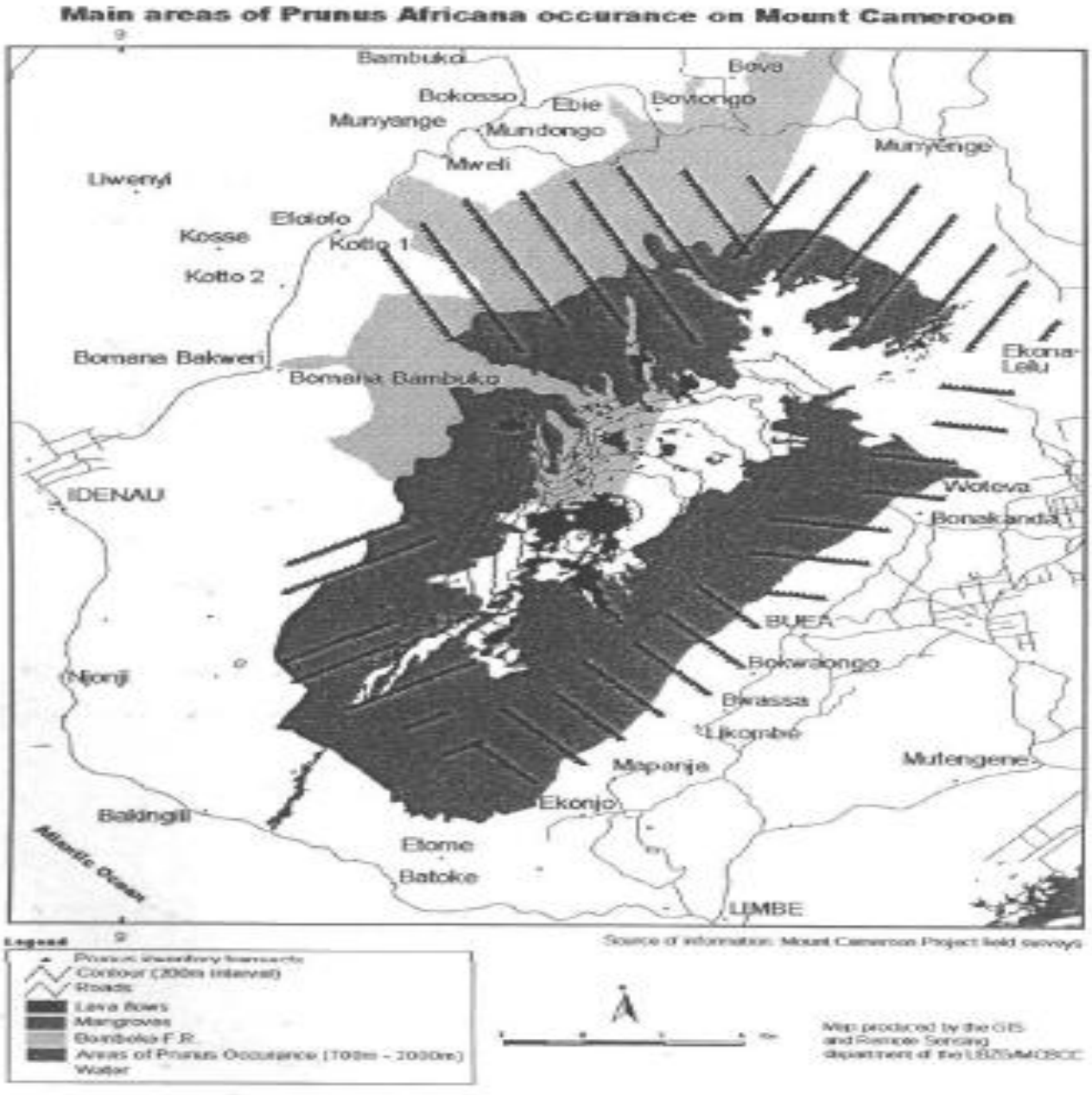
- ONADEF inventory, 1996. This study was commissioned by Plantecam in the framework of growing awareness in the Mount Cameroon Project (DFID/GTZ financed) of the requirements of the Plantecam factory for 1500 tons of Prunus bark for its yearly operations, much of which was expected to come from Mt Cameroon. A stratified sampling, with a 1% sample size, covering 48 603 ha with 2km distance transects, was used. Results showed a density of 0.76 stems / ha and 66% rate of destructive harvesting with 22% mortality rate. Further analysis led to the calculation of the sustainable exploitable quota which was 298 tons/year a management. The survey which was carried out by ONADEF, a Government parastatal agency, (and with the involvement of the local population) was jointly sponsored by Plantecam and MCP, and closely monitored by joint teams of Plantecam, MINEF, and MCP staff who independently cross checked a sample of the field work and confirmed the results to be sufficiently accurate. To prepare the local inhabitants for their eventual legal involvement in the harvesting of Prunus bark, MCP also assisted Plantecam to organise a training course for villagers on proper harvesting techniques (ONDADEF, 1996; (Ewusi, 1998).

- Prunus inventory and Management Plan for *Prunus africana* harvesting on Mt Cameroon, ONADEF and University of Reading, 1999/2000: This study was commissioned by MCP-GTZ after Plantecam rejected the findings of the 1996 inventory. The need to identify the best sampling methods was the key issue despite the existence of inventory norms (ONADEF, 1991; MINEF, 1993) and protocols proposed by MCP team (Acworth, 1997 & 2000). Villagers, MINEF and LBG-MCP staff participated in designing and implementing the inventory with support of MCP (DFID, GTZ) and Plantecam. Based on the patchily distributed nature of

Prunus as revealed in the previous inventories (Ewusi et al., 1992, MCP, 1996, ONADEF, 1996 & Ndam, 1998), an Adaptive Cluster Sample method (ACS) was used, seen as best method for sampling plant species with evenly distribution nature such as Prunus (Roesh, 1993, Underwood & Burn, 2000). The results are shown in

- Figure 23 and
- Figure **24**. The inventory indicated 35% of all trees had been harvested according to norms, 36% were harvested destructively, 26% were not harvested and 3% were unknown. A yearly exploitable quota of 209 tons was proposed was for the next 5 years of exploitation (2001-2006). MINEF adopted the recommended quota for Mt Cameroon. The reduction of Plantecam's quota from 1,500 t per year to 300 t per year caused the company to shut down in 2000 due the higher operating costs arising from the loss its monopoly permit and access to authorities (Ondigui 2001, Ndam & Ewusi, 2000). The prunus yield studies (MCP, 2000) that supported the inventory showed the impact of unsustainable harvesting with 86% of tree mortalities caused by human activity (6% by fire, 35% by poor exploitation and 44% felled). Bark thickness varied from 1.1 cm to 1.7 cm across size classes. Height to first branch varied from 8.2 to 15.2 m.

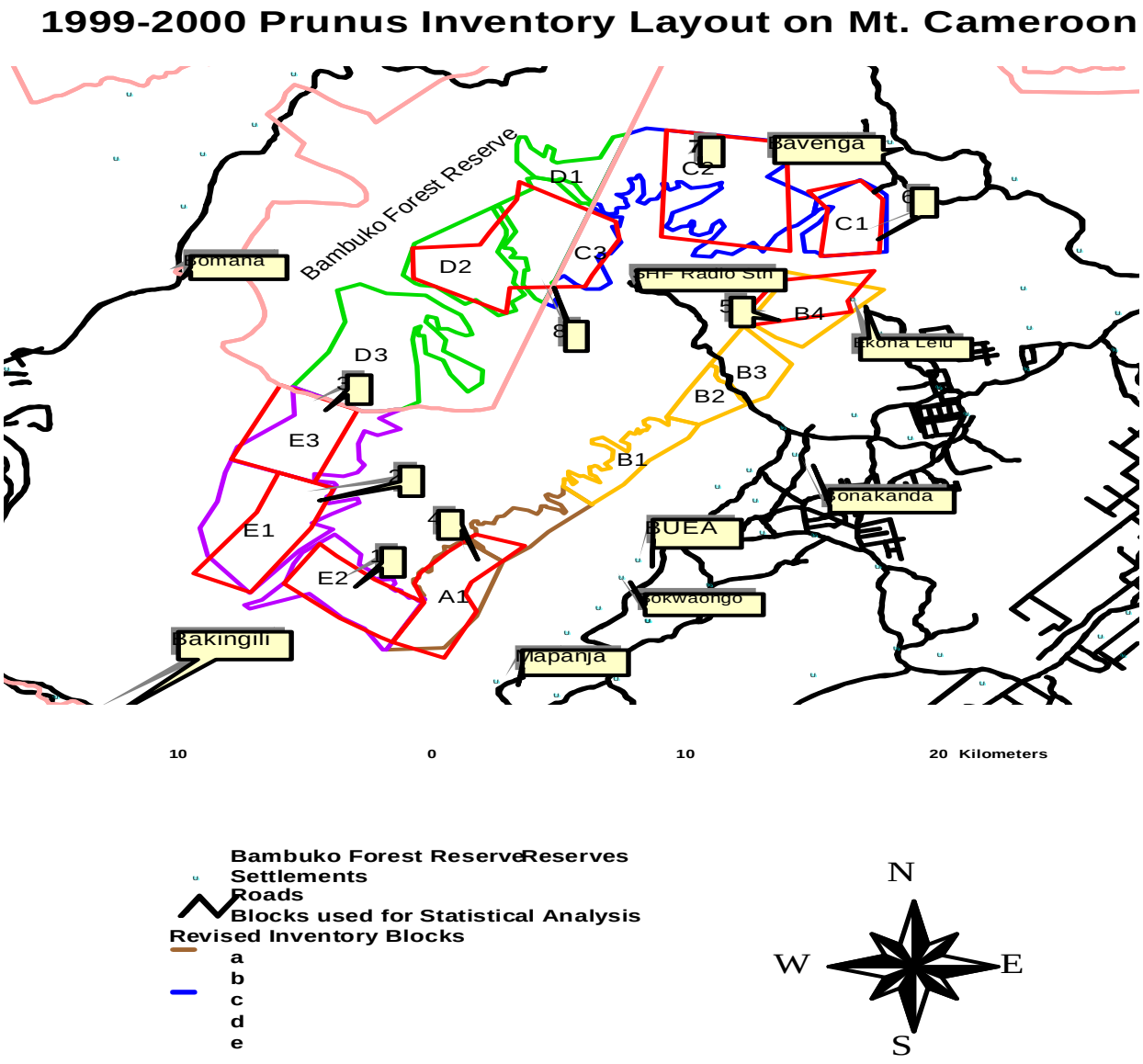
Figure 23 Distribution of *Prunus africana* on Mt Cameroon 1999/2000



- State of exploitation Bokwango Mapanja, Benoit - GTZ, 2006. This short monitoring study as part of a MSc thesis focused on exploitation in Bokwango Mapanga area of Mount Cameroon and concluded from 62 trees monitored that 81,4%, were trees unsustainably harvested and 64% over-exploited, that the unsustainable methods were used for trees with under norm DBH.

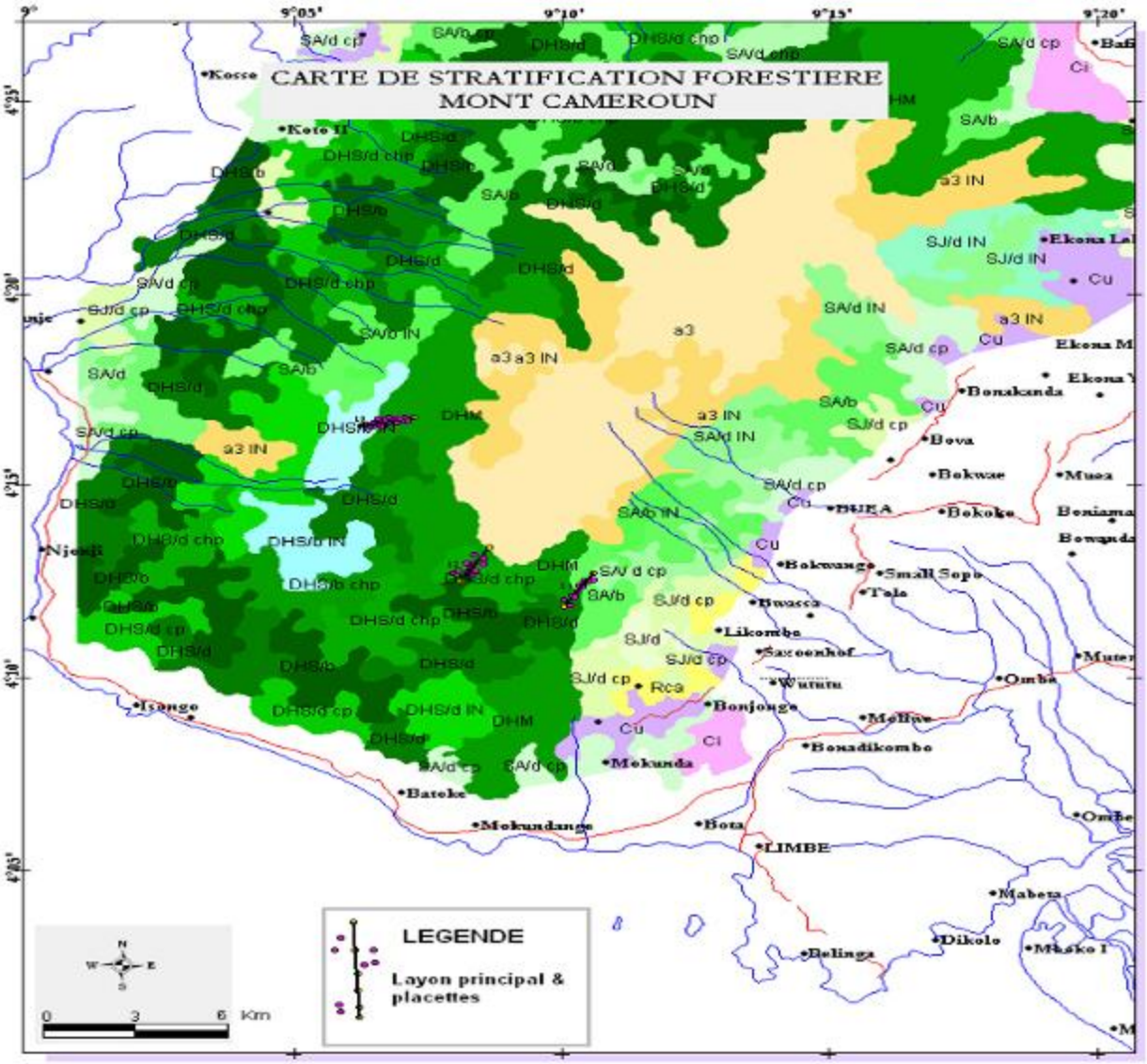
- Prunus monitoring on Mount Cameroon, Meuer-GTZ, 2007. This monitoring study was commissioned by GTZ to gauge the effects of harvesting as the validity of the 1999 inventory came to an end. It used transects based on key harvest areas and looked at tree size, health and harvesting rates to gauge the state of the resource basis and effects of exploitation in 9324 ha and the exploitable density was 4.4 stems /ha. Of 2679 trees observed, 85% had been harvested, of which 42% destructively - the majority of which occurred within the last 5 years (94 %). Of the 1789 debarked trees, 22 % were dead and 39 % showed degrees of die-back, 39% were healthy. 30 % of recently harvested trees were completely dead and mortality following the destructive exploitation was expected to rise further to 50 %.The widespread unsustainable harvesting, suggests that the depleted resource base can no longer sustain the quota of 209 t determined after the last inventory. (Meuer, 2007)

Figure 24 Inventory Mt Cameroon 2000



- Prunus inventory on Mt Cameroon, CIFOR, 2007-2008 This study was commissioned prior to the EU suspension, within the framework of the FAO-CIFOR-SNV-ICRAF project to support small and medium enterprises in the NTFP sector in Central Africa. Conducted in 2007 and 2008, the objective was to increase the knowledge of availability of *Prunus africana* in the North West and South West Provinces of Cameroon, to provide the competent authorities with the tools necessary for sustainable management the resource, taking into account both an improvement in the living standard of stakeholders dependent on this species and its conservation. ACS transects covered 73,128 ha, see Figure 25. The density of 11.4 exploitable stems /ha was found and a quota of 528 tons was calculated over 10 years taking into account prior harvesting based on the percentage in the GTZ 2007 monitoring report. 2355 trees, averaging 13 years old were noted in 13 plantations in the North West. (Foaham et al., 2008).

Figure 25 CIFOR 2008 Inventory Mt Cameroon



6.2 Adamaoua

The mountain chains and plateaus in Mayo, Faro, Déo and Mayo – Baléo area on the border with Nigeria have been subject to two inventories and one botanic survey, that also surveyed the neighbouring Nigerian forest. Tchabal Gang Daba is in Department Faro et Déo, Tignère Council. Tchabal Mbabo is situated 90 km from Banyo at 2240 metres altitude. The Mbabo plateau borders the Dodéo plain. Tchabal Gang Daba is 1960 metres altitude with gallery forests, about 10 km from Tignère between the villages of Gadjiwan and Samlekti. The region has a subtropical transition climate characterised by two almost equal seasons. Annual rainfall varies from 1 000 mm to 2 000 mm, most falling in August and September. Annual temperatures are around 23°C, with maximum of 30° and a minimum between 15°C and 18°C.

- Prunus inventory in Adamaoua, ONADEF, 2001: During a survey of the Adamaoua region three Prunus sites were determined (ONADEF, 1999): Tchabal Mbabo (Banyo), Tchabal Gang Daba (Tignere) and Tchabal Bong Bong (Banyo). 145,500 ha were sampled (0.37%), in 49 gallery forests and 3 montane forests using 94 transects over 29.1 km. The ACS method was intended but not used due to lack of previous knowledge of Prunus distribution, the time to carry out preliminary survey and lack of trained staff (Belinga. Pers com). Densities of 8,22 stems /ha and 0,99 stems /ha were found for Tchabal Mbabo and Tchabal Gang Daba respectively. 85% of trees had not been previously exploited, and 11.3% had been either felled or unsustainably exploited. Average height to the first branch in Gang Daba was 4.5m and in Mbabo between 18 m in the forest to 9m in gallery forests. Bark thickness was on average 11 mm in Mbabo and 7.6 mm in Gang Daba. Quotas of 493,6 tons /year and 8.8 tons / year were recommended for these respective areas for the 10 years of exploitation (2002-2011) following the inventory (Pouna & Belinga, 2001). The quota was not given per block and exploitation has not since been monitored.

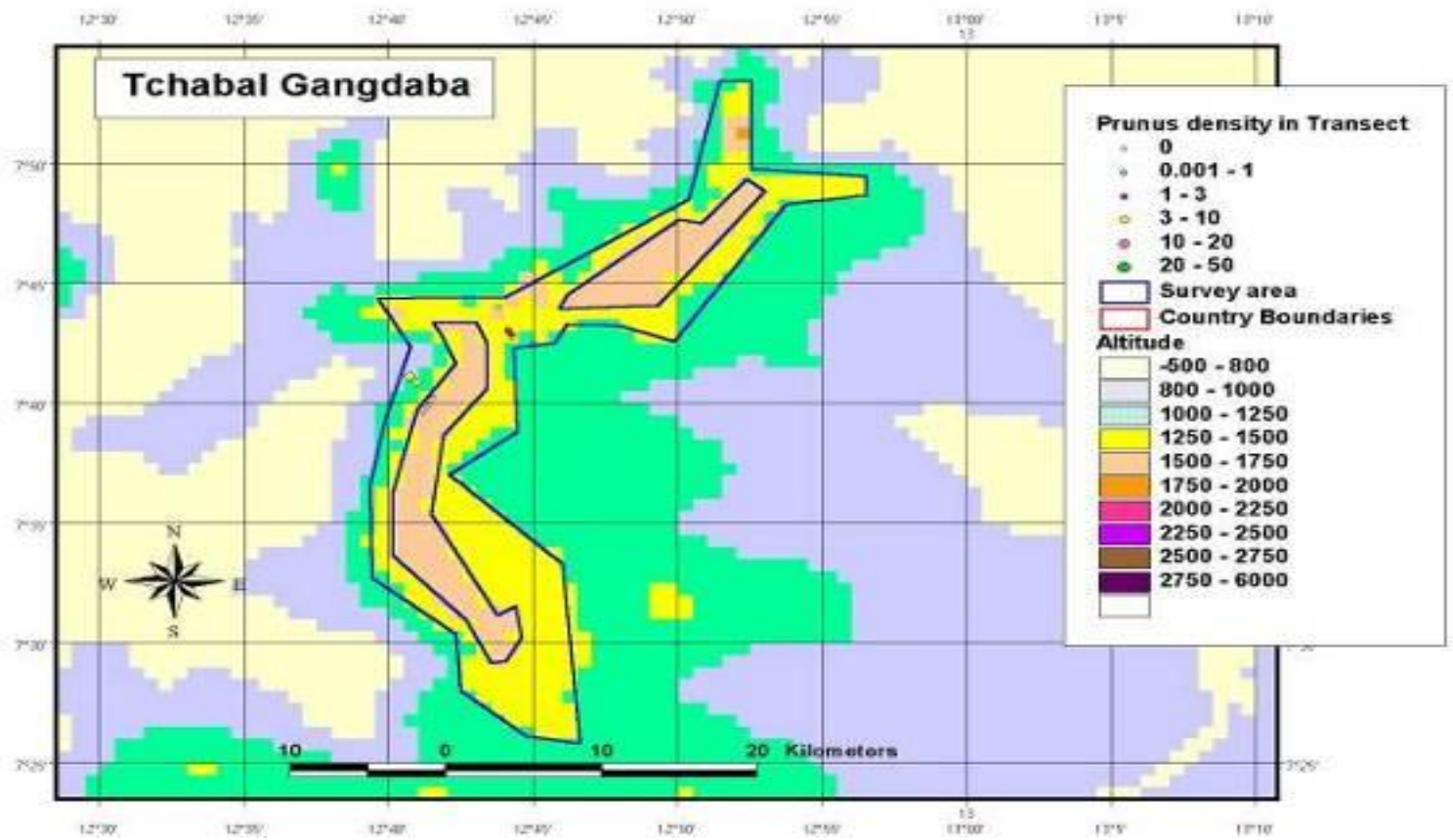
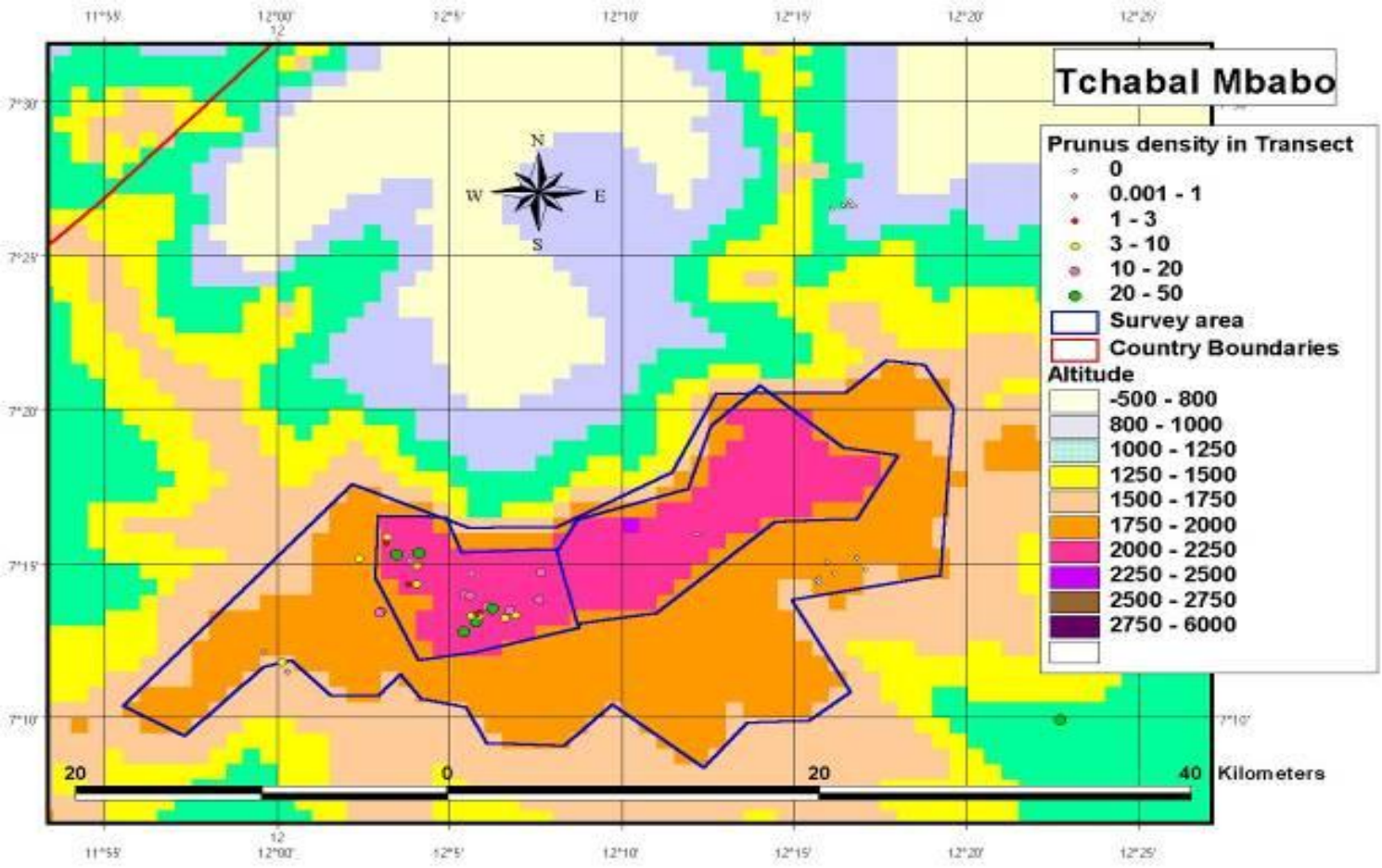


Figure 26 ONADEF Tchabal Gangdaba inventory 2001

Figure 27 ONADEF Tchabal Mbabo inventory 2001



- Prunus Rapid Assessment in the gallery forests of Samba Pelmali Boudanga near Nyamsoure, 2008: Quadrants were used to observe 261 Prunus trees. The exploitable trees were at the density of 21.8 stems / ha, with a simplistic yield calculation used to determine a quota of 28.8 tons / year for the next 10 years (MINFOF, 2008).

- Botanical survey of Tchabal Mbabo, Adamawa, 2004: A botanical survey with ground truthing, GPS coordinates and specimen collection was performed to inventory the actual vegetation in the Tchabal Mbabo area, taking into account differentiation according to habitat. The focus was on key species (abundance, spatial distribution and value) that support the global importance of conservation of Tchabal Mbabo. Special attention was paid to the state of the forests and the spatial distribution of habitats. The survey identified ten IUCN globally threatened montane plant species including *Prunus africana* and highlighted the forests importance as water catchment area, for its high biodiversity value and as good representation of West African montane vegetation to 2400 m. Extensive *Prunus africana* escarpment forests were noted. Threats from overgrazing by cattle, burning and wood collection were noted, equally the unsustainable harvest of *Prunus africana* by contractors from Bamenda and apparent lack of monitoring of quotas. An education programme on how to remove bark in a sustainable manner was recommended as were the setting up of replenishment nurseries (Chapman, 2004).

6.3 North West

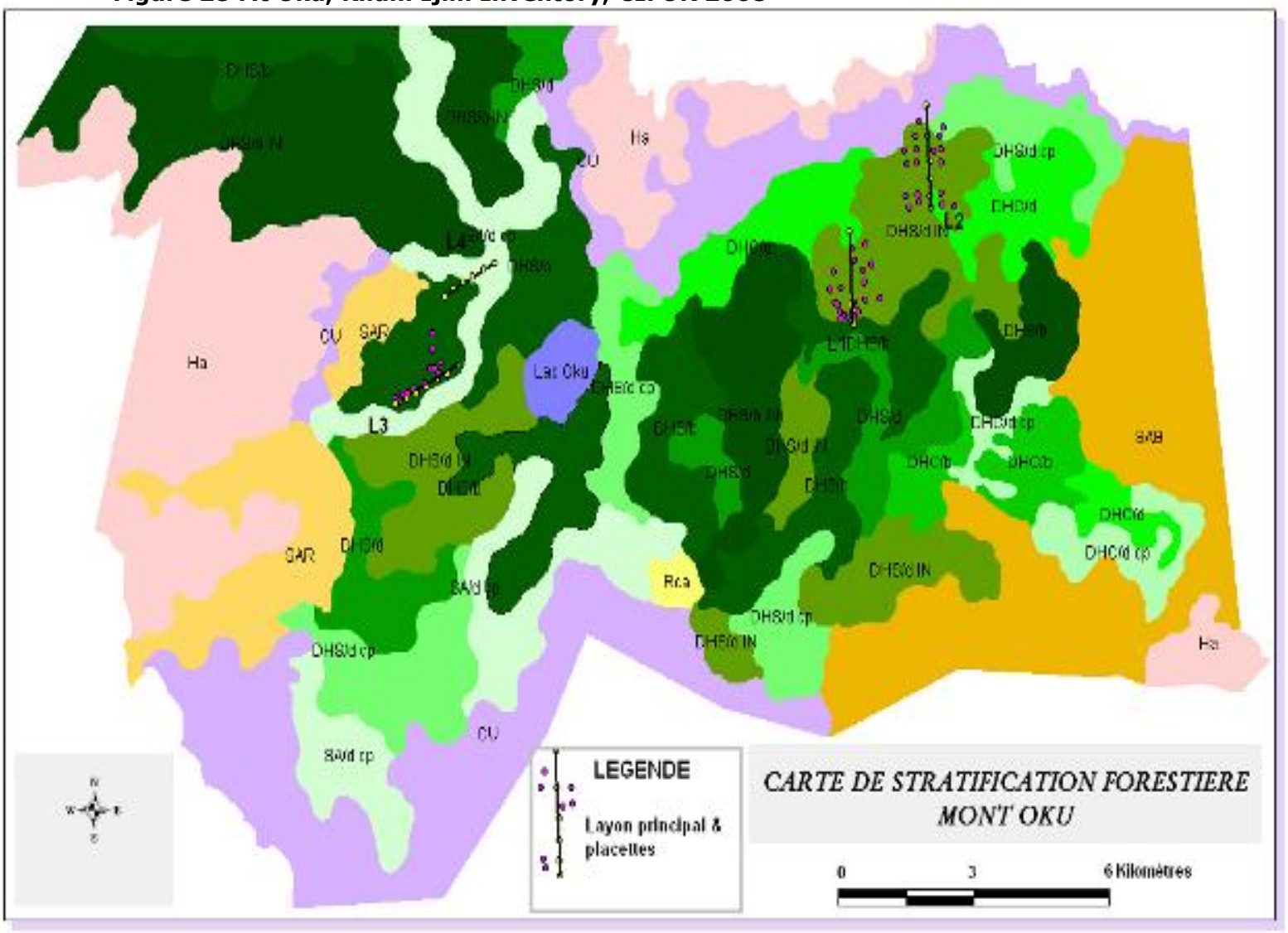
The Bamenda Highlands or ''grassfields'' contains the peaks of Kilum (3010m) and was until the mid 20th century heavily clad by a moist montane ecosystem containing very high levels of endemism. A steady and systematic degradation and fragmentation of the montane biome has resulted in an erosion of biodiversity, with a tiny fraction (98km^2) of the original forest persisting and in constant threat from farming, grazing and bush fires. In the remnants, found mostly in the most inaccessible places, high levels of biodiversity in all taxa are still found.

- Rapid assessment survey, Emfveh Mii and Ijim Community forests, Whinconet/SNV, 2007. A rapid assessment was made (Nsom, Tah & Ingram 2007) of the density, health and state of harvesting of all *Prunus africana* trees along 2 linear transects totalling 2.5 hectare. This was conducted to support a workshop on sustainable harvesting with Prunus actors including CFs in Oku. Densities of exploitable Prunus in Emfveh Mii and Ijim community forests were 15.6 stems/ha, based on a total of 350 trees counted, with the following results;
    - 159 trees (62%) were over 30 DBH, 81% of all trees in Emfveh-Mii CF had been harvested, 98% of which were harvested unsustainably
    - 47% had good or fair bark regeneration and 37% had good or fair crown health after harvesting, 13% died
    - Next sustainable harvesting only feasible from 5-10yrs
    - Very little regeneration and fruiting recorded
    - 28 trees (34%) over 30 DBH in Ijim CF, 21% of all trees in Ijim had been harvested, 62% of which were harvested unsustainably
    - 100% had good or fair bark regeneration and 98% had good or fair crown health after harvesting

- Prunus inventory Kilum-Ijim, CIFOR, 2007-2008. Part of the FAO-CIFOR-SNV-ICRAF project, ACS and transects were used in 480 ha to observe 8743 Prunus trees in the wild. Exploitable stems in Kilum Ijum forest, see Figure 28, were at a density of 3.5 stems / ha and a quota of 31.5 tons was recommended for the next 10 years, taking into account the percentage exploited found in the GTZ-Meuer 2007 and WHINCONET reports. 2962 trees, averaging 13 years old were noted in 18 plantations across the North West. Numerous large and small scale regeneration and planting activities over the last 20 years were noted, with an average survival rate of about 32%, with an estimation that 486,400 trees currently exist; with an average age of about 10 years. An accurate estimate of exploitable stock from this data is not available, but it represents an important genetic source and stock for regeneration and demonstrates the previously unrecognized scale of domestication and planting outside of natural forests (Foaham et al., 2008).

- Simple Management Plan and Management Agreement of BIHKOV FMI, 2009. An NGO, ANCO assisted the FMI to revise its SMP and inventory the 2040 hectares of forest, divided in to 12 management compartments. Eight of these were earmarked for harvest in 3 years. 77% of the 1705 trees counted were in young, in size classes up to 40 cm dbh. Density was 1.15 in general, but only 0.6 for trees over 30 dbh. Forest destruction has been caused by wild fires and goat grazing, affecting 9 of the compartments, 2 are recovering from fallow periods and Nkarkov compartment 10 is severely affected by poor exploitation resulting in die-off of many trees over 60cm dbh. The FMI tried to use different strategies to stop theses two activities but failed. Illegal and unsustainable Prunus harvesting became rampant in Bihkov at around 2004 to 2006. Taking into account prior harvesting, an estimated quantity of 41.819 tons is available the community forest over the next five years (Tah, 2009)

Figure 28 Mt Oku, Kilum Ijim Inventory, CIFOR 2008



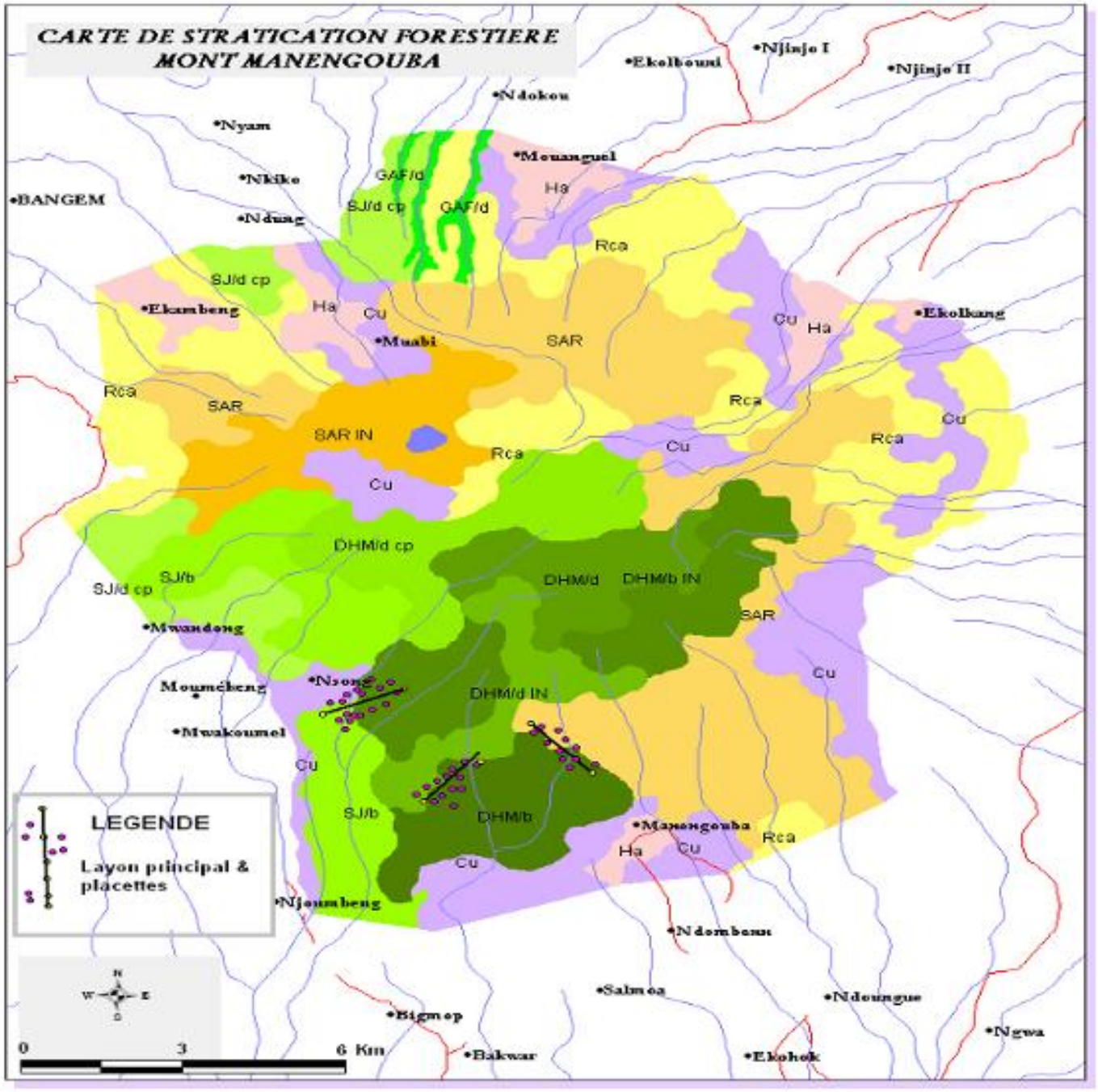
- Prunus plot inventories and monitoring to assess the effect of bark harvest on populations in Kilum, Stewart (1998, 1999, 2007). This is the long -term ecological monitoring assessments in Cameroon, working with plots totalling 2.5 ha with high densities (37 and 48 per hectare) were followed over 9 years. A decrease in populations of all sizes, and especially decrease in size classes of young trees was noted, Harvest and fire have significantly reduced the crown area since the 1998, with mostly the largest trees being affected. Grazing animals have reduced the estimated number of seedlings in all plots. After harvest, 50% of medium and large trees died.

6.4 Littoral-Bakossi Mountains

The Western Highlands chain extends through the South West with the montane peaks of Kupe-Manengouba (2396m) and Bambotous (2100m) approximately mid-way along the Cameroon mountain axis. Situated in the Littoral region, they falls in the South West region (an Anglophone region) and extends into Littoral (a Francophone region). They are also a recognised biodiversity hotspot with unique endemic bird and plant species.

- Prunus inventory on Mount Manengouba, CIFOR, 2007-2008. Part of the FAO-CIFOR-SNV-ICRAF project, forest stratification, ACS and four main transects were used in 6,237 ha to observe 11,783 Prunus trees in the wild. Exploitable trees were found at a low density of 1.9 stems /ha, with 53% of the stock being exploitable. A quota of 29.6 tons/a year was recommended for the next 10 years. Few plantations were found in the area. (Foaham et al., 2008).

Figure 29 Mt Manengouba inventory, CIFOR 2008



The inventories are summarized in Table 3 and can be seen in the map in Figure 30.

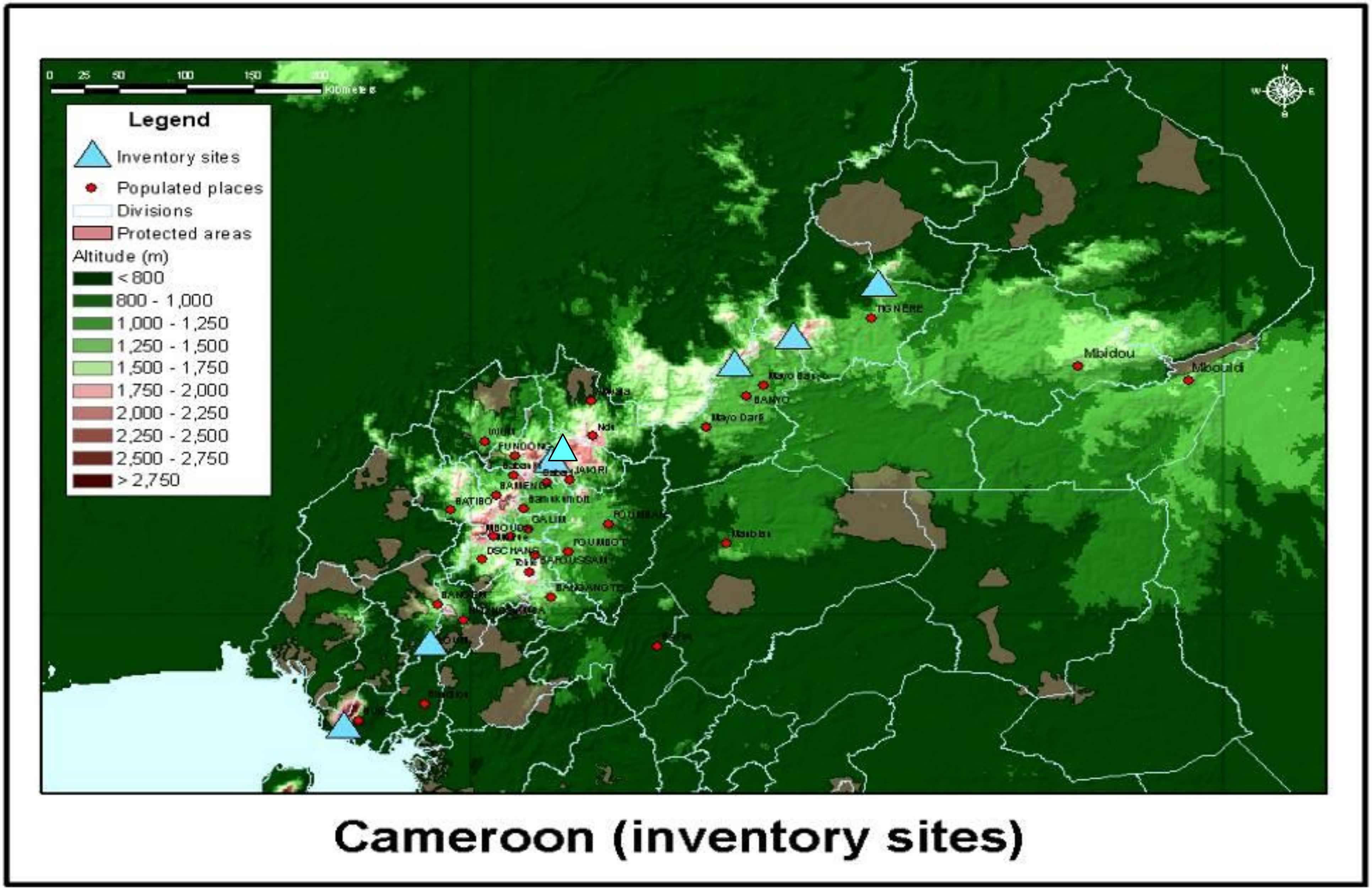


Figure 30 *Prunus africana* inventory sites in Cameroon

Table 3 Summary of *Prunus africana* inventories in Cameroon 1992-2008

Division	Location	Inventory methodology	Inventoried by	Financed by	Date of inventory	Mapping	Area sampled Hectare	% Size of sample	Total N° trees > 10 DBH	N° of trees >30 DBH	Total Hectare of area sampled	Density per hectare	Density exploitable per hectare > 30 cm	Estimated qty tonnes per year	Timescale validity inventory
Adamaoua															
Mayo Banyo	Samba Pelmali Boudounga	2 plots 35 Ha Quadrants	MinFoF Adamaoua	Private company	2008	GO	12	0.34	261		12.0	21.75	0.00	28.2	
Tchbal Gangdaba	Tchabal Mbabo	GO, GIS, specimen collection	Chapman	Birdlife Int'l	2004	GO, GIS	16 approx	-	-	-	-	-	-	-	
Mayo Banyo	Tchabal Mbabo	Transects, 53 layons	ANAFOR	GTZ	2001	AP Map GIS GO	101.4		1246	951	101.4	12.29	9.38	493.0	2011
Mayo Banyo	Tchabal Gang Daba	Transects, 33 layons	ANAFOR	GTZ	2001	AP, map GIS GO	29.3		63	28	29.3	2.15	0.96	8.8	2011
North West															
Bui	Bihkov CF	All counted	ANCO/FMI	FGF/FMI	2009	GO	2040	100	1705	918	1480	1.15	0.62	41.8	2014
Bui & Boyo	Kilum Ijum	ACS Transects 4 grids 1500m 41 layons 250 to 500m	CIFOR	FAO (EU)	2008	AP map GIS GO	42	0.37	8743	8316	2480	3.53	3.35		2018
Bui	Emfveh Mii CF	2 linear Transect - 3200 m X 3m, all trees	Whinconet	Whinconet & SNV	2007	GO	1.7		328	159	17.1	11.87	9.30		
Bui	Ijum CF	1 linear Transect - 2300 m X 3m, all trees	Whinconet	Whinconet & SNV	2007	GO	0.6		122	28	9.6	12.71	2.92		
Bui	Lumutu & Emfeh Mii	5 plots, each tree counted in 50X50m quadrants	Stewart	self	1998 - 1999	GO	1.25		47	?	1.3	37.60			N/a
Bui	Lumutu &	5 plots, each	Stewart	Explorer	2007	GO	1.25		61	?	1.3	48.80			N/a

Division	Location	Inventory methodology	Inventoried by	Financed by	Date of inventory	Mapping	Area sampled Hectare	% Size of sample	Total N° trees > 10 DBH	N° of trees >30 DBH	Total Hectare of area sampled	Density per hectare	Density exploitable per hectare > 30 cm	Estimated qty tonnes per year	Timescale validity inventory
	Emfeh Mii	tree 50X50m quadrants		Club Grant											
South West															
Fako	Mt Cameroon	18 X 0.25 hec plots in 7 transects	MinFoF SW	Plantecam	1992	GO	31.5		249	179	31.5	5.50	3.50		
Fako	Etinde	20 X 0.25ha plots	LBG	Rainforest Genetic Program	1992	GO	5		59	35	5.0	11.80	7.00		
Fako	Mapanja, Mt Cameroon	18 plots, 12 1X2m plots	LBG MCP Uni Bangor	MCP	1994 1995	GO	0.04			?					
Fako	Mt Cameroon	5 blocks, 20m X 200m transects	ONADEF	Plantecam	1996	GO	0.2	0.7	69	42339	49849.0		0.85	298.0	
Fako	Mt Cameroon	20X0.5ha plots to 10ha plots	MCP	MCP	1997	GO-Monitoring				?		0.76		140.0	2000
Fako	Mt Cameroon	ACS Transects	LBG	GTZ	1999 2000	GO			2279	1233	not known	0.10	0.05	209.0	2005
Fako	Mt Cameroon	transects	Meuer Kirsten	GTZ	2007	GO			2679	2097	9324.0	0.29	0.22		
Kupe Muanengouba	Mt Kupe	ACS Transects 3 1500m, 53 layons 400 to 600m	CIFOR	FAO (EU)	2008	AP, map GIS 1GO	66	1.6	11783	6265	6237.9	1.89	1.00	29.6	2018
Fako	Mt Cameroon	ACS Transects 4 grids, 1500m 127 layons 400 to 1000m	CIFOR	FAO (EU)	2008	AP map GIS GO	271	1.7	833762	121758	73128.0	11.40	1.66	528.4	2018

GO – Ground observations, AP - Ariel photos, GIS- Geographic information systems

6.5 Lessons from past inventories

Whilst impossible to compare the eighteen different surveys and inventories due to the different methods and objectives used, a number of useful lessons can be drawn:

- Transects need to be random and the total *Prunus africana* habitat must be known (for example grasslands should be eliminated) to provide robust information and allow extrapolation to the entire forest habitat or community forest.
- Inventories need to take account of prior harvesting to allow sustainable quota setting.
- Studies such as Stewart (2007) and Meuer (2007) cannot be used to estimate densities but do provide critical data on seedling and bark regeneration and the impacts of harvesting on populations.
- CIFOR's 2008 study is the only assessment of plantations to date and indicates the previously unknown scale of planting. This was unrecognized in the 2006 Significant Trade Review (Cunningham, 2006). Given the small sizes and surface area, a total tree count or aerial photo using a plantation sample are feasible inventory options.
- Population distribution and densities varies widely across the 3 regions inventoried and within forest areas in the same region notably NW and Mt Cameroon, as a function of previous harvesting. Trees in larger age and class sizes do exist, contrary to the data provided in the 2006 STR and appear strongly correlated to previous exploitation.
- Average densities appear to reflect the typical clumped distribution of Prunus and may reflect past harvesting practices. Never harvested populations may have a different density than the Kilum Ijum area which had high mortalities in the 1980s and 1990s.
- Past inventories confirm the patchy nature of Prunus. This reinforces the necessity of using a methodology such as ACS to capture Prunus clustering characteristic.
- The 1992 and 1996 inventories on Mount Cameroon used transects only while the 1999/2000 and 2007/2008 studies used ACS.
- Human factors affecting natural regeneration of *Prunus africana* in forests are one of the most critical to its regeneration. They include unsustainable harvesting (ie not according to norms) and "illegal" harvesting in community forests (i.e. harvesting without the permission of the community forest or outside of the simple management plan), as well indirect activities such as bushfires, grazing by goats and degradation of forest environments by encroaching agriculture. Ecological factors affecting regeneration include decreasing numbers of frugivores (fruit eating animals such as birds, squirrels and monkeys) dispersing Prunus seeds.

Photo 5 Felled Prunus, Mt Cameroon 2006 and Kilum Ijim Forest

Note the clear forest-farm boundary visible since 2004 – degradation rates of up to 30 % in the 8 years up to 1995 have been recorded (Cheek et al., 2000)

7 *Prunus africana* harvest units

The section introduces a practical permitting system with sustainable quotas in defined harvesting zones, based on the ecological distribution presented in Section 6, with the procedural and technical steps outlined and the roles and responsibilities of all the stakeholders clearly specified. The *Prunus africana* harvest units are proposed based on knowledge gained from previous inventories and surveys (described in Section 6) and the policy, regulatory, trade and ecological context in Cameroon (in Section 5).

7.1 Current permit allocation system and zones

Prunus africana is classed as a 'Special Forest Product' and as such is regulated according to Article 56 of Cameroon's 1994 Forest Law. Its 'vulnerable' status as a Red list of threatened species (IUCN, 2006) and as a CITES Annex II list species, has not been translated into any differential status in Cameroon. For example, other Special Forest Products include Eucalyptus, rattans and fuel wood. The other CITES Annex II listed plant species in Cameroon *Pericopsis elata* (known locally as Assamela), is a timber species and is not classified as a Special Product. Exploitation permits for Special Forest Products are granted annually by a quota system whereby an exploiter is allowed to exploit a quantity of product (in tons) within an area – usually a whole region and sometimes within several regions or throughout the national territory. The quota is not inventory based. If a locality is specified, it is usually on a regional or national level and several exploiters are granted permits for the same area. For example, in 2006-2007 the Inter-Ministerial commission allocated 5 permits for a total of 555,5 tons and in June 2008 five organisations were granted exploitation permits for *Prunus africana* in at Tchabal Mbabo in Adamaoua Region, 3 of them for 100 tonnes, 1 for 150 tonnes and 1 for 50 tonnes. Permits are awarded for a period one-year, non-renewable by Ministerial Decision. The award is made after the deliberation of an Inter-Ministerial commission to grant special permits. Regional delegates of MinFoF are responsible for the monitoring of the special products quotas. Information on exports of special products is processed centrally by MinFoF in the Port of Douala and recorded in the 'COMCAM' database. The export of unprocessed special forestry products is regulated annually through an authorisation from MinFoF, provided upon payment of a fixed, volume based tax. MinFoF sends CITES Secretariat an annual report of the exports for the previous year and quotas set for the following in Cameroon.

The key stakeholders in the permitting/monitoring system are the MinFoF central and decentralised services (as CITES Management Authority), ANAFOR (as CITES Scientific Authority) a proposed affiliated 'Scientific Committee', the permit holders (enterprises or community forest management institutions), harvesters, owners of *Prunus africana* on private or managers on communal land, the communities who are adjacent to natural sources of *Prunus africana* and small scale or subsistence users.

7.1.1 Strengths and weaknesses of current permit system

The main strength of the current system lies in its statement of intent, its open competitive nature in theory and the fact that a regulatory permit framework exists for forest products. The 1994 Forestry law and its decree of application clearly prescribe an inventory of an area before a permit is granted for that area. The inter-ministerial commission in theory ensures scrutiny and regional monitoring is provided for.

The current system of permits for *Prunus africana* and for NTFPs in general, has however several major weaknesses:

- Permits are based on assumption that *Prunus africana* occurs in natural forests, whereas information dating back to 1992 show an increasing number of planted sources. Currently there is no way of tracing the origin of bark.
- Granting permits without conducting prior inventories, yet prescribing the quantity to exploit defies forest management and sustainability principles and leads to depletion of a resource base without knowing the potential. Even though a number of inventories have been conducted in different areas of the country, permits are not granted based on these inventories.
- An explicit objective of projects in zones of prunus harvesting (MCP, BHFP, SWEP) is that assume that community participation in the management and protection of resources of community forests and protected areas is will permit dual objectives of income generation and nature/ecosystem conservation. To date, areas where community based harvesting have predominated have not demonstrated an improved track record, compared to non-project areas. These area do however coincide with the higher densities of Prunus and have been exploited by both communities and permit holders at the same time. However even in zones designated purely for community use (Meuer 2007), unsustainable and over-exploitation has occurred. Monitoring Data on the exploitation rates in areas not exploited by through community based organisations in Adamaoua is also not available.
- The system of granting permits for regions or nationally and lack of coordination mechanisms between MinFoF regions, does not allow Prunus to be traced back to its source.
- Granting permits to multiple organisations for the same area creates unsustainable exploitation by allowing harvest in the same area, even to the same tree, within the same period. It is difficult for forestry services to effectively monitor activities of multiple exploiters in the same area and no person bears responsibility for destructive practices.
- The short term nature of permits and the unspecified locality means there is no ownership of any particular site. There is thus no incentive for a permit holder to protect a site or its resource of Prunus in the long term. The permit system instead acts to stimulate short term economic gain above long term resource management.
- The current system does not enhance good governance processes; the permit procedure is not transparent, as exploiters in the field often do not correspond with permit holders and the links are unclear. The process is also not equitable in allowing small scale, local organizations access to commercially exploit the resource, due to the expensive and bureaucratic and complex permit procedure.
- The permit system does not specify the level of control required by MinFoF of exploiters in the field or the harvesting technique. Although the 2007 Circular introduced the "Cahier de Charge" this has not been implemented in practice since the EU suspension of trade.
- Although permits require a "Certificate of Origin" issued by the Minister in charge of forests prior to exportation (see MINFOF Circular letter n° 0958 of November 15th, 2007), a definition of the term 'origin' is not made. Certificates of origin reviewed at the MinFoF Douala Port Post I state only that the produce originates from Cameroon but not its actual geographic location or source (e.g. planted or wild *Prunus africana*).
- Permits are in practice costly and difficult to obtain, especially for smaller and new companies wishing to enter the market. Some companies report that it has taken more than two years to obtain a permit, the quota of which is often very different from the quantity requested – making business planning very difficult. Companies in the international pharmaceutical sector also report that the short-term nature of the permits is extremely un-stimulating for a long term investment in a factory or processing unit in Cameroon.

Examples of the unsustainable effect of the system of permit allocation can be seen on Mount Cameroon and the Kilum-Ijum Forest and are well documented (WHINCONET, 2005; Meuer,

2007; Stewart, 2007; Ingram, 2007-2008; Ingram, 2008). At Kilum-Ijum the 18 community forests all developed five year Simple Management Plans (SMPs) with external support. However none of these included inventories or quotas of *Prunus africana*. Widespread exploitation occurred between 2005 and 2007, even in CFs that did not yet have approved SMPs. This exploitation extended into the Plantlife Sanctuary and the Oku sacred forest, with the implication of traditional rulers. Similarly, despite the management plan established for Mt Cameroon, by 2006, three of the five blocks were almost totally depleted of exploitable Prunus, despite the presence of a trained, local community based organisation with a remit to harvest sustainably. Meuer (2007) points out that even in MOCAP controlled zones there were also infringements. Most areas affected now fall within the proposed Mt Cameroon National Park. Even though traditional rulers have had some clout in restricting access to *Prunus africana* (notably in Bakingili, due to Chief Ephraim Inoni, the incumbent Prime Minister, the Fon (chief) of Oku in the Kilum Forests during the Bamenda Highlands Forest Project period and in some areas of Mt Manengouba), community-managed *Prunus africana* harvests have generally not been any more sustainable than private sector areas and traditional authorities have not been able to stop destructive harvesting practices. Both conflicts between communities and permit holders and collusions have been noted.

7.2 Recommendations for Prunus Allocation Units

Given these challenges, a new permit system is proposed. The Permit Allocation Units (PAUs) have been participativley defined and developed with input from stakeholders, particularly during Prunus Platform meetings, community forests, SNV and the Forest Governance Facility from 2007 to 2009 (Ingram 2007; (MOCAP-CIG, 2007; Ingram et al., 2008), consultations by GTZ in November 2008 (Ndam and Asanga, 2008) and at a meeting with over sixty stakeholders in the *Prunus africana* chain in February 2009 (see **Error! Reference source not found.**).

This revised system outlined below was accepted in principal by the Scientific and Management Authorities during a meeting between MinFoF, ANAFOR, GTZ and CIFOR (see **Error! Reference source not found.**).

1. Of the sixty four areas where *Prunus africana* occurs in Cameroon identified in 2000, only a few of these zones comprise a sufficient surface area or densities of *Prunus africana* to suffice as an economically interesting exploitation unit for a permit holder. The sites are therefore grouped into six landscape regions (see Annex 6) with fifteen harvesting zones known as Prunus Allocation Units (PAUs) (see Figure 32 and Table 4). The PAU is based on a similar model to the Forest Management Unit used in Cameroon for timber concessions. The PAU grants long term exploitation rights for the exploitation of *Prunus africana* only within the territory specified, according to an inventory and subsequent Management Plan for Unit. The operator of the PAU, also known as the 'permit holder' or 'concessionaire' is then given an annual authorization to exploit a given quantity of *Prunus africana* based on compliance with the Management Plan, as demonstrated by annual reports provided by the operator and monitoring by MinFoF.

2. The competent authority (MinFoF) prepare a text for the Minister's signature, creating Prunus Allocation Units (PAU) as the main regulatory implementing tool for the national Prunus Management Plan in Cameroon.

3. The PAUs have been defined based on the following criteria:
   a. The areas allocated as PAUs for *Prunus africana* harvesting include Permanent forests. The following types of Permanent Forest domains are excluded from the PAU; Protected areas such as national parks, forest reserves, plant and fauna sanctuaries and botanic

gardens[5]. Therefore protected areas which are located in a PAU such as the Oku Plantlife Sanctuary, Mt Manengouba, Santchou and Takamanda National Park[6] will not be open to any type of *Prunus africana* exploitation. This is a conservation measure and essential to protect short and long term genetic diversity. Where a Council Forests exists, the relevant council is the appropriate entity to manage a PAU.

b. The only *exception* among protected areas is the proposed Mt Cameroon National Park due to the livelihood and cultural aspects associated with *Prunus africana* exploitation and seeks to boost community participation in the management and protection of the resources of the park, as well as generate income. Exploitation in the proposed Mt Cameroon National Park will be included in the Management Plan of the Park following and re-inventory (redefinition of the current CIFOR 2008 inventory on Mt Cameroon to define precisely PAUs SW1 and SW2 to ensure that the Park boundary, buffer zones and harvest areas outside of the boundary are transposed onto the current inventory). Considering field experiences since the last monitoring exercise in 2007, a result of a re-inventory may be that in some over-exploited zones harvesting would be prohibited to allow for regeneration. Where harvesting is possible, it is recommended that the Park Management Plan incorporate exclusive user rights to supervised community groups under customary use rights. The monitoring of any authorised harvesting activities would be monitored by a combination of Ministry of Forestry and Wildlife and trained park rangers.
c. Where a PAU includes Non-Permanent Forests (Community Forests or Communal Forests) and private plantations, farmland/agroforestry systems/homesteads etc.) all entities with de-facto exploitation rights to these domains need to apply for the entitlement for harvesting *Prunus africana* for commercial exploitation.
d. Customary community "droit d'usage"(user rights) are not permitted for *Prunus africana* in protected areas (Except point b above) due to its status as a protected species (Red Data list and CITES), which supersedes normal user rights.
e. The PAUs largely coincide with administrative boundaries. However they take into account natural boundaries, access routes, regional cross border administration, and all areas above 900 meter a.s.l., the average elevation above which *Prunus africana* is found in Cameroon.

4. As noted in Section 5.5 on the ecology and national distribution of *Prunus africana*, the majority of *Prunus africana* in Cameroon is found in 6 zones totalling an estimated 9 million hectares areas above 800 meter a.s.l. *Prunus africana* is normally found in the wild in or at the edges of, natural forests. The PAU maps therefore highlight such areas of forest and vegetative cover and provide details of the approximate area but not the exploitable quantity of *Prunus africana*. This must be determined and paid for by the PAU operator.

5. For PAUs where current inventories already exist (CIFOR 2008 inventory of the North West and South West – which corresponds with PAU NW1, SW1 and possibly SW2, and LBM1; and ANAFOR's Tchabal Gang Daba and Tchabal Mbabo 2001 inventory– covering Adamaoua PAUs 1 to 5), the following amendments are proposed to be incorporated into their PAU Management Plans;
   a. For the individual Community Forests in the North West (PAU NW1) with existing simple management plans or those under revision, these SMPs need to be revised to include a quantitative inventory. The CIFOR 2008 inventory of 31 t per annum for the total Kilum Ijum forest for 2008-2013 should be seen as an approximate guide to potential in the area and is not suitable for application to individual community forests. This is due to

[5] Law 1994 Article 24

[6] None of these protected areas currently have Management Plans. A Management Plan would clarify if normal user rights are applicable or if rights to harvest Prunus africana for personal use were prohibited. Therefore the strictest sense of the law, the CITES status of Prunus africana, is extended to Protected Areas.

large differences between individual community forests in the previous exploitation rates and management regimes for prunus (Nsom, Tah et al., 2007), (Stewart, 2007).

b. For Mt Cameroon (PAU SW1 and SW2)– the continued relevance of the CIFOR 2008 inventory depends upon two factors i) The correspondence between the zones inventoried in 2007-2008 with the final boundary of the Mt Cameroon National Park (defining the exact boundaries of SW1 and SW2), and ii) the need to reduce the quota to take into account of prior harvesting of exploitable stock. Correspondence from organisations active on Mt Cameroon MOCAP, GTZ and WCS) and monitoring studies (Meuer 2007) indicate that on average of 85% of trees had previously been harvested (of which 57% were *not* harvested sustainably) and 15% had never been harvested. This figure can be used to recalculate the amount of stock on Mt Cameroon inventoried in 2007-2008 by CIFOR as 528 tonnes annually. A conservative quota based only on stock never exploited would be 793 tonnes (79.3 tonnes per year over 10 years). An less conservative quota based only on the 43% of stock that had been previously sustainably exploited would amount to 1931 tonnes i.e. 193 tonnes a year for 10 years. A 'compromise' quota based on the total stock that never exploited plus that which has been exploited, but sustainably, amounting to 2724 tonnes ie 272 tonnes a year for 10 years).

c. For plantations (in SW2 and NW2, NW3, NW4), the figures provided in the CIFOR 2008 inventory need to be confirmed and registered by the owners.

d. For Adamaoua, the ANAFOR 2001 inventory needs to be verified given the lack of detailed data on actual quantities exploited since 2001. A ground truthing, rapid assessment of at least 10% of the area inventories, across in 5 random plots should be sampled to confirm exploitation levels, techniques, mortality and density and how this compares to the stock inventoried in 2001. Field work should be conducted in conjunction a verification of the Adamaoua MinFoF regional delegation records of quantities exploited since 2001. This will enable a revision, if necessary, of the current quota for Tchabal Mbabo of 493 tons per annum (2001-2011) and Tchabal Gang Daba of 8.8 t. pa (2001 -2011).

6. Where a zone in a PAU covers mixed Permanent and Non-Permanent forest domain and protected areas, the following rules will govern exploitation arrangements;

a. Where the PAU includes Council Forests - only the concerned Council has the right to exploit Council Forests for *Prunus africana* and the PAUs can be granted only the Council. The Council may subsequently subcontract the exploitation to a private entity or community based enterprise (where qualified).

b. Where the PAU covers Community Forests, to ensure that local communities participate fully in managing their natural resources and derive benefits, PAUs can be granted only to community based organizations (Community Forest Management Institutions) where such organizations exist or are in the process of being set up, and show a clear interest and capacity for sustainable *Prunus africana* management (ie a current Simple Management Plan exists or is in the process of being attributed). The CF Simple Management Plan (SMP) should incorporate an inventory of *Prunus africana* and subsequently incorporates this quota into the SMP. This is an additional requirement for approval by the Ministry of Forestry and Wildlife prior to harvesting, over and above the community forest procedure of attribution (GovernmentofCameroon, 2008).

c. For all *Prunus africana* situated on plantations or privately owned small holdings, only the legal owner of the land can exploit this *Prunus africana*. Prunus may only be harvested and sold commercially once owners have confirm their ownership by obtaining an attestation from the nearest MINFOF office every two years which indicates the site owner and site identification, the site location and area, the number of Prunus trees, the approximate diameter at breast height of trees (of different ages/sizes), the date of planting and the date of previous harvesting and harvesting technique (see Monitoring forms).

d. Private owners are not obliged to sell their stock to the PAU holder in their region.

7.3 PAU Allocation procedure

1. The allocation should take place through an advertised, open competition. This should state a reasonable deadline for the treatment of applications and allocation of units, stating the legal consequences of silence from the competent administration and open recourse for the applicants. The advertisement of the PAU allocation procedure and rules should take into account the often remote nature of the PAUs and often low levels of literacy and of access to information by (approved or in process) community forests, CBOs and councils in these areas. The allocation procedure should be well advertised using local information and with sufficient timescale to allow local organisations to apply. The cost of the PAU should not be extortionate as to effectively prohibit smaller, and community based from applying. Payments for the PAU license should be spread over a number of years of the life of the PAU. MinFoF local services and regional delegations should be equally well informed of the procedure.

2. **Qualifying entities** to compete in the open bid (following the guidelines in section 5.1.1) are defined as;
   - A legal, registered enterprise or a Community Forest (Forest Management Institution), Community Based Organisation (CBO) or a Council.
   - An entity with no outstanding taxes, fines or legal cases.

3. The interested entities in a PAU should submit an **application dossier**, which consists of the following elements:
   a. An application for a stated PAU
   b. A certified copy of the certificate of legal accreditation,
   c. A tax certificate,
   d. An attestation of payment of taxes on previously granted permits,
   e. Information on the modalities of collection, storage and transportation of the produce concerned,
   f. Procedures guaranteeing transparency and profitability of the practice,
   g. Methods to promote the involvement of local communities and indigenous people;
   h. All PAU operators are obliged to demonstrate that they will use only certified, trained harvesters.

4. Upon fulfilment of the application criteria and a complete dossier, each PAU will be allocated by MinFoF to a single permit holder (also referred to as concession holder or operator) for exploitation solely of *Prunus africana*. The PAU entity must then prepare a PAU *Prunus africana* Management Plan that includes an inventory for the PAU and submit this for approval prior to any exploitation. A new PAU Management Plan must be prepared each 10 years for the 30 year duration of the PAU.

5. Inventories, based on the ***Prunus africana*** **Inventory Norm** (to be legalised as a Ministerial Decision – see Section **Error! Reference source not found.** for guidelines) are paid for by the PAU operator and may be executed either by;
   a. MINFOF
   b. the local communities (or their consultants)
   c. the by PAU operator (or their consultants)

   Inventories will be approved by the CITES Scientific and Management Authorities. ANAFOR may use a Scientific Committee to provide expertise when needed.

   The inventory for each PAU should result in a report, known as ***Prunus africana*** **Management Plan.** The 10 year plan aims to guide the exploitation of the PAU by the private operator, Council or Community Forest Management Institution. The Management Plan specifies the annual harvestable quota over a period for 10 years,

from different clear Forest Management Units (FMUs), within the PAU, based on the inventory. The plan includes the following;

a. Inventory methodology and approach (including participation of local communities)
b. Description of PAU area inventoried, with maps and ecological stratification
c. Results of the inventory
d. Sustainable quota
e. PAU Management Plan
f. Details of organisation conducting inventory

6. The PAU Management Plan will be approved by the CITES Scientific and Management Authorities upon receipt. A reasonable fee may be charged to cover administrative costs review by the Management and Scientific Authorities of the PAU Management Plan. The Management Authority (MinFoF) will subsequently issue a **PAU Management Plan Approval**. This document approves the harvestable quota for *Prunus africana* from each PAU for each operator (see Section 14.2) and indicates:
   a. The identity of the permit holder ('operator')
   b. The date of issue and expiration, nominally 30 years. The duration should may vary for specific PAUs
   c. The exploitation zone - with accompanying map showing annual harvest zones and any excluded zones e.g. private land, protected areas, community forests etc.
   d. The authorised product; *Prunus africana*
   e. The attributed annual quotas on a 10 year basis, based on
   f. The harvesting technique(s) to be used
   g. The annual regeneration obligation in number of surviving and planted out saplings) and location (natural forest, privately owned or via community or council forests)
   h. The annual monitoring and reporting requirements
   i. The right or prohibition of the holder to surrender or give it on rent.

7. The Management Authority (MinFoF) will subsequently issue an **Annual Exploitation Permit** specifying the harvestable quota for *Prunus africana* from each PAU and the zone.

8. For private owners, the Management Authority (MinFoF) will issue an **Annual Exploitation Permit** specifying the maximum harvestable quota for *Prunus africana* from each private owner.

9. PAU operators will report annually, with a **PAU Annual Report,** to the Management authority MinFoF, who will provide a copy to the Scientific Authority. This will report summarise briefly the information contained in the Monitoring Forms for each batch of *Prunus africana* exploited (see Section 14.2 Monitoring procedures) and include;
   a. Total quantity in fresh (wet) weight of *Prunus africana* harvested that year in the PAU and per zone
   b. List of certified harvesters used
   c. List of tagged trees

10. The Scientific and Management authorities will, on at least annual basis, monitor and control the operation of the PAU using the following documentation (see Section 14 for more details):
    a. Review the PAU Annual Reports and Monitoring Forms A, B, C and D from PAU operators, comparing the amounts harvested from each PAU to the quota allocated, that the method of harvesting conforms to the norms.
    b. Review the amounts deemed available by private owners in the Annual Exploitation Permit with actual quantities harvest as recorded in the Monitoring Form.

c. Review the amounts reported as exported (Monitoring Form E) by buyers and compare with the total amount reported as harvested from all PAUs and private owners.
d. Where necessary, in field monitoring by field trips and verification by MinFoF regional delegation will be performed.

The authorities may, upon analysis of the data;

e. Revise or cancel any quotas judged as unsustainable.
f. Refuse PAU or private owner permits for subsequent years and/or for specific zones if quotas are judged as unsustainable or over-exploitation has taken place in previous years.
g. Suspend or sanction any entities not employing certified harvesters.
h. Suspend or sanction any harvesters not operating according to the harvest norms.

Figure 31 Area of Prunus Allocation Units (hectares)

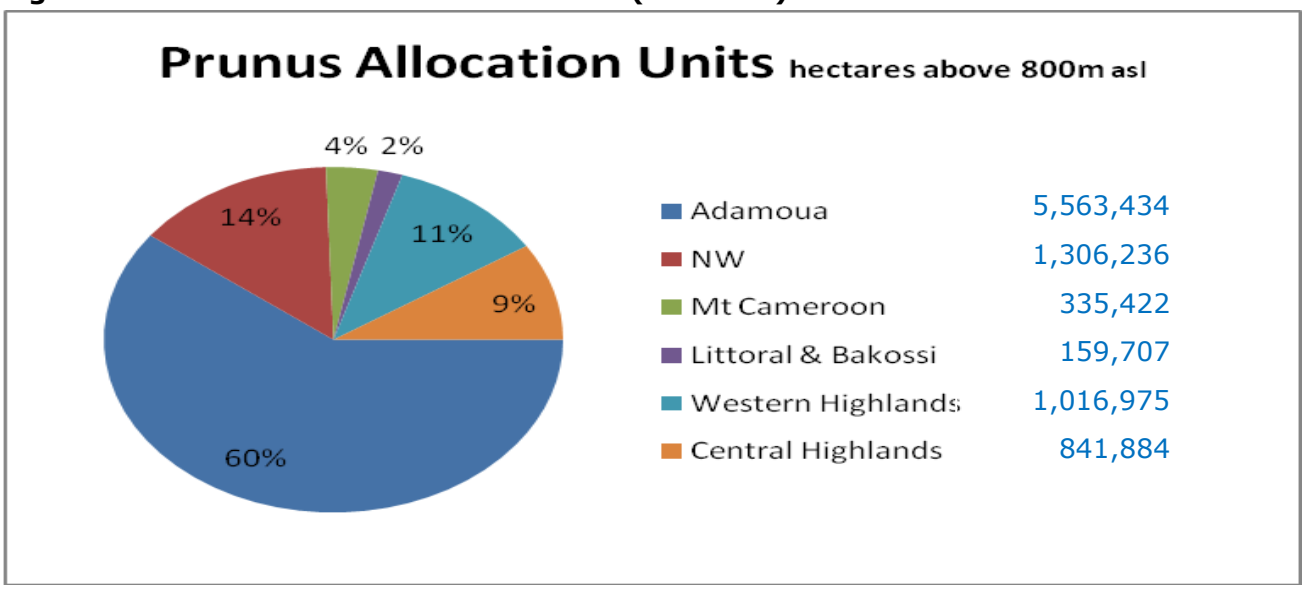


Photo 6 Sustainably harvested *Prunus africana*, Mbi CF

Photo 7 Old, thick *Prunus africana* bark, Mt Cameroon

Figure 32 Indicative map of Landscapes and PAUs in Cameroon

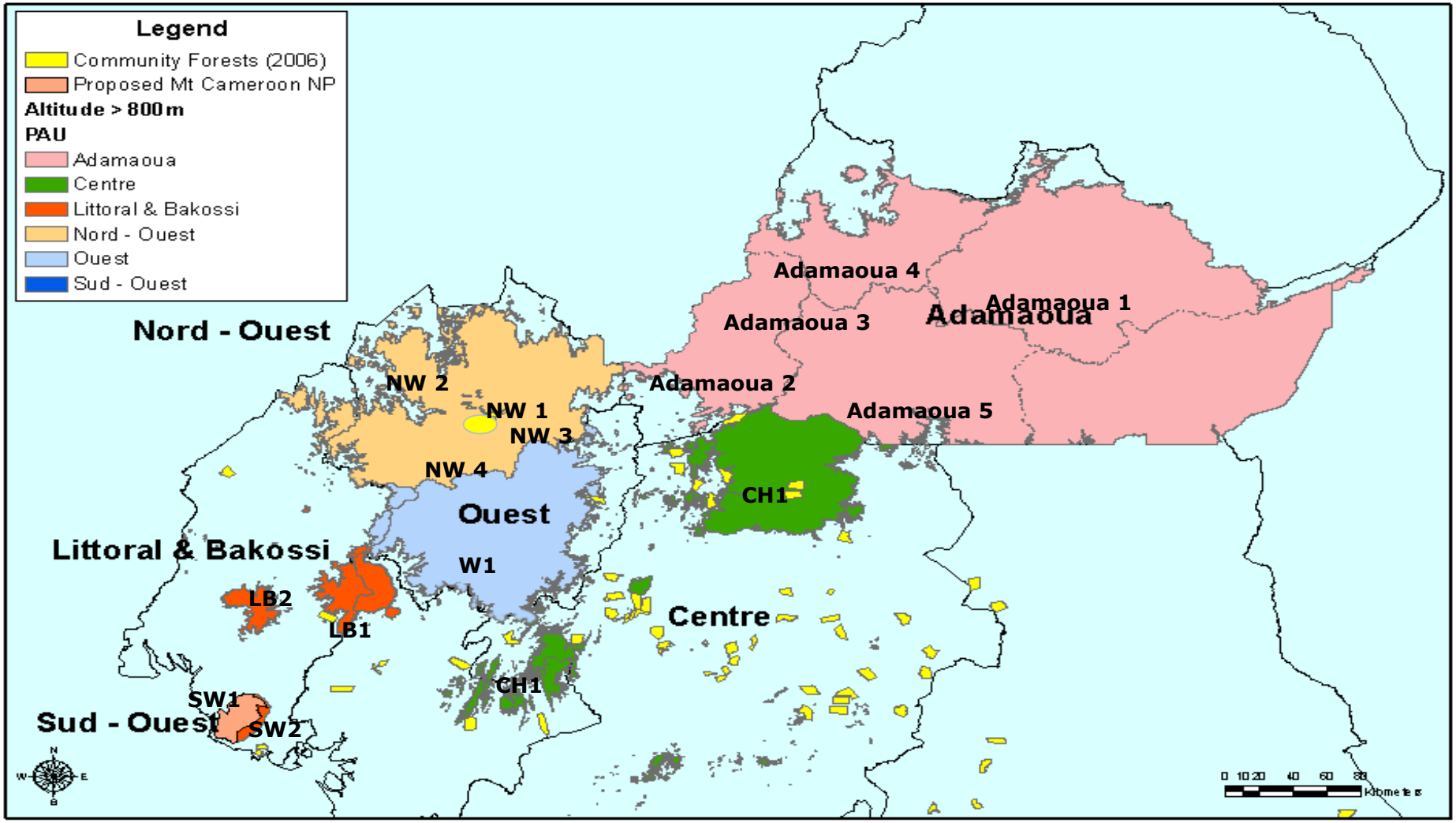


Table 4 Prunus Allocation Units in Cameroon

Major Prunus Landscapes in Cameroon	Division	Location	Proposed 15 PAUs	Comments
Adamaoua Landscape (divided into 5 permit holders for an agreed tone per year depending on verification of quantity contained current inventory) 5,563,434 ha>800m asl	Mayo Banyo Faro & Deo	Faro et Dero Samba Pelmali Boudounga Tchabal Mbabo Tchabal Bong Bong Gandoua Wawa Tchabal Gang Daba Tignere environs	Adamaoua 1 Adamaoua 2 Adamaoua 3 Adamaoua 4 Adamaoua 5	PAU extends to Nigerian border - due to concerns of cross border trade, Nigeria-Cameroon collaborative monitoring necessary. Permits granted to 5 organizations to exploit in area with quota totally 500t but no FMUs defined for permit holders. Needs rapid assessment of validity of 2001 inventory. Accessibility to Faro et Daro gallery forests mainly from Banyo. Logistically preferable for Banyo to control but liaise with Tignere Tchabal Mbabo in the process of becoming National Park - the boundary is delimitated and part of the PAU may be proposed as Community Hunting Zone.
North West Landscape (divided into 4 permit holders, each for agreed t /yr to be confirmed by an inventory 1,306,236 ha>800m asl	Bui	Jakiri, Laikom and Oku	North West Region 1 (Kilum-Ijum 18 Community Forests)	All CFs need individual inventory to be incorporated into SMPs. CIFOR inventory is guideline only for total area
	Bui & Boyo	Kumbo, Fundong and Oku	North West Region 2 (outside region 1 & with private plantations)	Wild stock in gallery forests but depleted by destructive harvesting, Private plantings of a range of ages exists, inventory ongoing in Bui (CAMEP 2008)
	Donga Mantung	Nkambe and whole Division	North West 3 (Zone with private plantations and Community Forests)	Includes substantial planted Prunus and emerging CFs - a single PAU should be waived in favour of a mix of community based and individual plantation registration.
	Ngogketunjia, Momo, Mezam & Menchum + Akwaya (Manyu)	Bamenda, Ndop, Mbengwi, Wum and environs	North West 4 (Zone with private plantations and Community Forests)	Akwya accessible from the NW, and therefore logistically better administered from the NW – in liaison with the SW Delegate. Zone includes Prunus in the wild and plantings but sketchy statistics. Emerging CFs and plantations, therefore a PAU should be waived in preference for community or private registration
Mt Cameroon Landscape divided into 2 permit allocations , each with agreed t /yr to be confirmed by an inventory 335,422 ha>800m asl	Fako , Meme	Bakingili Bokwago, Bomana Bwassa Mapanja Rumpi Hills Bonakanda Koto II	Mt Cameroon 1 (in gazettement process for Mt Cameroon National Park – boundaries not yet finalised	Zone 1 (Fako & Meme - Bakinguili, Bokwango, Bonakanda etc.) all forests outside CFs have been heavily exploited. Differing opinions NGOs (WWF and KfW) about harvest sustainability. MOCAP preference to restrict PAU permit to local organisation and local user rights.
			Mt Cameroon 2 (outside the Mt Cameroon National Park)	Probably in Park buffer zone. Still some Prunus available. MOCAP preference to restrict PAU permit to local organisation and/or local user rights.
Littoral & Bakossi Mountains Landscape divided into 2 permit allocations, each with agreed t /yr to be confirmed by an inventory 159,707 ha>800m asl	Moungo Kupe-Manegouba	Santchou Bouroukou (near Melong) Nkongsamba environs Nsoung environs Mount Kupe (Loum) Mount Lonako (Nkongsamba) Mount Manengouba (Nkongsamba)	Littoral & Bakossi Mountains 1 Littoral & Bakossi Mountains 2 (Areas outside Integrated Ecological Reserves)	Only for areas outside Integrated Ecological Reserves. Potential CBO interest in PAU. Only for areas outside Integrated Ecological Reserves.

Major Prunus Landscapes in Cameroon	Division	Location	Proposed 15 PAUs	Comments
West Landscape grouped into 1 permit holder of ≤ X t /yr to be confirmed by an inventory 1,016,975 ha>800m asl	Haut-Kam	Bafang environs	Western Highlands 1	Clustered into one site because of proximity, easier access and small quantities. Lebielem is along the Bambutous range. Some plantations known but data deficient.
		Bandekum		
		Mboebo-Folentcha (Bafang)		
	Nde	Bangante environs (Batchingou), Tombel		
	Noun	Mount Mbapit(Baigom-Foumbot)		
		Mont Koubam Bangouraim		
		Mont Yawou (Makam-Foumban)		
	Menoua	Dschang Environs		
		Foréke (Dschang)		
	Bamboutos	Mount Bamboutos (Mbouda)		
	Lebialem	Bangem, Bamebou		
Central Highlands Landscape grouped into 1 permit holder of ≤ X t /yr to be confirmed by an inventory 841,884 ha>800m asl	Mbam et Kim Mefou et Akono	Mt. Ngora, Mt. Yangba Mt. Golep Mt. Eloumdem	Central Highland 1	Recommendation only after verification of existence of a economically interesting quantity e.g. 100 tons.

8 Inventory Norm

This section summarises the current state of knowledge and practice relating to inventories. It provides the basis for developing an inventory norm, which is essential to clarify and revise the current regulatory framework.

8.1 Current practice

A small number of specialist forestry studies have looked at how to inventory un-evenly distributed species such as *Prunus africana*. Thompson (1990, 1991a, 1991b) and Roesh (Roesch F.A.Jr., 1993) combined the probability-proportional-to-size sampling schemes that are commonly used in forestry with an adaptive cluster sampling (ACS) scheme to develop a system that could be applied to inventories. Acharya et al (2000) sampled rare tree species using systematic ACS and found that for clustered species the efficiency for density estimation increased by as much as 500%. However, for unclustered species it decreased by 40%. They suggested that an optimal group size is related to design efficiency, because when groups become too large ACS becomes comparable to complete enumeration. The most pertinent of these studies, concentrating solely on Cameroonian *Prunus africana*, were conducted as part of the MCP (Acworth 1999(Underwood et al., 2000). Field trials of ACS were conducted as part of the 2000 Mt Cameroon inventory and provide an excellent guide to inventory techniques and how to conduct an inventory in the field, the underlying sampling theory and methods of estimation. The study found that ACS was more efficient compared with conventional strip sampling (for trees with dbh of at least 10 cm) with the equivalent sampling effort to obtain the same precision with conventional sampling compared with ACS was estimated to have a 70% greater cost. It was also shown that ACS yields significantly more information about the number of trees sampled.

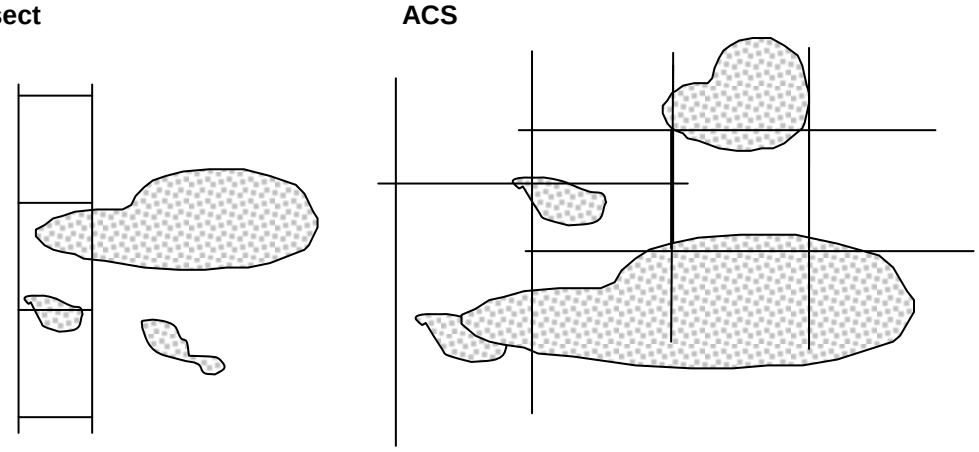


Figure 33 Comparison of transect and ACS methodologies

Inventory methods for non-timber forest products (ReforestingScotland, ; Ehlers et al., 2003; Lynch et al., 2004; URS, 2005); Wong 2003, Wong 2001) all specify that inventories should involve a combination of quantitative surveying (i.e. species presence, quality and density per unit area), habitat definition and mapping, actual cultivation levels and potential, social considerations e.g. current activities in forests and ease of access, demand for the product, harvesting impact and extrapolation based on a combination of these data. Local knowledge should also play an important part in the inventory process where possible. The most appropriate method however should be needs-based and depend on local circumstances, including forest area, habitat complexity, local needs and the nature of the 'target species'. When inventories are used to produce harvest quotas, the choice of inventory methodology needs to consider the level of precision needed, appropriate sample methods and methods of calculation.

A meeting of scientific advisers (Prunus Platform, held at CIFOR Yaoundé on 27 August 2008) reviewed the methodologies used by past inventories and confirmed that future inventories need a standardised method. A consensus was not reached about the most suitable method, given the difficult balance between scientific rigour, costs, time and capacities. However the value of the ACS method was accepted.

The CITES Review of Significant Trade recommendations for *Prunus africana workshop* (CITES, 2008) highlighted that although inventories have been done in Madagascar, Cameroon and Equatorial Guinea and are a requirement for all countries as part of the Lima 2006 Recommendations (CITES, 2006; Cunningham, 2006), there is not yet an accepted methodology for these inventories. The ISSC-MAP does provide some guidance. Key requirements for inventories were presented, including the need for vegetation mapping, a sampling methodology, data on tree size and density, bark thickness, bark damage and crown health. The University of Cordoba Management Plan for Equatorial Guinea (Navarro-Cerrillo, Clemente et al., 2008) was also hailed as a valuable guide for inventory methodology. This plan takes an The design selected was a systematic inventory with a random starting point and data collection every 100 metres along existing harvest lanes. A specific, accepted methodology has not been proposed by CITES.

As described in section 6, the fourteen studies of *Prunus africana* in Cameroon include inventories, plot monitoring, rapid assessments, regeneration studies and surveys. They vary in the methodology used, with only the CIFOR 2008 study (Foaham, Dagobert et al., 2009) using the same inventory methodology for more than one location. Experience indicates that ACS is the most rigorous method. Recommendations based on these practical experiences were made by Acworth et al (1988), Hall et al (2000), MCP (2000), Belinga (2001), Cunningham (2006), Betti (2008), Ndam and Asanga (2008) and Foaham et al (2009). Also relevant is the work on *Prunus africana* in Bioko in Equatorial Guinea, which is considered as very comparable to Cameroon (Sunderland and Tako, 1999; Navarro-Cerrillo, Clemente et al., 2008).

This lack of a common methodology, both in Cameroon and internationally for this species, underlines the need for a common inventory methodology.

Given that the majority of experience worldwide in inventorying *Prunus africana* has been in Cameroon, we are in a good position to assess which inventory methodology is most appropriate to provide accurate, pragmatic and sustainable quotas for exploitation. This requires a detailed and study beyond the scope of this management plan. Therefore, recommendations based on experiences are presented to enable the development of a specific *Prunus africana* Inventory Norm, which will be become a regulatory binding document.

8.2 Recommendations for the Inventory Norm

Drawing on these experiences with *Prunus africana* inventories outlined above, the following recommendations are made for inclusion in the inventory norm;

1. The past inventories have confirmed the patchy nature of Prunus and low densities in the wild. This substantiates the necessity of using ACS to capture such clustering behavior. The past Prunus inventories in Cameroon have used either classic transect method or the Adaptive Cluster Sampling method (ACS) as shown in Table 3. Many reasons motivated the choice of the methods. The 1992 and 1996 inventories on Mount Cameroon used transects only while the 1999/2000 and 2007/2008 ones used ACS. ACS transects and quadrants are most appropriate – despite their higher cost and complexity as they combine randomness (to eliminate field bias) with systematic sampling (to eliminate methodology bias). A summary of the advantages and disadvantages is presented in Figure 34. In conclusion, ACS method is more difficult to execute and analyze, but is both more efficient and reliable.
2. A clear distinction needs to be made in the inventory norm, the yield calculation and subsequent quotas and permits between dry and wet weight bark. The 50% ratio has been confirmed by exporters and importers (see **Error! Reference source not found.**) and is substantiated by literature (Fauron 1983).

Figure 34 Comparative analysis of transect and ACS methods

Transect method	ACS Method
Familiar & easy to use.	Unfamiliar and difficult to use.
Parallel transects of 0,5 ha (250x 20 m) contiguous plots (strip) often used.	In addition to Parallel transects of 0,5 ha (250x 20 m) contiguous plots (strip) often used, location of plots between main transects based on Prunus clustering nature.
Perceived by Cameroonian field scientist .(e.g. Belinga) as underestimating the stock therefore good for conservation measure .	Perceived by Cameroonian field scientist (e.g. Belinga) as overestimating the stock therefore dangerous for conservation measure.
Sampling level can be determined in advance based on fixed precision, means available and size of survey area	Sampling level not easy to be determined in advance base on fixed precision, means available and size of survey area
Wider range in average number of trees per hectare, e.g. 2.92 – 6.65 trees/ha on Mt Cameroon in 1996	Smaller range of average number of trees per hectare e.g. 3.4 – 5.63 trees/ha for Mt Cameroon in 1999
Higher Standard Error	Lower Standard Error
Relatively easy to analyse	Relatively difficult to analyse
Frustrating for field staff as Prunus are scarcely measured	Motivating for field staff as Prunus are abundantly measured
Amount of work approximately known in advance, therefore easy planning	Amount of work unknown in advance, therefore difficult planning
Relatively cheap and less time consuming	Relatively costly and more time consuming
With very low concentrations, much could be left uncounted	With very high concentrations, much could be double counted
Can be worst if transect is not along the altitudinal range	The altitudinal range is integrated with principal and secondary transect
Tendency to limit parameters of observation(e.g. health)	Tendency to widen parameters of observation (e.g. health)
Worst if starting from down to summit with risk of fatigue when reaching the rich higher strata	Worst if starting from down to summit with risk of fatigue when reaching the rich higher strata
NA	No clear stand of the minimum number to be seen in the main transect before deciding to add secondary plots
Needs full participation of stakeholders if ownership and wider application is needed	Need full participation of stakeholders if ownership and wider application is needed
Seems to be less and less recommended in Cameroon for Prunus	Seem to be validated as method in Cameroon and approved by CITES (CIFOR 2008) .
Tiama, the Canadian forest analytic package could be adapted for Prunus analysis (CIFOR, 2008)	Tiama, the Canadian forest analytic package could be adapted for Prunus analysis (CIFOR 2008)
Use of mid confidence limits of the mean RME for calculations of populations leading to overestimation damaging to the species	Use of lower confidence limits of the mean RME for calculations of populations leading to underestimation necessary for conservation measure

(Source Ndam and Asanga 2008)

3. For Community Forests which have much smaller surface areas (a maximum 5000 hectares) which are then partitioned into different compartments, the inventory sample method should be based on a head count of 65% of the surface area in compartments where Prunus is potentially to be harvested.

4. For plantations, the inventory sample should be based on a 100% head count (using marking and controllers). FMIs can provide labour hence reducing the cost of the inventory.

5. The method of forest type classification should combine ecological type and altitudinal range and perturbation (same ratings as CIFOR and ONADEF – show in Section 5.5.2)

6. A brief description of the socio-economic/ethno-botanic situation in the inventory area relating to *Prunus africana* and its use. For example, describing if Prunus is harvested locally or not; if there are experienced harvesters and if they are organised into groups; if Prunus is harvested for local medicinal or other uses and by who; prior problems with

over-exploitation or illegal exploitation and other anthropogenic threats to *Prunus africana* e.g. grazing, bush fire, forest clearance for pasture or agriculture.

7. Although full participation of local communities in inventory is not always realistic, it is important because of the potential benefits that can be gained. Participatory inventories such as WHINCONET and ANCO's those in Mt Cameroon vary dramatically from those with some local consultation, such as CIFOR's , those with and none, such as ONADEF's. There is a need to balance possibilities for bias in transect site selection with local understanding and implementation of the results. Especially for Community forests, the community labour in counting trees can reduce costs dramatically, as long as supervision to main scientific rigor and objective data collection is maintained.

8. Inventories need to measure;
    a. Density of prunus per hectare
    b. DBH per individual tree (using standard classifications e.g. those presented in CIFOR's work)
    c. State of tree health (using crown foliation cover) and extent of debarking (see **Error! Reference source not found.**).
    d. Average bark thickness in cm per class diameter
    e. Average volume bark per tree DBH (Bark thickness/tree height)

9. The inventory should be explicit about any peculiarities in the PAU such as access to the terrain, monitoring or control, and threats to natural regeneration (e.g. grazing areas, fire, honey hunters, etc) and season of harvesting (rainy or dry or none)

8.3 Principles

Given the recommendations above, the following elements should be included in an inventory norm, which should be a regulatory binding standard;

1. Exact coordinates, brief geographical and biophysical description and map of the PAU or community/communal forest to be inventoried
2. Description of the ACS methodology and its function (to produce a sustainable harvest quota);
3. Description of the result of the norm; e.g. a figure in wet weight and dry weight converted tonnes of *Prunus africana* bark for a given area.
4. Description of how the inventory should be executed in the field.
5. Methodology for sampling of transects and plots.
6. Methods and equations for calculations and estimates including RME and confidence limits (90%) and extrapolation from the sample transects to total area.
7. Suitable methods for data treatment and tools.
    - Tools and equipment required to conduct the inventory
        - Global Positioning System (GPS) with compass and altimeter
        - Geographic Information system (GIS)
        - Clinometer/ Clisimetre/relaskop/hypsometer or enbeeco (measuring tree height and height to first branch, hypsometer can be used, although not essential –for measuring tree canopy)
        - Bark thickness gauge eg Priestler`s bark gauge
        - Scales (for weighing actual bark yield)
        - Drum and water (measuring density of bark by weighing weighed bundles immersed in drum full of water)
        - Moisture content analyzer for moisture content of bark measure
        - Relascope (Basal area measurements of stands of trees) – not essential
        - Calipers, measuring tape or rope to measure dbh
        - Tape or string 25 m to measure distance of plots
        - Binoculars
        - Machete
        - Waterproof writing or recording materials

8. The level of detail of satellite images and maps (Ariel photos 1/20,000 and topographic maps 1/50,000).
9. Minimum level of qualifications and experience required for those conducting the inventory.
10. Notification requirements to local MinFoF authorities and any other relevant authorities and obligations of MinFoF to accompany or monitor the inventory.
11. The role of local knowledge and participation of local communities/experts/ forest user
12. Method of reporting and presenting the data, including a map of Prunus distribution and which indicates sample plots. This will be incorporated into a PAU Management Plan or a Registration Form.
13. The process of evaluation and approval by the Scientific and Management Authority and the Scientific Review Commission.

8.4 Research and capacity building needs

The studies below are needed due to data gaps to develop a scientifically robust inventory standard.

Table 5 Inventory research and capacity needs

Need	Output
Capacity building of MinFoF and actors in civil society and research to conduct inventories	Practical experience of using the standard in the 'field', conducting analysis and interpretation of results
Extensions to the Strip Adaptive Sampling Method A limitation of the method used in Mount Cameroon 2000 inventory is that a block, or stratum, must consist of a rectangle (although possibly deformed as described in Section 2.3) with parallel transects of the same length. This is a practical difficulty when strata need to follow irregularly shaped topographic or other features, and such features are common. A more flexible design would allow strata of arbitrary shape with transects of varying length. Although designs have been attempted in other fields and some theoretical results exist (Pontius, 1997), they have not yet been tried on *P. africana*. Primary sampling units should be selected (the transects), with a probability proportional to size (PPS). A trial of PPS adaptive sampling should be carried. This study would have two main components. First, using information gained from the Cameroon data, a computer model could be designed to represent the spatial distribution of *P. africana*. This model should allow for variation in features of the distribution such as density and degree of aggregation (or clustering). The other component is a mechanism for simulating various adaptive sample designs, allowing variation in not only the four parameters above, but also basic design features such as number and length of transects.	Simulation study - resulting in a better understanding of the relationships between sample design parameters and also indicate combinations which are optimal in terms of both statistical efficiency and cost. It is quite possible that some results on the tricky issue of expected size, and therefore cost, of the final sample would also become available. Furthermore it should be possible to use the simulation model to explore extensions of the strip adaptive sampling method, in particular two-stage sampling and designs with transects of variable length (see below).
Optimising Sample Design Parameters There are four features of an adaptive sampling plan which need to be decided as part of the design process. These are • the criterion used for adding plots; • the shape of the plots; • the plot size; • the distance between plots. The effects of these parameters on the efficiency of the sampling interact with each other in complex ways. There are as yet few theoretical results, and even fewer previous practical case studies, to draw from which may assist in deciding these aspects of a sampling plan. The Mount Cameroon inventory, with little previous work for guidance chose these based on common-sense, but nevertheless *ad hoc* way, practical convenience being a major consideration. It is not clear how much research effort will be required before	Simulation studies – resulting in improved design parameters

Need	Output
theoretical results on these issues become available. In the meantime, a computer simulation study could explore the inter-relationships between these design parameters with a view to identifying optimal combinations of parameter values. Simulation studies of this kind have been successfully applied to adaptive sampling in areas other than forestry (Smith et al, 1995 in Underwood and Burns 2000).	
Two-Stage Adaptive Sampling Given that a serious drawback of adaptive sampling is the size and potential cost, it is difficult to know precisely how big the final sample will be, and there is therefore a resource allocation problem at the planning stage. This problem is exacerbated by having to choose the adding rule before any data has been collected, hence a feast or famine situation with additional plots can arise. Currently some theoretical results exist which shed some light on *expected* sample size, but these have not been used in practical situations as they rely on being able to model the population distribution. One method to overcome these problems is to use a two-stage adaptive sampling process (Salehi & Seber, 1997 in Underwood and Burns 2000).) The first stage consists of sampling the plots on the main transect, for all transects in a stratum. This is equivalent to the standard current ONADEF method. The time taken to do can be estimated as the length of each transect is known prior to going into the field. A simple estimate can be obtained from this. The aim is to then use the data collected from this stage to assist in the choice of an appropriate adding rule. It would also be hoped that a better idea of the expected sample size can be obtained. As yet however two stage adaptive sampling has not been used in the field and it is not known whether expected final sample sizes can be estimated following the first stage. Some simulation work and theoretical work is required to do this.	A two-stage adaptive sampling process design

Sources: Adapted from (ETFRN, 2000; Underwood and Burn, 2000)

9 Bark yield calculations

An accurate calculation of bark yield is an essential part of each inventory and the subsequent Management Plan for PAUs, also for estimating yields from private owners. This section provides answers to questions such as ''How much of the desired raw material (quality & quantity) does the species produce under natural conditions?'' and ''What is the regeneration rate of harvested populations and individuals?''. These calculations and figures form the basis for the Harvest and Inventory norms.

9.1 Bark yield studies

Seven studies have been conducted on bark collected in Cameroon from different classes of tree size and provide a good basis for yield calculations. Five were performed by Plantecam and Mapanja Prunus Exploiters' Union for yields from Mt. Cameroon, conducted by Tako (Mundongo, Jan 1997), Dibobe (Mapanja Sept 1997 and Mapanja, July 1997), Ekonjo (a joint study in Dec 1997) and by the MCP in 2000. A Forestry Department study of 7,717 trees harvested in Bui Division, North West Province also produced yield data. Cunningham et al. (2002) calculated bark yields from 7 felled trees in Ntingue in Menoua Division, West Region, the using work done on Black wattle (*Acacia mearnsii),* a tree used in South Africa for tannin production. Bark mass data from these trees was similar to Schönau's tables for *Acacia mearnsii,* with bark 8mm thick at breast height bark (see Table 6) showing similarities between predictions from Acacia mearnsii bark mass tables and medium sized (>13cm dbh), but not the smaller *Prunus africana* trees (Cunningham et al 2002). In contrast to their small sample size, Schönau determined bark mass tables from a sample of 1,379 12 years trees with a mean density of 1,363 trees/ha (551.7 trees/acre), amounting to 28.1 tons/ha (11.37 tons/acre). Mean bark thickness at breast height in these Acacia mearnsii trees was 5.46 mm, with a mean DBH of 14.4 cm and a mean height of 16.4 m at 12 yr (Schönau, 1973, 1974).

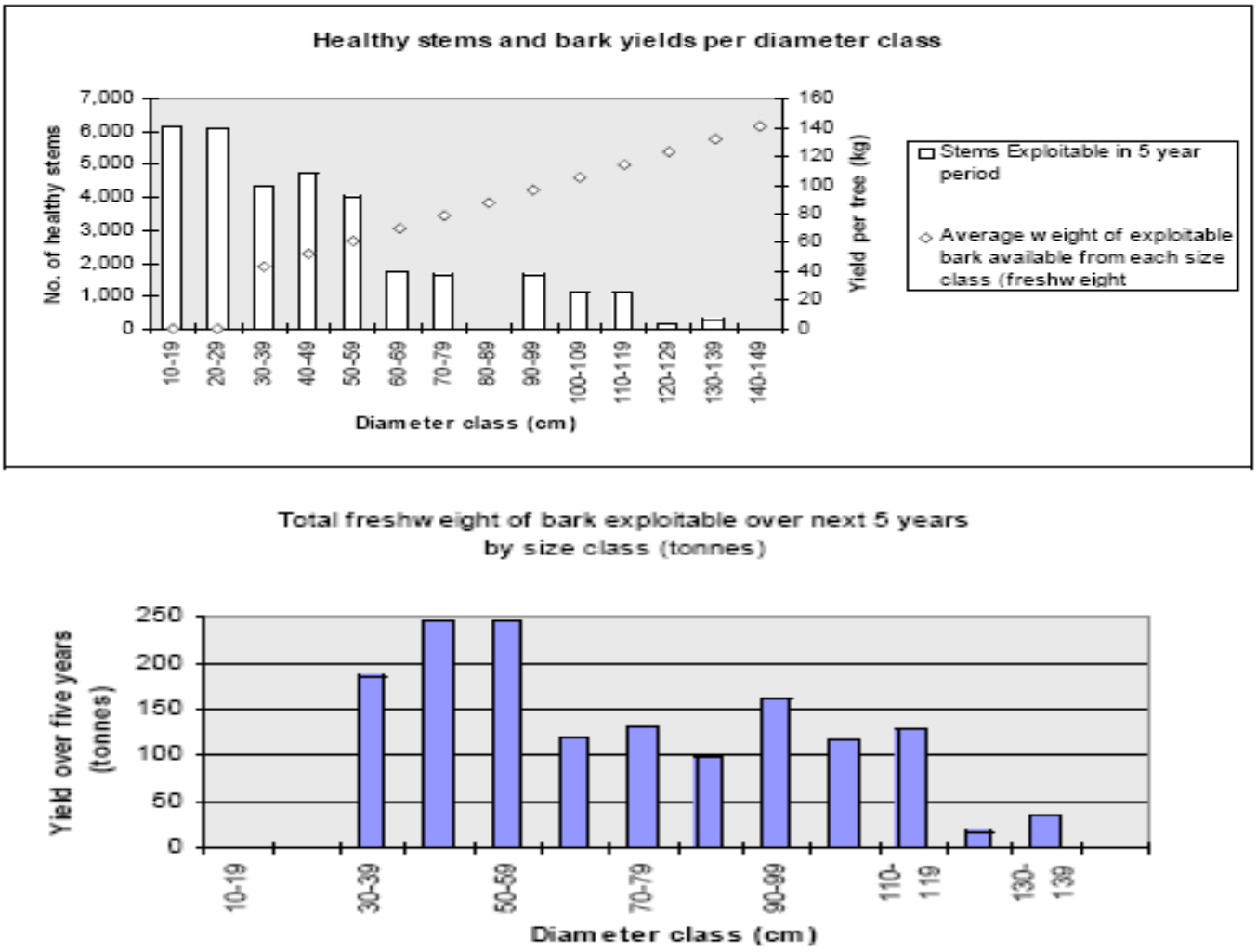
Table 6 Bark mass comparisons Acacia mearnsii and *Prunus africana*

Acacia mearnsii			***Prunus africana***		
height(m)	**dbh (cm)**	**wet bark mass (kg)**	**height(m)**	**dbh (cm)**	**wet bark mass (kg)**
18.5	25.0	59.6	18.3	26.0	60.6
18.0	19.0	44.9	18.0	19.1	40.2
13.5	22.5	39.2	13.6	22.6	38.3
13.0	17.0	29.0	13.0	17.1	26.4
10.5	13.0	18.5	10.6	13.2	18.8
7.5	11.0	11.4	7.6	11.0	6.1
5.5	7.0	n/a	5.8	7.1	3.4

Source: Cunningham et al 2002

Similar tables for *Prunus africana* can be used as guide the quantity of bark harvested per diameter class, see Figure 35.

Figure 35 Bark yields per diameter class



(Source Acworth 1997)

Millettia conraui, a montane forest tree whose bark is used traditionally in Oku to make oil containers demonstrates the practicability of sustainable bark harvest in montane forests. From the trunk of a standing tree, a quantity of bark is taken that is just enough for one to a few containers depending on tree size and the tree left to fully recover before bark is taken from another area of the trunk. Debarking is usually commenced well above ground level (often above breast height) for half of the trunk but rarely up to the first branch. The bark fully recovers within three years and the tree is ready for another round of harvesting. The SNV study on traditional harvesting (Ingram 2008) also indicates that small patches taken for traditional medicine also have little impact on health.

Overall, the yield results are show that yields are variable, due to differences in the exploitable height (from breast height to the first branch), the technical ability of the exploiter to climb and peel bark from the tree, the technique of harvest, tools used and care taken during harvest), and the rotation and recovery periods left between exploitation passes.

9.2 Sustainable yield equation

The basic assumption for calculating bark yield is that there is a sufficient correlation between tree size, tree health and growth rates, despite differences in soils, rainfall and genotypes. The impact of tree health and harvests are therefore critical factors affecting growth rates.

A prediction of the sustainable yield of *Prunus africana* bark from an inventoried site can be made from estimates of the natural population, the average yield per tree and the length of time between successive debarking to allow total recovery of the bark and maintain tree health (Acworth et al. 1999; Underwood & Burn, 2000). The basic *Sustainable Yield* of bark per annum calculation therefore is expressed by;

$$\mathbf{SY} = (D \times A \times Y_t) \setminus R$$

Where:

SY = Sustainable yield of Prunus bark per annum per Unit
D = Population density of exploitable trees (stems\ha)
A = Area of exploitable forest containing *Prunus africana*
Y_t = Average sustainable yield of bark per trees (Kg fresh weight\trees\harvest) (area X thickness)
R = Rate of total recovery of the bark (in years)

This formula requires concrete data rather than estimates of each of the parameters (D,A,H and R) as best and worst possible estimates may impact sustained yield dramatically. An inventory of the absolute number of trees (D) in each exploitation zone (A) is only one factor. Other factors can be estimated during a static (at a single point in time) inventory, such as the average sustainable yield of bark per tree (H). A factor of this yield is the degree of historical debarking of Prunus, tree growth rates, mortality rates, and the health of trees. A dynamic inventory, involving regular re-measurement of some sample trees over time, is also needed to determine the long term impacts of exploitation on the rate of recovery of bark per tree (R) (Acworth et al., 1999). To calculate the sustained yield for an eight year period, the *PAU Sustained Yield* calculation below is proposed:

$$\mathbf{Q_n} = \Sigma Q \quad \textit{Kg dry weight equivalent}$$

$$\mathbf{Q_{pau}} = \frac{A_{pau} \times P_{ae} \times RME_d \times Y_t \times P_{te}}{F_h} \textit{Kg dry weight equivalent}$$

Where:

Q_n	=	Annual Quota	*Kg Dry weight equivalent*
Q_{pau}	=	Annual Quota per PAU	*Kg Dry weight equivalent*
A_{pau}	=	Area of PAU	*Hectares*
P_{ae}	=	Proportion of Area Exploitable in PAU	*Percent*
RME_d	=	Reliable minimum estimate of density in PAU	*Stems per hectare*
Y_t	=	Average yield per tree in one harvest	*Kg dry-weight equivalent*
P_{te}	=	Proportion exploitable trees (alive & not over-exploited)	*Percent*
F_h	=	Number of years between harvests (8 Years)	*Years*

This estimate is expected to be valid for an eight year period. Due to natural mortality and the impact of exploitation on tree survival, the long-term rate of mortality, recruitment and growth of Prunus must be estimated to determine the sustainability of the harvesting cycle. At the beginning of the inventory, growth rates can be calculated by looking at the *Size Class Distribution* (diameter size according ranges) in the PAU. This should take account of the level of previous harvesting as size class distribution varies significantly in Cameroon. At least a higher number of the smallest two size classes should be present and a large number of the oldest classes to assure regeneration.

Given mortality rates averaging 17% in Cameroon (see section 5.5.1) it is essential to verify tree health and the recovery rate of sustainable and un sustainably harvested trees to determine mortality rates after 1st and more importantly 2nd harvest (i.e. when the entire circumference of the tree has been stripped). Thus even before the a 2nd harvest (i.e. 5 years after first harvest) is carried out, a verification of the health. is necessary to verify growth using the *Mortality, Recruitment and Growth equation*;

$$\mathbf{Np} = Ni - Nm + Nr$$

Yt per size class

Where:

Np = Number of Prunus trees standing at the end of eight year harvesting cycle
Ni = Initial number of Prunus trees at beginning of eight year harvesting cycle
Nm = Number of tree mortalities during eight year harvesting cycle
Nr = Number of tree recruitments during eight year harvesting cycle.
$\mathbf{Y_t}$ = Average yield of bark per tree (Kg fresh weight\trees\harvest) (by size class)

There is a significant amount of available data in Cameroon from three regions supporting the majority of these calculations, shown in Table 7.

Table 7 Data to support sustainable yield quotas of *Prunus africana*

Parameter	Information required	Information available
Exploitable area (**A**) and management strata	The area in which P. africana in Cameroon is found must be estimated, and stratified into those areas that are accessible to harvest and those that are not. Stratified map can be used. The quota should apply only to the zones and strata that are (economically) accessible and adequately sampled during the inventory and nothing more. There is no need / point in sampling inaccessible areas to any level of accuracy. The accessible areas must be stratified on the basis of forest type or other appropriate classification which may influence the density of Prunus, and each stratum adequately sampled to provide a reliable mean for the stratum (stratified map).	Stratified maps available for for Mt Cameroon, Muanegouba and Kilum-Ijum, Tchbal Gangdaba and Mbabo (see Annex 4 and CIFOR, 2008).
Density (**D**) of productive trees (excluding dead or over-exploited trees)	For the purpose of calculating the sustained yields for 5 to 10 year periods, the density per hectare of productive trees over the minimum exploitable diameter must be calculated for each stratum. Thus all dead or completely stripped trees, which cannot be expected to produce again during this 8 year period, will be excluded. Using the Harvesting Norm where a tree stripped from alternate sides every 8 years, any part of the trunk is normally given 16 years to regenerate its bark after harvest. This rule should apply even more strictly to a completely stripped tree. Thus, such trees should not be included in the estimate of 8 yearly quotas. Only when evidence is available that totally stripped trees have recovered will they be included in future estimates of sustained yield.	Density per hectare available for Mt Cameroon, Muanegouba and Kilum-Ijum, Tchbal Gangdaba and Mbabo (see Annex 4 and CIFOR, 2008). The degree of previous exploitation has also been incorporated, based on averages from monitoring studies on Mt Cameroon and Kilum Ijim.
Frequency of exploitation ($\mathbf{F_h}$)	A norm of harvesting every 5 years was proposed by the MCP and also used in the Adamaoua inventory as the then best informed figure, although the scientific basis for this norm was lacking.	Harvesting rotation norm is now proposed for a conservative period of 8 years, in response to concerns (see Section 11.1), and pending ongoing research and further studies to confirm if the limit can be safely lowered to 5 years (see **Error! Reference source not found.**) The harvesting cycle should be adjusted

Parameter	Information required	Information available
		accordingly when better information on bark regeneration rates and impact of harvesting on tree physiology is available.[7]
Rate of recovery (**R**) and tree health[1]	Canopy mortality is an indicator of tree health and recovery rates from harvest or stress, and should be recorded. Many previously exploited trees clearly show signs of stress, and if these trees need to be excluded from the immediate harvest cycle, then the yield should be reduced accordingly. Canopy cover provides a good indicator and standards can be used see **Error! Reference source not found.** (Whinconet 2007, Stewart 2007).	Data from Mt Cameroon (Meuer 2007) and Kilum Ijum (WHINCONET 2007, Stewart 2007) available- but not incorporated into current inventories. Recovery of *Prunus africana* trees after harvest varies a lot on Mt. Cameroon. The 1996 and 2000 inventories noted that that properly harvested trees generally recovered well, but appeared to have a higher percentage of survival on the wetter South / Western flanks of the Mountain - probably because higher humidity reduced stress/damage to the stripped cambial layer. On the much drier Northern and Eastern flanks of the mountain, a higher percentage trees were dying, even after 'normal' debarking. Tree mortality might also be higher in the drier North (Adamaoua etc), and even the North West. The Adamaoua inventory indicated exploitation in Tchabal Mbabo 24 % of trees under 30 cm DBH were exploited and 11% were unsustainably harvested (including felled). CIFOR is conducting a rate of recovery study May – September 2009 to assess thickness of barks after harvest in Mt Cameroon, mt Manengouba, Kilum Ijum and Adamaoua.
Mortality (**Nm**), recruitment (**Nr**) and growth rates	Mortality of Prunus from natural causes and as a result of exploitation can both reduce the exploitable population over time. It is therefore important to estimate the health and size of the juvenile population (below 30 cm diameter) and to know the rate of 'recruitment' of Prunus trees from smaller diameter classes to exploitable size. In typical forestry situations (where trees are being felled), this is the key factor that determines the sustained yield of a species. It also plays a role in the long term management of *Prunus africana*, in determining the frequency of exploitation. This concept is easier to understand by setting the 2 classes; a recruitment class under 30 dbh and an exploitation class of over 30 dbh. All previous populations inventoried have shown different size class structures, making it very difficult to gauge a 'normal' size class distribution.	Mortality rates in the Cameroon inventories range from 0% to 50% for harvested trees, with an average of 17%. This is significantly higher than the natural average of 1.5% year. Recruitments rates are known from the 2 classes ('recruitment' <30 cm dbh) and 'exploitable' >30 cm dbh) identified for Prunus on Mt Cameroon, Manengouba and Kilum-Ijum. In Tchbal Gangdaba and Mbabo (classified 11 classes 2 classes ('recruitment' <10 cm dbh) and 'exploitable' >10 cm dbh) under. Data is included in inventories (see Annex 4 and CIFOR, 2008).
Initial numbers of trees (**Ni**)	Baseline numbers of trees inventoried in representative ecological strata.	Inventories for Mt Cameroon, Mt Manengouba, Kilum-Ijum, Emfeh and Ijim CFs, Tchbal Gangdaba and Mbabo (see Annex 4 and CIFOR, 2008).
Tree yield	Average bark thickness needs to be	Inventories in Tchbal Gangdaba and

[7] The Natural History Museum of Paris expressed interest in collaborating on studies of the impact of bark removal on the physiological functioning and health of *Prunus africana*. The Museum is the French Scientific Authority for CITES.

Parameter	Information required	Information available
(Yt)	known to calculate the average yield of bark per tree. This depends on the thickness of the bark, the size class of the tree and the height of the tree.	Mbabo show average thickness for trees above 30cm dbh as 1.1 cm Tchabal Mbabo and 7.6 cm Tchabal Gang Daba. For Mt Cameroon thickness varies from 1.1 cm to 1.7 cm across size classes, with an average of 1.5 cm. About 10% of trees not exploitable, usually larger trees >100cm dbh due to difficulty of climbing, or knots or twists in the stem, which make it difficult or impossible to peel the bark. In contrast, small trees are easily exploited, and are often exploited above the first branch: 33 out of 119 stems (28%) exploited above first branch, most of them below 60cm dbh. On average, exploitation reached to 80% of stem length (Dibobe, 1997).
Bark dry weight equivalent	Fresh bark mass is on average twice that of dried bark; 1000 kg of wet bark from mature trees will produce 500 kg of dry bark at 50% humidity, which will produce 5 kg of extract.	These figures were confirmed by exporters and importers as still being relevant for Cameroon Prunus bark (see **Error! Reference source not found.**).
Yield per tree ($\mathbf{Y_t}$)	Yield data from the field is needed to estimate the average yield by size class of tree. This can be standardised by defining the tree size classes. However past inventories and monitoring studies have used slightly different approaches, which mean it is difficult to comparatively interpret data. The available data suggests that an average yield is around 65kg bark (fresh-weight) per tree for all size classes (weighted by size class distribution). Yield studies have been conducted on Mt. Cameroon by Plantecam, in part with the collaboration of MINEF, MCP and local communities.	Yield data available for bark thickness on Mt Cameroon (Dibobe, 1997; MCP, 2000) average 1.5 cm and for Adamaoua 11mm at Mbabo and 7.6 mm Gang Daba (Belinga, 2001) From these studies, an average mature tree may yield 75 kg (Cunningham and Mbenkum, 1993; Hall, O'Brien et al., 2000) with between 69 kg and 43 kg (with an average of 68kg) being reported in Mt Cameroon (MCP, 2000) and 55kg per tree in the North West (Forestry Department) . Taking the calculations of yields per tree from data available, an average of 68kg bark can be harvested per tree only if trees are exploited properly, according to the 2/4 exploitation norm. Note that in Adamaoua, the inventory proposed 500 T per annum ('optimistic' given that the trees occurred only in galleries with small geographic extent), it was possible to assume that all trees were healthy and could produce their full potential yield - because they had not been exploited before. Nearly 10 years have passed since harvesting began, and it should now be possible to reassess the health of those trees that have been harvested once, or twice and determine whether or not they are surviving 'normal' harvesting in the same way as they do on e.g. the wetter flanks of Mt. Cameroon.
Reliable minimum estimate of density in PAU ($\mathbf{RME_d}$)	Prunus is very unevenly distributed in all PAUs. Where the majority of 0.5ha plots have no Prunus in them. Increased confidence limits of the accuracy of population estimates can be achieved by amalgamating 20 x 0.5ha plots to form 10ha plots, most of which contain some Prunus.	Plots with average of 0,88 hectares, totalling 29ha and 101ha used in Adamaoua (Belinga 2001) and for the CIFOR inventories 5 000 m² (0,5 ha) each. In the 3 sites, 379 hectares (758 plots; 542 Mt Cameroun, 132 Manengouba and 84 in Oku).

Parameter	Information required	Information available
	A temptation for exploiter is to minimize the investment in inventory, which can result in estimates based on very low sampling rates, with very high Standard Errors. The "Mean" population of Prunus calculated from such surveys can be highly misleading because it is known with such limited accuracy.	To minimise the risks of over-exploitation the lower Confidence Limit of the mean (at 90% Confidence Limit rather than 95%) should be used. Even then, there is a (small) risk that estimates of populations are greater than measured. Using RME encourages conservative estimates of yield, which is necessary, given historical weak control over harvesting vis-a-vis quota allocations, and 2) provides a valuable incentive to the management authority and the Permit holder to invest in higher accuracy inventories to ensure quotas are as high as possible (i.e. with lower Standard Errors, the RME, and therefore quota, goes up).
Dry weight equivalent	Evidence of the specific weight of wet bark and the ratio with varying moisture content is important to calculate the difference between freshly harvested bark at forest edge and dried Prunus, the stage at which it is exported.	Personal communications (see **Error! Reference source not found.**) confirmed that a wet bark has a moisture content of 75-90%, to be classified as dried this has to be from 10-15%. Norally 'orthodox' seeds such as Prunus are from 5-7% (Schmidt, 2007). In Cameroon, exporters are required to sell at below 30% or the product is rejected. For extraction purposes, moisture content has to be below 10%. The average dry bark weight has a 50% weight loss in the drying process. This is confirmed by (Fauron et al., 1984).

10 National quota

The national annual quota for commercial, large-scale exploitation of any part of *Prunus africana* in any given year will be the sum of the all quotas from the approved PAU Management Plans for specific Prunus Allocation Units and the addition of all registered planted Prunus. A national quota for bark can be calculated with the following equation;

Annual TQ = ∑PAUq + ∑RPPq *Kg dry weight equivalent*

Where:

TQ = Total national Quota for Prunus bark dry weight equivalent
PAUq = Sum of all Prunus Allocation Unit annual quotas Kg dry weight equivalent in approved Management Plans
PRRq = sum of all registered planted Prunus annually Kg dry weight equivalent

This equation does *not* include small-scale traditional, subsistence and own use exploitation of *Prunus africana* bark. The scale of harvesting for own use on such different and smaller scale on average; on average 10 wide by 10 or 20 cm long is stripped from the lower bole of a healthy, mature tree . Despite its CITES and Red listed protected status, it is proposed that user rights[8] are specifically allowed for this species, due to its significant health and socio-economic values, see Section 5.4.3.

8 User rights as enshrined in 1994 forest Law Article 8 and in Section 1 Articles 26 and 29

The calculation above is for bark only as currently this is the only part of the tree harvested. If other parts of the tree are to be harvested (leaves, fruits or roots), calculations need to be devised.

10.1 Available stocks of Prunus africana

The inventories currently valid for Tchabal Gang Daba and Tchabal Mbabo in Adamaoua, Mt Cameroon, Mt Manengouba and Kilum Ijum (Belinga, 2001; Foaham, Dagobert et al., 2009), once adjusted for prior and unsustainable harvesting, provide an indication of the available stock. An estimated 735 tonnes wet weight prunus bark is available from these main *Prunus africana* bark production zones in Cameroon. Approximately 343 tonnes of wet weight bark may be present in privately owned and community based plantations, using available data with a number of assumptions and extrapolations. Figure 32 shows how the 1078 tonne total was calculated.

These inventories and the calculations of available stocks do *NOT* represent either a national quota, or individual PAU quotas or a quota for stocks of private prunus. The quotas given for inventory sites are not transferable to Management Plans for the corresponding PAUs, due to the large number of qualifications and conditions that are necessary, which are detailed in Section 7.2 and in Figure 32.

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Photo 8 MOCAP Training ASSOFOMI and ASSOKOFOMI members on harvesting techniques, March 2007

Figure 36 Available *Prunus africana* (wet weight) stocks based on current data

Inventory site	Corresponding PAU	Area in hectares	Average Density /ha	Total number of *Prunus* trees	Number of exploitable trees >30 dbh	% Exploitable trees of total stock	Totals Stock of exploitable	Average exploitable stock tonnes/10 year rotation	Stock Never harvested %	Stock not harvested tonnes	Total stock already exploited %	Previously exploited tonnes	Total stock previously sustainably exploited %	Sustainable stock availability tonnes[3]	Total available for exploitation Tonnes	Average exploitable stock tonnes annum / 10 year rotation
PAU																
Tchabal Gang Daba	Adam 4	10060	2.1	6641	4125	39%	88	9	100%	88	0%	0	0%	0	88	
Tchabal Mbabo	Adam 2	27445	12.3	209405	149575	60%	4936	494	85%	4196	15%	740	3%	17	4212	421
Mt Cameroon	Mt Cam1	73128	11,4	833762	121758	15%	5284	528	15	792	85	4491	43	1931	2724	272
Mt Manengouba	LB Mt 2	6238	1.9	11783	6265	53%	296	29	50%[8]	148	50%[8]	148	50%	74	222	2
Kilum Ijum	NW1	2481	3.5	8743	8316	95%	315	31	32%	100.8	68	214	2	4	105	1
	Sub total	119352	6	1070334	290039	52%	10919	1090	58%	5177	42%	5446	12%	1952	7130	73
Private prunus																
13 SW plantations[4]	LB Mt 1 Mt Cam 2	≥11	212	2355	1649	70%	63	6	85%	54	15%	10			54	
18 NW plantations[4]	NW 2, NW3, NW4	≥185	98	2962	1659	56%	51	5	70%	36	30%	15			36	
Other planted Prunus[5]	WH1, W2, NW3, NW4	n/a	n/a	1,611,498	211,429[5]	41%[6]	1865[7]	187	70%	1306	30%	560			864	8
	Sub total	≥ 196		1616815	214736	56%	4882	488	75%	3427	25%	1455			3427	34
	TOTAL	**119548**		**2687149**	**504775**	**54%**	**15802**	**1579**	**67%**	**8605**	**34%**	**6901**	**12%**	**1952**	**10557**	**107**

[2] Trees never exploited + trees exploited sustainably as% of total inventoried
[3] Trees never exploited + trees exploited sustainably in tonnes
[4] Inventory quota adjusted to take account of previous unsustainable harvesting
[4] Based CIFOR 2008 inventory and figures in Section 16.
[5] Assumption based on 32% survival rate of original population
[6] Extrapolated average for trees older than 13 years with a 30 cm dbh
[7] Assumption based on 55kg average bark harvest from each tree.
[8] Conservative assumption based on average of all prior harvesting rates
(Source: adapted from (Belinga, 2001; Foaham, Dagobert et al., 2009)
(All figures are to nearest decimal point)

11 Harvest Norm

This section summarises the current state of knowledge and practice on harvesting and its effects on tree health and mortality. This provides a basis for developing harvesting standards, which are essential to clarify and revise the current regulatory framework.

11.1 Current harvest practices

A controlled, sustainable harvest of *Prunus africana* bark was attempted by Plantecam in Cameroon between 1972 and 1987. This was based on a system of bark removal from opposing quarters of the tree trunk, by teams of Plantecam workers. This worked relatively well until the 1985 licences were issued to 50 entrepreneurs. The harvest quotas were demand based and not grounded in any inventories or assessments of sustainable harvest techniques.

The Forestry Administration is reported as prescribing the following rules for sustainable bark harvesting of medicinal plants in general, and of *Prunus africana* in particular in 1986 and 1992[9] (Ndibi and Kay, 1997; Ondigui, 2001) (Ministry of Agriculture (1992) Cahier des charges et al., 1986; Ministry of Agriculture (1986) Cahier des charges et al., 1992);

- Bark should be rremoved from the trunk in strips from 1.30 metres above ground level to the 1st branch.
- Only trees with diameter at breast height (DBH) >30 cm can be debarked.
- Trees with DBH <50 cm should be debarked on two strips in opposite sides, each strip no wider than 1/4 of the circumference of the tree.
- Trees with DBH ³ 50 cm should be debarked in 4 strips regularly distributed around the circumference, each no wider than 8 of the circumference. Lateral roots with a minimum diameter of 20 cm on trees with DBH ³ 50 cm trees can also be debarked.
- The debarking should then be done prior to clearing the root rhizosphere and should not exceed 1/4 of the root's circumference.
- After debarking, the root should be recovered by soil to avoid desiccation and to enable a rapid reconstitution of the bark.
- All trees with debarked roots and trunks should be marked with numbers.

Trees harvested by Plantecam staff using this method appeared to have fully recovered their bark after some time. Local people, especially those that had worked for Plantecam indicated a recovery time of about 5 years. However a significant number of these trees suffered from crown dieback and also stem borer attacks, which implies that the lifespan of these trees could have been shortened due to harvesting. Mortality among trees sustainably harvested was also lower compared to those whose barks had been poorly harvested. The trees continued to increase in diameter and produce seed. In contrast, over 90% of the trees that had been completely stripped of bark died (Ndam and Asanga, 2008).

The Mount Cameroon Project (Hall, O'Brien et al., 2000) popularised this '2 quarters technique', in the "Harvest Prunus, No Kill'am'' posters and extension booklets. These specified a four stage process where debarking concerns only Prunus trees with a diameter at breast height of over 30 cm, and harvesting is carried out by debarking opposite quarters of the tree, at 1.30 m height from ground level and not above the first branch. Each tree debarked should completely recover before being subject to another debarking.

The Law of 1994 (RepublicofCameroon, 1994) requires the Provincial Chief of Forestry to attach a technical report for Special Forest Products specifying the method of harvesting and the quantities of each species to be exploited. The technique for exploitation of Prunus is not specified.

[9] MinFoF has not been able to find any reference to these rules by the Forestry Administration (then with the Ministry of Agriculture). These rules are not referred to in Special Products Licenses since 2004. We conclude that techniques for harvesting referred to in 1992, and those proposed by the MCP are therefore "best practice rather than legal standards.

Unfortunately, these harvesting 'norms' have in reality been the exception rather than the rule for the majority of harvests in Cameroon, shown clearly in Photo 9. Meuer's (2007) survey on Mt Cameroon indicated that 43% of trees harvested were unsustainably debarked, the majority of which occurred since 2000. The 2000 inventory also found the majority of trees were harvested unsustainably (36%). WHINCONET (2007) showed that 98% of trees in Emfveh Mii and 62% in Ijim Community Forest were also harvested unsustainably.

The recovery of *Prunus africana* trees after harvest varies substantially. On Mt. Cameroon the 1996 and 2000 inventories indicated that properly harvested trees generally recovered well, but appeared to have a higher percentage of survival on the wetter South / Western flanks of the Mountain - probably because higher humidity reduced stress/damage to the stripped cambial layer. On the much drier Northern and Eastern flanks of the mountain, a higher percentage trees were dying, even after 'normal' debarking. This suggests that tree mortality might also be higher in the drier areas such as North West, West and Adamaoua regions (Ndam et al 2008). In moist sites, bark re-growth is better, but crown death of *Prunus africana* trees still occurs (Cunningham, Ayuk et al., 2002). Stewart's quantitative study (in press, see Stewart 2007) show that unsustainable harvesting frequently causes crown death. Poor bark re-growth in dry sites can also lead to wood-borer and fungal attack. In Adamaoua, when the first inventory was done, the majority of trees were healthy and could produce their full potential yield - because only 11% had previously been exploited. Nearly 10 years have passed since harvesting began and the health and survival of those trees harvested once, or twice with 'sustainable' harvesting is not yet known.

Findings from two areas on Pico de Basilé (harvested once in 1998) and Maco harvested two or 3 times in between 1998 and 2005) on Bioko Island, Equatorial Guinea, a comparable montane ecosystems to Mt Cameroon and Kilum Ijum, indicate that repeated harvesting does appear to be linked to decrease in crown size and higher mortality. It was concluded that judging by the defoliation rates, *Prunus africana* shows good recovery capacity following bark removal, as long as the proper techniques are used and the tree is left long enough for the bark to regenerate. Under these circumstances, the stress of harvest seems to cause a reversible loss of vigor, visible in partial defoliation of the crown, which later recovers as the bark regenerates. This explains the differences found in 2005 by Sunderland and Tako (1999). Differences in harvesters' skills appear to be a critical factor as known, experienced personnel were harvesting in Pico de Basilé, while considerable damage to the cambium of recently harvested trees in Moca where more destructive techniques were used. A rate of 40% crown defoliation was seen as a critical level at which not to re-harvest (Navarro-Cerrillo, Clemente et al., 2008).

In two of the main harvest areas of Cameroon more links have been found between unsustainable harvesting and high mortality rates[10]. On Mt Cameroon crown health, die back and mortality rates were almost identical for all methods of debarking, from underexploited to totally debarked, with approximately 50 % of trees remaining healthy. Only zero debarking (>75 % healthy), felling and trees and 'unknown methods of debarking' produced significant deviations. The latter were often trees that were already dead (> 70 % size class 9 and 10) but still standing, where the type of debarking could not be determined. Among the sustainably debarked trees, 30 % were old individuals more than 90cm DBH, which probably died naturally and account for the high percentage of unhealthy individuals. The high number of overexploited trees with a high percentage of healthy crowns is possibly due to the recent exploitation activity within one year of monitoring. It was concluded that totally and bole debarked trees only show the effects of destructive debarking after one year, as sites where exploitation had occurred 2-3 years previously had higher levels of dead, destructively debarked trees dead (Meuer 2007). This observation is supported by the work on Bioko, where recently unsustainable exploited trees did not exhibit the effects of harvesting, but after seven years the effects of using different removal techniques and repeated harvesting were more obvious (Sunderland and Tako 1999; (Navarro-Cerrillo, Clemente et al., 2008). Recent work in Bihkov CF in the North West also indicates that older trees over 60cm DBH die when poorly or over-exploited (Tah, 2009). The percentage of trees with high crown die-back rises with the intensity of exploitation from ~17% for normal debarking to over 30% for total debarking. Mortality rates following destructive

[10] No studies of the effect of harvest in Adamaoua have been conducted to date.

exploitation are therefore expected to rise further, from 30 % to maybe 50 %, as documented by Ewusi et al. (1996) and Stewart (2001). The effect of bark harvesting on populations at Mt. Oku showed that a loss of 50 % does not allow recovery from debarking and leads to population decline.

Consultations with stakeholders during Prunus Platform meetings (see Section 4.1) indicated that the major problems to be redressed by harvest norms were;

1. The non-existence or unsure status of a legal harvesting norm
2. The non -respect of harvesting best practice
3. Climbing the tree and physically removing the bark poses practical problems and can damage trees.
4. Inexperienced and untrained harvesters can damage trees using 'steps' and aggressive use of machetes
5. Bark 'stealing' in community forests
6. Removal of bark sections left by the previous harvester
7. Lack of 'ownership' of Prunus, multiple permit holder, unspecified zone system – creating competition and lack of management or responsibility for resources
8. Inadequate or no monitoring and control systems exist to track or penalise poor harvest techniques.
9. No concrete experience or results with alternative, managed harvest techniques

Photo 9 Unsustainably exploited Prunus, Mt Cameroon, 2006

Concurrently, the majority of actors consulted also indicated that;

- About 75% had received training and written explanation of the 2/4 quarters 'best practice' harvest techniques
- All exploiters indicated that they were aware of the techniques
- All government services were aware of the techniques
- A number of well trained, expert harvesters exists
- Trainers exist and recent harvest training has taken place (MOCAP-CIG, 2007)

These data underpin the need for a careful reconsideration of harvesting norms within a more rigorous management regime.

11.2 Recommended harvest norms

Two revised standards are therefore proposed, at least for present, until thorough scientific research can establish an evidence-based norm.

11.2.1 Method 1: 2/4 Quarters

A fundamental problem with the current 'best practice' 2/4 Quarters system of debarking from breast height up to the first branch, is that it has not been proved in the field. Reports from MOCAP and community forests in the North West, combined with monitoring surveys, demonstrate that if and when the norm has been applied, other harvesters later debark the remaining quarters or totally debark.

Actors in the Prunus chain are however convinced that a combination of sole exploitation rights, certified harvesters, well publicized techniques and a revised, conservative norm, based on research where possible, can be sustainable (see (Ingram, 2007; Ingram and Awono, 2008).

The following revisions to the norm and practices are therefore recommended;

- The minimum exploitable DBH should increase to 40 cm (Cunningham 1993, Stewart 2007; (Navarro-Cerrillo, Clemente et al., 2008)).
- The period of rotation should increase to 8 years (see **Error! Reference source not found.**, **Error! Reference source not found.** and (Navarro-Cerrillo, Clemente et al., 2008), with the two remaining quarters are harvested in a similar way. After the second eight-year period i.e. after sixteen years, the previously harvested portion is harvested again. This means that there is an eight-year cycle for harvesting from the same tree and a sixteen year cycle for harvesting from the same portion of a tree.
- Before the second harvest is carried out, a verification of tree health should be done. Quotas for second (8 year) harvesting should be based on monitoring results of healthy trees only. Trees with over 40% defoliation (crown cover) should not be harvested.
- Prunus more than 80 DBH should not be harvested due to suspected increased levels of mortality for older, larger trees (Stewart 2007)
- The exploitation system should use tags to trace each tree and traced harvesters (see Section 14.2, Tree Tagging Form)
- Pegs or 'steps' can wound trees and only ropes should be used for climbing.
- All harvesters should be trained and certified (See Harvester Certification, Section 14) with sanctions for non-compliance with the norms.
- Bark removal from the designated portion should be done gently with a stick or blunt side of a machete to not damage the cambium, by peeling and not scraping the cambium.
- Harvesting preferably during the rainy period (June , July, August) and not at the height of the dry season (December - January) to minimise mortalities.
- Leave some trees in the harvest areas for seed. One sole harvest of 1 tree in every 10 (≥60 cm) is recommended, not harvesting one tree in every 20 (≥60 cm).

11.2.2 Method 2: Felling

For planted trees a similar system is proposed to that used for *Acacia mearnsii* bark production, where successive plantings of trees are either coppiced or felled and then totally stripped of their bark (Cunningham et al. 2002). The timber can then be sold, for fuel wood, poles, handles or other uses. All studies of *Prunus africana* so far show that the high quality hard wood and considerable growth rates make it at least as attractive to small scale farmers as fast growing species such as Eucalyptus, and provide good economic returns (Franzel, Ayuk et al., 2009).

The management authorities in Madagascar and Kenya had also opted for this harvest method. Felling may be an easier harvest system for privately owned, domesticated Prunus where the onus on replacement is different than for Prunus in natural forest. Provided that felling of owned *Prunus africana* is based on registration and controls. National and individual regeneration plans and actions than ensures an at least to maintain or increase stocks of trees felled are important. This is also practical way of avoiding laborious bark harvests and high mortality rates even with 'normal' harvest techniques.

11.3 Principles

The following elements should be included in a Harvest Norm, which should be regulatory binding standards;

- Description of the *Prunus africana* tree
- Description of trees suitable for harvesting (age/size/diameter and tree health)
- Definition and description of the process of harvesting
    a. in natural forests
    b. privately owned Prunus
- Result or output of harvesting process (description of the parts of tree and products of harvesting and terminology (wet weight, dry weight, extract, powder)
- Obligation of the tree owner/PAU holder to replace Prunus in event of felling or mortality
- Tools and equipment permitted for harvesting
- Techniques and tools not permitted
- Description of monitoring and controls procedure
- Description of entities permitted to harvest prunus and qualifications/certification and training required
- Description of the permit procedure to harvest and permit costs.

11.4 Research needs

The studies below are needed due to data gaps to develop a scientifically robust harvest standard.

Table 8 Harvest research gaps

Need	Output
In the field' tests of alternative harvest methods and monitoring the effects over a period of at least 3 years	Demonstrate if and which method of harvest to maintain living trees and sustain repeated harvests and the period in between harvests
Assessment of replicability of harvest standards in different climatic zones and altitudes of Cameroon (especially drier areas of North West, West and Adamaoua regions)	Effect of climate and altitude on tree mortality and bark regeneration
Costs and financial returns of different harvest methods (periodical debarking, felling, coppicing)	Most cost efficient harvest method
Levels of extract from different Prunus tree parts and from genetically different Prunus (Mt Cameroon/Oku and Adamaoua)	Knowledge of which plant parts contain highest levels of active ingredient (extract) Knowledge of which genetic varieties of Prunus contain extract favoured by buyers
Bark regeneration and growth rates	Rotation time if practising periodic debarking

12 Roles of Management and Scientific Authorities

The authorities responsible for *Prunus africana* in Cameroon are the Ministry of Forestry and Wildlife (MINFOF) and the National Agency for Forestry Development Support (ANAFOR). This section outlines the current roles, organizational structures of the two organizations and sets out a plan for improving their roles. Other actors and their function in the Management Plan are also highlighted.

12.1 Management authority: MINFOF

Address: Ministry of Forests and Fauna (MINOF)
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Expertise: Director of Forests; Coordinator of the office in charge of plants management
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Email: ebia_ndongo@yahoo.fr

The Decree n° 2005/099 of 06th April 2005 on the organization of the Ministry of Forestry and Wildlife (MinFoF) states that the Ministry is located under the authority of a Minister who is charged with the responsibility of elaborating, implementing and evaluating Ministry of Forestry and Wildlife forestry and wildlife policy. The Minister is responsible for:

- Management and protection of forests of the national estate
- Focus on and control of implementation of programmes of regeneration, inventories and management of forests
- Control of respect for regulations in the domain of forest exploitation by the various actors
- The application of administrative sanctions when need arises
- Liaison with professional bodies within the forestry sector
- Management and control of botanic gardens
- See to the application of international conventions ratified by Cameroon as concerns wildlife and hunting

To accomplish the above mission MINFOF has:

- A private secretariat
- Two (2) Technical Advisers
- An Inspector General
- A national Brigade for forestry control and fight against poaching
- A Central administration
- Decentralised Services
- Linked services

MinFoF supervises ANAFOR, the National Forestry School at Mbalmayo, the Wildlife School at Garoua and acts as liaison with the Food and Agriculture Organisation of the UN on Forestry matters. Structures for management forests and NTFPs are situated within the central administration and the Decentralised services. The Central Administration is made up of:

- Secretariat General (SG)
- Department of Forestry (DF)*
- Department of Promotion and Transformation of Forest Products (DPT)*
- Department of Wildlife (DF)
- Department of General Affairs (DAG)

*These departments are directly concerned with Prunus management

The Department of Forestry is comprised of four (04) Sub-Directorates;

- Sub-Directorate of Agreements and Forestry Finances
- Sub-Directorate of Inventories and Forest Management
- Sub-Directorate of Community Forests
- Unit of Regeneration Monitoring, Reforestation and Silvicultural Extension

The Department of Promotion and Transformation of Forest Products is made up of three (03) Sub-Directorates:

- Sub-Directorate of Promotion of Wood
- Sub-Directorate of Wood Transformation
- Sub-Directorate of Promotion and Transformation of Non-Timber Forest Products (NTFPs).

The Department of Forestry (sub-directorate of agreements and forestry finances) is charged with processing permits for both wood and non wood products. Our observation is that this department pays more attention on processing the licenses for the timber concessions as this constitutes a major state revenue earner. They pay very little attention in scrutinizing applications for special permits under which NTFPs fall, thus the flawed system in issuing Prunus permits that has led to chaos and wanton destruction. Further investigation revealed that the sub-directorate of promotion and transformation of NTFPs in the DPT is rather powerless as they have no control of the process of granting special permits. There is thus a functional problem within the management authority that creates a gap in paying proper attention to the system of issuing Prunus permits. A way out of this should be to transfer the responsibility of processing NTFP (special) permits to the DPT (sub-directorate of promotion and transformation of NTFPs). This department should have an interest in sustainable management of NTFPs in order to keep it active. This recommendation is in line with the FAO guidelines for the management of NTFPs.

The Decentralised Services of MINFOF comprise:

- Provincial Delegations of Forestry and Wildlife
- Divisional Delegations of Forestry and Wildlife
- Control Posts for Forestry and Wildlife
- Technical Operational Units

12.1.1 MinFoF responsibilities for *Prunus africana*

Given these organs and operational responsibilities, as the CITES Management Authority, MinFoF should be responsible for;

1. Introducing the Inventory norm and Harvesting norm as ministerial Decisions
2. The PAU procedure and allocation of PAUs. Note that coordination between national and regional levels as necessary to ensure dissemination of information on the PAU allocation procedure to local organisations and Community Forest Management Institutions – who otherwise may remain unaware of the PAU procedure.
3. Issuing PAU approvals, registering private owners and issuing annual permits
4. Monitoring exploitation (monitoring forms, annual reports, Exploitation permits)
5. Controls of prunus – of monitoring forms and physically of the transport, of export at critical points airports, ports, international boundary crossings) and in the field/forest in exploitation zones
6. Sanctions for infringements
7. Maintenance of COMCAM database with Prunus data from Monitoring forms
8. Annual Special Forestry Product reporting
9. Annual Reporting to CITES - prepared jointly with ANAFOR – to CITES
10. Preparation of a Ministerial Decision elaborating the procedural collaboration between MINFOF and ANAFOR during permit allocation and monitoring.
11. Assistance form MinFoF local services to Community and Council Forests applying for PAUs for inventory, control and monitoring.

12.2 Scientific Authority: ANAFOR

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ANAFOR'S responsibilities concerning CITES are outlined in Article 3 of its Statute, granted by the Minister of Forests and Fauna (MINFOF). Decision N° 0104/D/MINFOF/SG/DF/SDAFF/SN of March 2, 2006, appointed ANAFOR to the role of the Scientific Authority in Cameroun for questions concerning threatened species of wild flora. Articles 3,4, and 5 of the Decision invoke the Scientific Authority as the body responsible for delivering an opinion at each stage of the management of a registered species under Appendices 1, 2 and 3 of CITES. ANAFOR as a Scientific Authority therefore has to;

1. Carry out continuous monitoring and estimate the situation of registered indigenous species to Appendix II and assure relative data on the exploitation and, if necessary, to recommend the corrective measures to be taken to limit the export of specimens to preserve a species distribution and ecosystems function.
2. Carry out the necessary checking of registered Appendix I species imported or introduced, or to make recommendations with on controls and issuing of licenses or certificates.
3. Annually propose, with the Management authority the permits for exploitation, quotas (number and volume of exploitation of each species of flora).
4. Monitor population dynamics of the species, in collaboration with the research institutions (IRAD, ICRAF… etc), economic operators and NGOs. The activities arising from this mandate will have support on organizational, technical and financial levels in the current operation of the ANAFOR.

Since its creation, ANAFOR has realised the following activities;
1. A four year aciton plan approved the Minister of Forest and Wildlife. This has yet to receive financing
2. A project proposal to build the institutional and staff capacity for the management of CITES species submitted to the International Organisation for Tropical Timber (OIBT/ITTO)
3. The Focal Point has participated in a number of meetings; the 2006 Conference of Parties at Lima, and at Den Haag in 2007; a Regional workshop on sustainable Periscopsis elata (known as Aformosia or Assamela) in Kribi from 02 to 04 April 2008) and in the SRG at Naivasha in September 2008.

Taking into account its youth as Scientific Authority, its technical and institutional weakness, inadequate budget, insufficient staff and low capacity and skills relevant to CITES and the Annex 2 plants to perform these obligations funding, it is currently difficult for ANAFOR to be effective as the Scientific Authority. As ANAFOR is under the supervision of MINFOF, this also takes away their independence. Formerly the National Herbarium was the scientific authority but this was seen as inadequate. IRAD is seen as too independent of the Management Authority and also has a low staff capacity. To address these weaknesses, ANAFOR has requested ITTO to strengthen its role as Scientific Authority, which should fill a major capacity gap. The accepted technical proposal is now in the pipeline for funding. The application of knowledge and skills from CITES MSc and institutionalising this within ANAFOR should go a long way to this. Potential funding for the CITES work described above is from 2 sources;

- Annual budget e.g. FCFA 30 million was allocated to ANAFOR to support its CITES work during 2009 (Annual Plan of Work).
- Administrative fees from PAUs
- Continued fundraising from other grants/projects and private sector.

The Scientific Group of Examination (GES) and the Committee for Plants in Geneva, Switzerland April 2007, recommended to the Permanent Committee to inform Cameroon to respect the terms of the Convention, particularly the strict application of article IV subparagraph 2a and 3. This article relates to the operation of the Scientific Authority which must validate the quotas of export on the basis of scientific information relating to the management of this species that guaranteeing the survival of the species. This situation has been problematic for the Scientific Authority which needed to set up emergency actions in response to the pressures caused by the suspension of the trade of Prunus. ANAFOR has indicated that it is in the process of determining long term action plan for managing *Prunus africana* and also for how the Authority coordinates scientific activity on *Prunus africana*.

ANAFOR has yet to convincing scientific data and a present a comprehensive strategy of information collection on *Prunus africana*. ANAFOR has only been able to make ''snapshot'' assessments of the current status (Ackagou Zedong, 2007) and a summary scientific research on Prunus in Cameroun (ANAFOR, 2008; Betti, 2008), which were insufficient to deal with the international pressure on the authority in the two last years to produce a response to the recommendations made at the CITES meeting in Lima 2006.

ANAFOR has a support role rather than a direct implementation role in CITES. The national forestry plantation programme is a long term programme that is still being developed. However they are involved in short term programmes like the Programme de Réboisement pending the completion of the forestry plantation programme (DGA ANAFOR, Pers Com) and are no longer directly carrying out reforestation on behalf of The Ministry of Forestry and Wildlife but are mandated to support other initiatives i.e. community Based Programmes, Municipal Councils, individuals and forest concessionaires.

In addition to this, a practical approach would be to co-opt the national herbarium (IRA) and the universities into a *Scientific Committee,* lead by ANAFOR as the leader to become the scientific authority. The University of Maroua (or Ngaoundere) covers the Dry Savanna, Dschang covers the Humid Savanna while Yaoundé I and University of Buea cover the Forest Zone. Experts from these bodies plus national institutions such as IRAD and international organisations such as TRAFFIC, CIFOR and ICRAF can support ANAFOR.

12.2.1 ANAFOR responsibilities for *Prunus africana*

Given these organs and operational responsibilities, as the CITES Scientific Authority, ANAFOR should be responsible for;

1. Scientific advice on PAU Management Plan approvals
2. Scientific verification of calculations used for quantities available from registered private owners
3. Scientific advice on monitoring of annual PAU reports and registered owners monitoring forms - comparing on reported quantities exploited to quotas Check use of monitoring sheets at field, roads and export levels
4. Allocation of means via its annual budget for annual field visit monitoring of quotas, bark harvesting and trend in supply.
5. Preparation of the Harvesting norm and Inventory Norm for ministerial Decisions.
6. Annual reporting to CITES - prepared jointly with ANAFOR – to CITES
7. Coordinate the Prunus Platform and disseminate information
8. Prepare a Ministerial Decision putting in place the Scientific Committee, its members, and mechanisms to provide for its funding and functioning
9. Coordinate the Scientific Committee and ensure capacity building of the members and dissemination of appropriate information associates at research institutions (e.g. universities, IRAD, CIFOR, ICRAF)
10. Remain up to date on the current scientific studies, research and projects on *Prunus africana* or which concern the PAUs, evaluate research and its application to the national *Prunus africana* management plan.
11. Draw up a long term research program on key areas of research and long term monitoring needs and encourage the members of the Scientific Committee, also NGOs,

CBOs and international organisations to participate in this research. Links can be made with the MinFoF Program Sectoral Forest and Environment Research programme

12. Act as coordinator of a network of CITES related plants specialists. For that contact should be made with research institutions (e.g. National herbarium, IRAD) and universities. Focal persons should be identified in those organizations. Focus should be on species in Appendix II such as *Prunus africana* and Pericopsis elata (Assamela).
13. Stimulation of specific programmes on agroforestry and regeneration of *Prunus africana*

12.3 Other actors in the Prunus chain

The CIFOR baseline study (Awono et al., 2008) analyzed the market chain for Prunus from the South West and South West regions; from harvesting to production, commercialization, use and consumption. It classifies the different actors involved in the chain (type, number and activities), whom can be placed into six groups namely; Regulatory authority, Pharmaceutical/food supplement companies, Government/Ministry, Development Agencies and NGOs, Permit holders/Economic operators and communities/Community |Based Organisations.

It has been argued that one of the reasons of failure to manage Prunus sustainably in Cameroon has resulted from the fact that there have been very poor coordination and linkages between the actors in the chain and a lack of access to relevant information on the state of *Prunus africana* in both Cameroon and the international market (Ingram, 2007), Whinconet 2005 and 2007). As part of a participatory process, WHINCONET, FGF, SNV and CIFOR facilitated actors to meet and discuss problems and jointly develop solutions under the name of a "Prunus Platform'. The matrix below (Table 9) is a result of the more than seven meetings from 2005 into 2008 and proposes linkages, roles and responsibilities of the different actors in the chain that should lead to sustainable management of *Prunus africana*.

12.4 Institutional recommendations

The following recommendations to improve the institutional arrangements of *Prunus africana*, within the context of the National Management Plan are proposed;

Action	Responsibility	Budget
1. Training MinFoF and ANAFOR Staff on implementation of CITES in Cameroon	ANAFOR and MinFoF CITES MSc trained staff	For ANAFOR and 'MinFoF to complete
2. Prunus Platform maintained as an informal network, information disseminated with ad-hoc meetings as necessary	ANAFOR + national and regional MinFoF	
3. Prepare Scientific Committee Decision for Minister	ANAFOR	
4. A text prepared to formalise collaboration between MINFOF and ANAFOR during permit allocation and monitoring. This text should further be developed to become part of the forestry law	MinFoF	
5. Focal points created in Universities and research institutes to ensure functioning of Scientific Committee, with responsibilities and roles, a dissemination and feedback mechanisms and appropriate financial support for participants where necessary.	ANAFOR	
6. Development of a long term research program and long term monitoring on key areas for *Prunus africana* and encourage uptake by institutes, projects, NGOs etc	ANAFOR	
7. Set up procedure to approve the PAU	ANAFOR	

Action	Responsibility	Budget
management plan and exploitation inventories- with support of Scinetific Committee if necessary.		
8. Monitor the sustainable use of CITES plant species (including *Prunus africana*). This necessitates the following: • Capacity building of ANAFOR CITES staff and that of associates at research institutions (e.g. universities, IRAD, CIFOR, ICRAF…) • Allocation of means for field visit to discuss monitoring of quotas, bark harvesting and trend in supply • Collect and update fair and relevant information • Get opinion of local experts (has they may have a most recent information) before advising MINFOF • Check use of monitoring sheets at field, roads and export levels	ANAFOR	
9. Set up a register of private owners at divisional and provincial level, with data flowing at least 6 monthly to MinFoF CITES authority and ANAFOR. Publicise the presence of the register and the procedure.	MinFoF	
10. Fix regeneration level for prunus in PAUs e.g. Three trees for every tree harvested/or every 55kg[11]	ANAFOR	
11. Community Forests with Prunus proposed in their SMP liaise with local MINFOF services on harvesting techniques control and monitoring.	MinFoF Sous Director of Community Forests/Regional services	
12. MINFOF regional and divisional services and ANAFOR office close to proposed PAU, should be consulted when permit holders apply for a PAU permit.	ANAFOR & MinFoF	

[11] Based on survival rates of between 32 to 60% - see Section 16 on Regeneration and domestication

Table 9 Matrix of Prunus stakeholder responsibilities roles and actions

	Regulatory authorities	Pharmaceutical companies	Government	Projects / NGOs	Permit Holders	Owners of trees/ Plantations	Communities / CBOs
CITES	Adapt regional regulations	Needs to regulate trade through certification	Country implementation of CITES recommendations	Feedback on scientific information on CITES species	Create & sustain awareness on CITES issues	Motivation for more planting.	Create & sustain awareness on CITES issues
Pharmaceutical companies	Support sustainable forest management	Agree to support & champion sustainable management	Support policy development	Fund development projects	Buy only from responsible Permit holders (certification)	Long term link for direct supply.	Support long term partnership
Government	Support participation in international fora	Provide framework for certification	Develop regional strategies	Feed back on relevant field data & information in exchange for respecting Project recommendations	Issue permit after agreed inventory & Prunus Management Plan Provide planting/regeneration incentives	Incentive for cultivation Provide planting/ regeneration incentives	Establish a favourable policy & provide technical support for sustainable management
Development Projects / NGOs	Promote Project achievements at national & international levels	Continuous awareness raising	Set enabling environment for Projects to support Prunus sustainable management	Support Prunus related workshops & networking	Collaborate for sustainable management	Support tree planting	Advocacy for best practices (e.g. sustainable management, fair price, regeneration)
Permits Holders	Raise awareness to respect CITES	Fair prices to fight poverty	Issue a single long term permit per permit allocation site	Organise & train community based harvesters, Fund regeneration	Support sustainable Prunus management and regeneration	Fair price	Buy from organised villagers with training in harvesting skills
Owners of trees/ plantations	Promote domestication Registration of trees	Promote large scale production	Set enabling environment for private planting	Capacity building for propagation	Offer fair prices to encourage large scale production	Networking, setting common price, exchange of information	Collaborate in regeneration and marketing of Prunus
Communities / CBOs	Raise awareness to respect CITES	Support sustainable forest management	Issue permit to organised communities (e.g. MOCAP, FMIs)	Support capacity building &sustainable Prunus management	Establish a fair price for equitable benefit sharing	Collaborate for inventory and protection.	Networking, setting common price, exchange of information

(Adapted from Ndam et al 2008)

13 Transboundary management

This section responds to the concerns of CITES about transboundary trade in *Prunus africana* between Cameroon and Nigeria. The CITES Significant Trade Review highlighted that it was likely that range of *Prunus africana* extends across the border from North Western Cameroon to North Eastern Nigeria in the Mambila Plateau/Cameroon highlands area, see Figure 37 Location of *Prunus africana* in Nigeria, but that this needs further investigation and that no data exist. It was believed that this population may be harvested and incorporated into the commercial export trade from Cameroon (CITES, 2006; Cunningham, 2006). The CITES Secretariat therefore recommended that the Management Authority of Cameroon collaborate with the Management Authority of Nigeria to enhance the monitoring of trade in *P. africana* between Cameroon and Nigeria.

In September 2008, the Minister of Forest and Wildlife sent letter to the CITES Authority, in Nigeria requesting collaboration (Reference). This request was copied to the CITES Secretariat. The Cameroon authorities await an official response.

Contacts were also made with conservation and research organizations active in the trans-boundary border montane areas to establish the extent of data on *Prunus africana* in Nigeria and any transboundary trade.

In Kagwene and Takamanda forest reserves, WWF and WCS had no reports of either recent or large scale commercial trade confirmed in these areas[12].

Prunus was signalled as present in Mambilla plateau in 2001 (Chapman et al., 2001). The Nigerian Montane Forest Project, a collaborative project between the University of Canterbury, New Zealand, the Nigerian Conservation Foundation and Nigerian National Parks, resurveyed the montane forests of the Mambilla plateau in Taraba State, Nigeria (

Figure 37) repeating the 1970's surveys by J. D.Chapman of the Nigerian Government Forest Service and reported Prunus in the Ngel Nyaki Forest Reserve (Chapman, Olson et al., 2004; Chapman, 2008) and in the Gasjaka Gumti National Park (Chapman, 2007). This Park is the largest national park in Nigeria with a trans-frontier conservation agreement signed 2003 (US$3.5 million through UNDP) and borders onto the Tchabal Mbabao area in Cameroon. Chappal Waddi (Tchabal Ouadè) is the highest point in Nigeria (Taraba State). *Prunus africana* is still common in the park but despite being the national park largely unprotected and under threat from harvesting, grazing and fire (Chapman, Bekker et al., 2007). It was reported that Nigerians had been known to work in Prunus camps in Tchabal Mbabo in 2002, but no trade from Nigeria to Cameroon was witnessed (Pers. comm., Hazel Chapman 2008). Reports of cross border trade were however noted (Pers. Comm. Tony Cunningham /Sarah Laird 2008).

Discussions with exporters and exploiters at each of the Prunus Platform meetings in 2007 and 2008, and during the meeting with exporters and importers on 20 April 2009, indicated that they had not exploited *Prunus africana* from Nigeria nor was there any knowledge of *Prunus africana* obtained from Nigeria. It was noted that the terrain in the Mambilla plateau/Tchabal Mbabo area is very difficult to access, causing exploitation to be costly, which acts as a disincentive for any (cross border) trade. They noted also that it is unlikely to be any commercial trade in Prunus to Nigeria as Nigeria is not listed by CITES as being an exporting country, therefore if there was any trade at all, it is likely that Prunus is exploited locally in Nigeria for medical use.

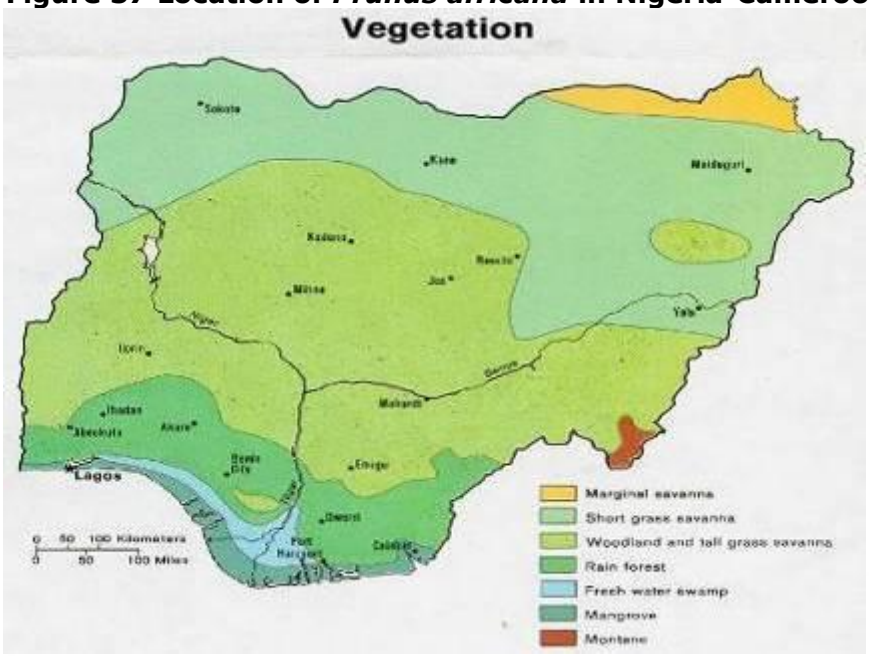
This data confirms that existence of Prunus in Nigeria but does not confirm transboundary trade into Cameroon.

[12] Pers comm. Aaron Nicholas and Anthony Nchanji (WCS)

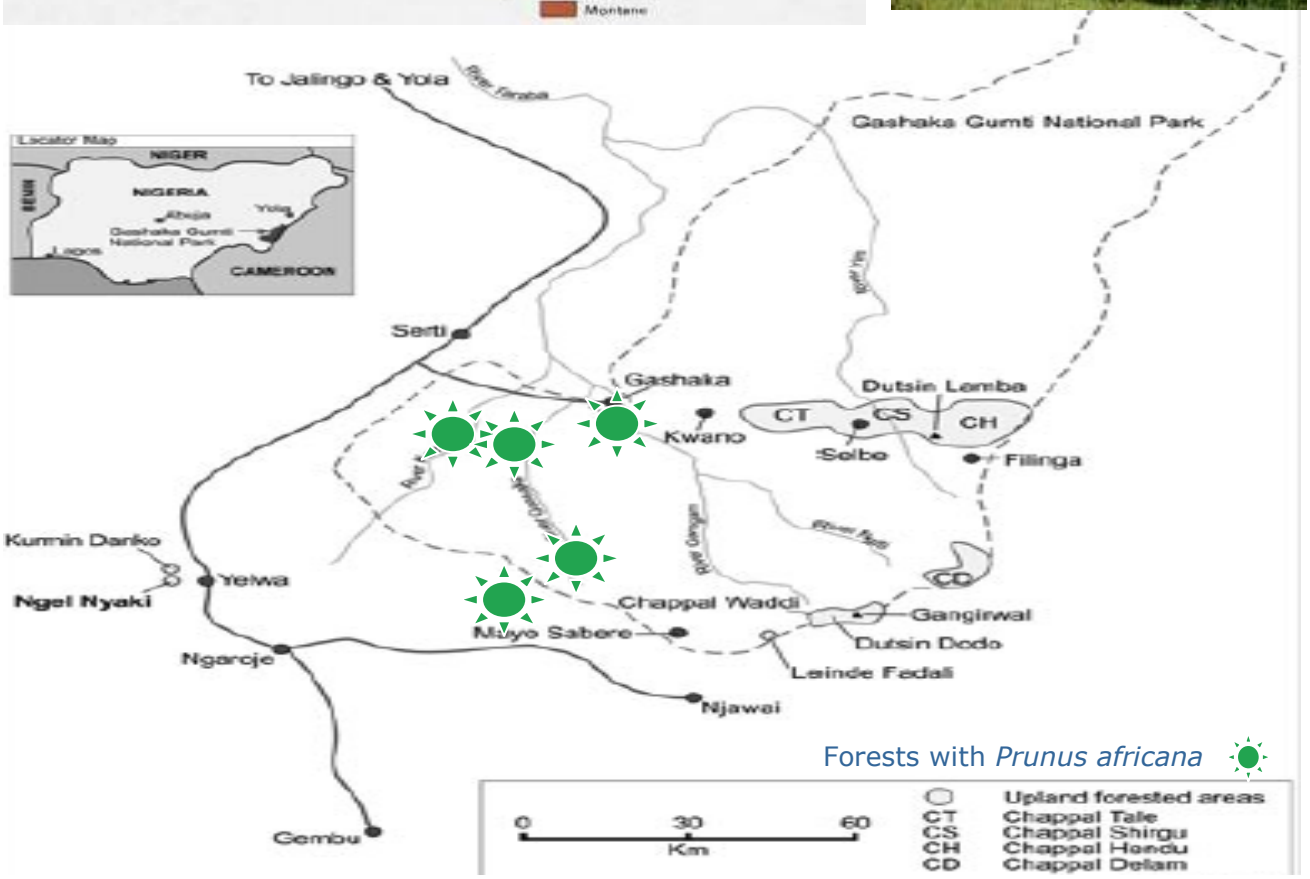
The following steps are proposed (see **Error! Reference source not found.**) to confirm that Prunus is not exploited from Nigeria and traded in Cameroon;

1. Field mission of MinFoF services to Nigeria border at Mamfe and Tchabal Gandgaba area to identify possible routes, volumes of trade, actors and actions.
2. Set up information circuit of communities and conservation organizations to feed any reports of trade to Management Authority
3. Annual correspondence from the Cameroon Management Authority and the Management Authority of Nigeria track any trade in Prunus between Cameroon and Nigeria.
4. At least annual correspondence between the Cameroon CITES authorities with research and conservation organisations active in the border zone.

Figure 37 Location of *Prunus africana* in Nigeria-Cameroon transboundary zone



Nigeria - Gashaka Gumti National Park



14 Control, traceability and monitoring system

This section sets out how to trace, monitor and control the exploitation of *Prunus africana*. The aim is to provide a workable, robust and transparent adaptive monitoring system that follows all *Prunus africana* exploited from the tree to export. It allows a periodic assessment of the impacts of harvesting to determine the impact of the current harvest protocols on the species and ecosystem, and if the management plan is successful. The system should ensure sustainability by providing information that supports timely corrective action to ensure that the resource is not over-exploited.

14.1 Appraisal of current monitoring and traceability system

As concerns have grown over the last decade about the unsustainable exploitation of *Prunus africana* bark, to the extent that MinFoF admits that "the exploitation of Pygeum has not been monitored and controlled well by it's local services" (MinFoF 2007) ,a number of proposals have been made for improved monitoring and traceability (MCP, 2000; WHINCONET, 2005; Ingram and Nsawir, 2007; Meuer, 2007). Unsustainable exploitation has very rarely been sanctioned, prohibitions have been short lived and often harvesting has continued and fines have been very small compared to profit from illegal harvesting, with experience indicating that both traditional and administrative sanctions and controls have always not acted as barrier to illegal or unsustainable harvesting (Whinconet 2005). The current situation of monitoring and traceability in Prunus sector is analyzed in Table 10.

Table 10 Strength and weaknesses of current monitoring and traceability system

Strengths	Weakness
Existence of a department that allocates permits	Permits allocated and monitored at central level in Yaoundé
No inventory based quota	Often no inventory check before issuing permit
Willingness of Prunus actors and permit holders to inventory stocks	No proper description of the site where a permit allocated
Willingness of Prunus harvesters and permit holders to respect harvesting norms if each site is allocated to one permit holder alone for a longer period	Many permit holders in the same area for Prunus harvesting, leading to unsustainable harvesting and no accountability
Willingness of Cameroon CITES Plant Scientific Authority (ANAFOR) to work/collaborate with MinFoF and other CITES organs	No formalised procedure for collaboration on daily basis with MinFoF and ANAFOR
Willingness of the focal person at CITES Plant Scientific Authority (ANAFOR) to set up a Scientific Advisory Committee, develop an annual work plan and search for funding within MINFOF and Prunus actors and undertake additional study to understand CITES	Limited expertise at Cameroon CITES Plant Scientific Authority (ANAFOR)
Willingness of relevant actors to discuss the issue and link inventory to agreeable Prunus management plan	The Prunus Platform initiative is largely lead by international organisations. Although these are based in Cameroon (SNV and CIFOR), the Prunus platform is not yet internalised or 'Cameroonian' ownership

(Adapted from Ndam et al 2008)

MINFOF introduced a Circular letter n° 0958 of November 15th 2007. This was in the same period as the EU introduced its suspension of imports, effectively halting trade and exploitation, such that the circular has not never been put into practice. It does appear to provide a good basis for a more effective monitoring and control system.

Taking into account these strengths and weaknesses and the provisions made in the 2007 MinFoF Circular, plus considerable input from actors during Prunus Platform meetings and during drafting of the Management Plan (see **Error! Reference source not found.**), the monitoring procedures below are proposed.

14.2 Monitoring procedures

The main elements of the system are shown in Figure 38. The monitoring procedure operates each time prunus is harvested at any PAU or by any registered owner. There are also long term procedures annually and every 5 years.

The procedure is based upon and traceable though a set of *Monitoring Forms* in duplicate (1 for permit holder, 1 for regional MinFoF delegation and 1 for MinFoF CITES Management Authority which accompany the Prunus harvested from the field or forest to the point of export.

A copy of the *Monitoring Checklist* can subsequently be provided to CITES and to the importer. The annual report produced for CITES by the Management and Scientific Authorities can be based on the an aggregation of the data from all Monitoring Forms.

Figure 38 Monitoring Scheme

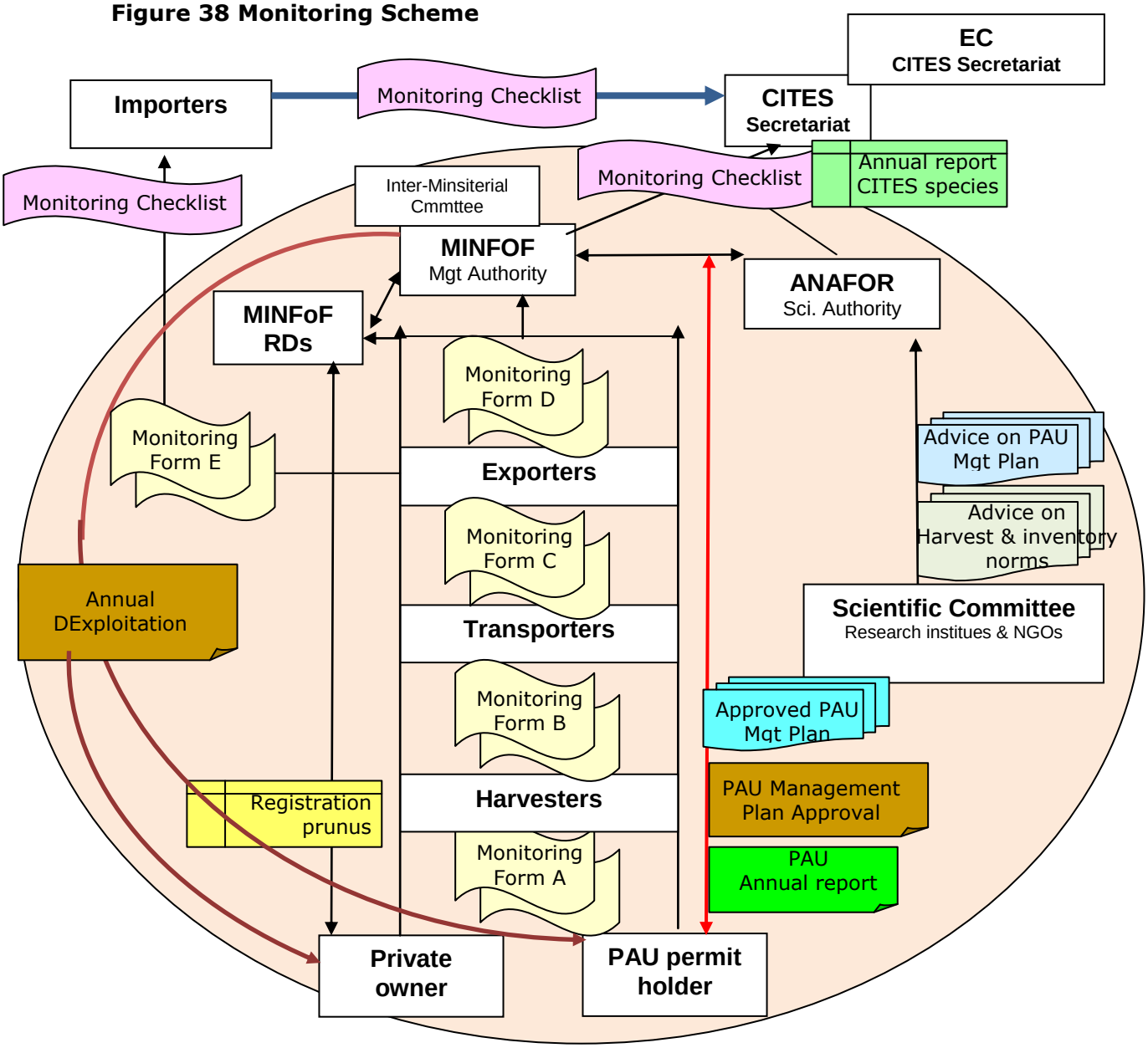


Figure 39 *Prunus africana* monitoring system

Monitoring Parameter	Indicator	Responsibility	Monitoring Location	Form/Tools
1. Trees harvested in natural forest harvest are identifiable and actual period of rotation known	Tree tagging and record keeping	Harvester and PAU permit holder MinFoF monitoring	PAU - Natural forest	Form A Bark harvesting & tagging form
2. *Prunus africana* trees and approx quantity of bark to be exploited from farms or plantations in any given year is known.	Number of stems Approx annual quantity harvestable per Region	Private owners	Privately owned on field/plantation	Form D Registration
3. All PAUs granted are known, the length of permit and permit holding entity is known.	Permit for PAU for a qualifying entity	MinFoF (Inter-ministerial committee)	PAU	MinFoF/Inter-Ministerial Committee Decision on PAU Permits granted
4. MinFoF and Regional Authority can verify that all PAUs to be exploited in any given year have a Management Plan + inventory and quota.	Sustainable quota in tonnes wet weight in approved PAU Management Plan	ANAFOR	PAU Region	Inventory Norm Form F PAU Management Plan Approval
5. The quantity of *Prunus africana* exploitable from PAUs, the permit holder and authorised harvesters in any given year is known	Quota wet weight prunus bark per PAU zone per annum	PAU permit holder (enterprise//community forest/council)	PAU Region	PAU permit PAU Management Plan Approval / Approved CF SMP[13] Form F
6. The quantity of Prunus exploited in any given year from each Region and by each permit holder is known.	Quantity and source of wet weight Prunus per Region and per permit holder	Permit holder, MinFoF Regional delegations/controls	PAU Regional level National	Form E Origin Form F PAU Approval MinFoF ComCam /SGFIF Database
7. The wet weight quantity of bark harvested at any one PAU in any given year is known.	Random test of norm on 10% of trees in any 1 PAU zone	MinFoF Regional delegation + harvester	PAU Regional level	Form A Harvest
8. The harvest technique used conforms to norms.	Random test of norm on 10% of trees in any 1 PAU zone	MinFoF Regional delegation + harvester	PAU Regional level	Harvest Norm Form A Bark harvesting
9. Prunus is only harvested by trained, certified harvesters	Tagged trees, registered harvester, training modules	MinFoF	PAU Regional level	Form A Bark harvesting Form G Certification
10. All prunus on route form forest/plantation to processing and export locations can be traced to a PAU or register private holder	Random controls by MinFoF Brigade du Control, MinFoF at Port of Douala and any controls at Council checkpoints	Permit holder, MinFoF Regional delegation & Control Brigade,	PAU Regional level	Form B Transport
11. Quantity of Prunus harvested is traceable from the tree to exporter to point of export and importer.	Quantity, transporter and method of transport for wet weight Prunus	Permit holder, MinFoF Regional delegations/controls	PAU Regional level National	Form A Harvest Form B Transport Form C Export Annual PAU Report
12. The origin and legality of all prunus exported from Cameroon is known.	Quantity and type of dry weight prunus exported	Permit holder, MinFoF Regional delegation & Control Brigade,	PAU Regional level National	Form E Origin Form C Export MinFoF ComCam /SGFIF Database MinFoF CITES Annual report WCMC CITES Database

[13] Where the PAU holder is a Community or Council forest - the prunus Inventory and quota should be included in their SMPs.

Monitoring Form A: Harvester Certification

HARVESTER CERTIFICATION	
Harvester name : Address	
Identity Card number;	
Date trained	
Training organisation	Signed – Trainer
I certify that I know and am capable of harvesting *Prunus africana* according to the Harvest Norm	Signed- Harvester

Monitoring Form B: *Prunus africana* bark harvesting

Monitoring *Prunus africana* bark harvesting in the field/forest by MINFOF				
Year: Date:	Controller's name:	Region:	Tel:	Matricule:
Site of the Prunus Allocation Unit :		Name of PAU permit holder:		
Has the site inventory been done?		Has the Prunus Management Plan been approved?		
What is the annual harvestable quota for the current year?				
Have harvestable trees over 30DBH been tagged?				
Name of harvesters(s)/organisation		Has the harvester been authorised by the PAU concession holder?		
Does the harvester have a training certificate?		Have harvested norms been respected?		
Type of document	**Documents to control**	**Existence of document Yes or No**	**Delivery date**	**Remarks**
Notification	Permit reference			
	Locality(ies) concerned			
	Quantity of wet weight bark harvestable per zone			
	Provincial delegate notification reference			
"Carnet de chantier"	Company name			
	Locality of harvesting			
	Harvesters names			
	Daily number of stems harvested			
	Daily quantity of product harvested			

***Prunus africana* tree Tagging Form**

PAU Site Name;			
PAU permit holder name:	Location:	Date:	Name Manager
Tree Number	**Tree size >30dbh cm**	**Tree health**	**Date harvested**

Tagging instructions;

1. Methods of tagging or marking a tree include paint, metal or waterproof plastic labels nailed on the tree. Each tree has a unique identification number. This may be a combination of codes for the PAU and the zone.
2. During inventory and during harvest, the number, size and health of every tree exploited, using a diameter tape should be noted. Only trees over 30cm dbh should be tagged.
3. Harvesters should only exploit trees which have been tagged. Each harvester should note of the tree number before harvesting and return the tag to the tree afterwards.
4. During harvest the number of the tree harvested should be noted, the name of the harvester and the yield exploited. This improves records of yields per tree and will provide accurate data on growth rates and mortality.
5. This allows monitoring of precisely who exploited which tree and when.

Monitoring Form C: *Prunus africana* transport

Monitoring of *Prunus africana* bark transport /Lettre de vehiclule MINFOF				
Year:	Controller's name:	Location:	Tel:	Matricule:
Site of the permit allocation:		Tonnage:		
Has the site inventory been done?		Has the Prunus Management Plan been approved?		
		Has other Prunus actors been involved?		
Has Prunus been harvested by trained local people?		Has harvested norms been respected?		
The forester on road to check the respect of the MINFOF Circular letter n° 0958 of November 15th, 2007				

Type of document	**Documents to control**	**Existence of document Yes or No (Y/N)**	**Delivery date**	**Remarks**
Attestation of harvest	Permit reference			
	Notification reference (start of activity)			
	Exact place of harvest			
	Exact quantity harvested wet weight			
Vehicle letter	SEGIF letter			
	Signature of near forest officer			

Monitoring Form D: *Prunus africana* export

Monitoring export *Prunus africana* bark /chips/powder at the national exit export points by MINFOF				
Year: Date;	Controller's name:	Location:	Tel:	Ref:
Site of the Permit Allocation Unit:		Tonnage Dry weight : Conversion from wet weight; Ratio used:		
Has the site inventory been done?		Has the Prunus Management Plan been approved?		
Form of export; Bark Chips Powder Extract		Has other Prunus actors been involved?		
Date of registration at Port;		Form A Bark harvested norms ?		
The forester on road to check the respect of the MINFOF Circular letter n° 0958 of November 15th, 2007				

Type of document	**Documents to control**	**Existence of document Yes or No (Y/N)**	**Delivery date**	**Remarks**
Certificate of origin	Vehicle letter			
	Receipt of regeneration tax payment			
	Copy of valid permit stating harvest zone and PAU			
	Attestation of harvest			

	Export registration			
CITES permit	Vehicle letter			
	Receipt of regeneration tax payment			
	Copy of valid permit			
	Attestation of conversion from harvest wet weight to exported dry weight			
	Export registration			

Monitoring Form E: PAU Certificate of Origin

PAU CERTIFICATE OF ORIGIN	
Site name :	
PAU Site reference ;	
Tonnage: Dry weight (Chips/ Bark / Power/ Extract) Wet weight	
Date of harvest	
Has the site inventory been done?	Has the Prunus Management Plan been approved?
Has Prunus been harvested by certified harvester?	Has harvested norms been respected?

PAU Management Plan Approval

PAU Management Plan Approval	
Prunus Allocation Unit: Name; Reference Number; Region;	
Responsible MinFoF Regional Delegation	
Name of Permit holder;	
Date PAU permit issued	
Date of inventory	
Conformance to Inventory Norms?	Y ☐ N ☐
Annual Quota per zone	
Year 1	
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Date of Management plan Date valid till	
Comments	
Approval by ANAFOR	
Approval by MinFoF	

Annual Registration Form for small holder/on-farm *Prunus africana*

Registration of *Prunus africana* trees on privately owned land by MINFOF services				
Year:	**Controller's name:**	**Location:**	**Owners Tel:**	**Matricule:**
REGISTRATION				
Site name:				
Owners name;				
Owner ID Number;				
Number of trees;				
Date of planting;				
ANNUAL MONITORING				
Date	Control	Remarks		
Date	Number of trees remaining			

	Number of trees Harvested			
	Type of harvesting			
	Number of trees planted			
Signed ; MniFoF		Date Owner		

Annual Exploitation Permit *Prunus africana*

Annual *Prunus africana* Exploitation Permit	
Prunus Allocation Unit or Registered Owner:	
Location & Region	
Reference Number	
Responsible MinFoF Regional Delegation	
Name of Permit holder;	
Date PAU Management Plan issued/ Or Date of Private Registration	
Date of PAU Management plan Date valid till	
Annual exploitable *Prunus africana* (wet weight) in tonnes	
Year	
Approval by MinFoF Signed .....Date	

Monitoring Checklist
For each quantity of Prunus africana exploited

Monitoring Checklist	
Date	**Source** **PAU** **Private owner** ☐
	Site Name/Reference;
Monitoring Forms:	*Tick if monitoring form is completed and signed*
A Harvester Certification	
B Bark harvesting	
C Transport	
D Export	
E Certificate of Origin	
Either PAU Management plan approved? Registration of private ownership?	
Annual prunus exploitation Permit	

14.3 Traceability

These monitoring forms and checklist, together with the Annual Exploitation Permit provide a traceable document that can be sent with the *Prunus africana* to the importers, monitoring agencies such as TRAFFIC, as well as CITES and the EU CITES authority. It demonstrates the legality of the product and its source of origin (either an inventoried site with a quota or a

privately registered source), the link with the PAU and Prunus Management Plan, the exploitation quota therein and that it has been harvested according to the harvesting norm.

The data contained in these documents should be incorporated into the national COMCAM database for forest products, as part of national monitoring for Special Forestry Products and for CITES.

14.4 Community or Council Forest participatory monitoring

A participatory monitoring system is recommended for all *Prunus africana* from PAUs from which the source of origin is a Community or Council forest. This is out of the scope of this national Prunus management plan, but is an issue for incorporation in the Community forest or council forest Management Plans. It is recognised that participatory monitoring of tagged trees for harvesting techniques and respect of exploitation quota can contribute to the stability of the institutions responsible that manage Prunus (normally the Forest Management Institution or council) the accrual and distribution of benefits, and combating illegal exploitation.

Assuming that the inventory was conducted with input from local beneficiaries and CF managers, monitoring that includes these stakeholders can also be more time effective and reinforce the official controls by MinFoF. The tagging system proposed has an added advantage of involving users and beneficiaries, and simple to understand for actors who may have low literacy and numeracy.

Monitoring should be during harvest periods. Transparency and accountability should be enhanced as one copy of the Monitoring Form is kept by the harvesting and PAU permit holder.

14.5 Long term monitoring

Long term monitoring is necessary to ensure any period adjustments in harvest norms, quotas or inventories. This may be based on the results of ongoing monitoring of PAUs, of research programmes conducted by academic institutes and international organisations, from any decisions or information originating from the CITES Secretariat or other countries with *Prunus africana*. Long term monitoring is therefore proposed annually and on a five year basis.

14.5.1 Annually

Annual reviews of the PAUs (PAU Management Plan Approval, Monitoring forms A, B, C and D and PAU Annual reports) and comparison of privately owned registered prunus annual permit with the quantities exploited (Form A) and exported (Form E) will be performed by MinFoF to ensure that quantities harvested are within the annual quotas.

The national quota for Cameroon for *Prunus africana* harvest requested annually to CITES will be based on the sum of all PAU quotas plus the total sum of Prunus from registered private owners. This will be revised annually and actual harvested monitored against exports.

Periodic adjustments in PAU or private owned permits may be made by MinFoF, in consultation with ANAFOR, in the following cases;

- Where the results of any monitoring surveys (by MinFoF or ANAFOR) or independent studies indicate unsustainable exploitation of *Prunus africana*.

- Where PAU operators or private owners are unable to counter illegal harvesting in their zone of operation.
- Due to exceptional circumstances e.g. droughts, pests, fires etc which damage significant quantities of *Prunus africana* in Cameroon.

14.5.2 Five years

A review of all the PAUs will be made by MinFoF and ANAFOR every five years (i.e. at midterm) to assess if they are still valid given results of any new research (e.g. inventory norms, harvest norms, new practices etc).

14.6 Sanctions

Using the proposed monitoring scheme, controls can be made. When infringements are found, strict sanctions are necessary given the long and repeated history of unsustainable harvest over the last two decades in all the landscapes of Cameroon. The following sanctions are recommended;

Infringement	**Sanction**
Harvesting from protected areas	Confiscation and fine plus suspension of annual permit
Unsustainable harvesting (ie non compliance with harvest norms) for up to 10% of trees monitored.	Fine
Unsustainable harvesting of over 10% of trees monitored.	Suspension of annual permit
Prunus harvested is not accompanied by signed forms.	Confiscation and fine
Use of untrained harvesters	Fine
Harvesting outside of PAU or registered privately owned Prunus permit	Fine
Harvesting more than annual quota	Fine
Harvesting of non-registered private prunus	Confiscation and fine

14.6.1 Long term monitoring research

Research over the long term is needed to respond to questions that have been raised by stakeholders and remain unanswered (Acworth et al., 1998)Cunningham, 2002; Ndam & Ewusi 2000, Ingram 2007(Ndam and Ewusi, 2000). It is recommended that ANAFOR monitor the outputs of research as well as actively encourage research partners to address the topics in Figure 40. The results of research can be incorporated into annual reviews of PAUs and the national annual quota as appropriate.

Figure 40 Monitoring research needs

Topic	**Result**
1. Set up of permanent monitoring plots measuring tree growth, bark regeneration rates, tree health and population dynamics and trial different harvesting techniques and rotations.	Long term effect of harvesting and different harvesting techniques.
2. Population modelling (health and size of juvenile populations) and rate of recruitment of *Prunus africana* (in PAUs and plantations) and adaptation of PAU management plans for the sustainable use (CITES LIMA requirement)	Monitor long term effects of harvesting on Prunus populations and ecosystems (follow up Stewart's work in Kilum Ijum, Meuer's work in Mt Cameroon and Whinconet in Oku)

Topic	Result
3. Monitoring of spending of regeneration tax	Adjust regeneration tax to adequately compensate for regeneration
4. Trials of harvesting of trees less than 30 DBH	Long term effect of harvesting techniques
5. Trials of alternative harvesting techniques and alternative tree parts	Increase available product, revise norms on sustainable harvesting techniques
6. Techniques to improve the production of bark and biomass, as well as speeding up growth	Follow up of Russel Grant's current PhD work at University of Lancaster)
7. Market studies to link international buyers more directly to Cameroonian sellers.	Improve links between producers and buyers, increase prices at forest-edge/farm-gate. Ensure better forest to consumer traceability and involvement of the industry in conservation, management and long term demand forecasting.
8. Characterization and identification of high yielding variants, propagation of improved germplasm, and dissemination of best nursery, management and silviculture techniques	Improve quality and quantity of *Prunus africana* products through (Follow up of ICRAF' Nairobi and Yaounde work on propagation and cultivation)
9. Investigation of in-situ and circa-situ regeneration	Promote faster growth techniques (follow up Germo Tatto's current PhD work, University of Yaounde)

15 Production facilities

Cameroon currently has the following facilities for treating and exporting *Prunus africana* (Awono, Manirakiza et al., 2008; Ntsama, 2008);

Bark – first stage drying

In the North West, some of the community forests practice first stage drying. This involves cleaning (excess mud, mosses, leaves etc) and sun-drying Prunus barks. The ASSOFOMI office in Oku and ASSOKOFOMI office in Fundong have been used for drying. Private individuals have used their own houses or sheds. This does not appear to happen on a regular basis and the norm is that bark in strips of approx 30 cm x 1 meter are sold at wet weight direct from the forest. There is a 50% reduction in weight from wet or humid bark when dried.

- Community forests
- Some private individuals

Bark treatment

This stage involves drying to a moisture content of 50% of less, by cutting the bark into chips of about 10-20 cm, spreading on plastic mats and sun drying, or spreading on racks in warehouses. This may then be packed into jute bags for shipping.

- MOCAP, Buea
- Africaphyto, Douala
- Agrodenree, Douala
- Afrimed, Bafoussam and Douala

Bark power (powder at less than 10% moisture content)

This stage involves processing the bark by machine into a power.

- CEXPRO, Douala
- AFRIMED, Yaoundé and Bafoussam)

Chemical extraction

Although Africapyhto has the capacity to make extract, since 2007 the company has only exported bark and not extract. The extraction capability is used for small scale tests and not for export.

- Africaphyto International, Douala

Extract processing
There are currently no processing facilities in Cameroon, since the closure of Plantecam in 2000.

15.1 Terminology

The terms "extract" and "powder" are clarified as;

Powder = dried and ground plant material from the bark, leaves, fruit or roots - normally not less than 10% moisture content

Extract = extract prepared a non-crystalline extract red transparent paste in a solvent base methanol, water, chloroform, methylene chloride, benzene, cyclohexane, petroleum ether, diethyl ether, acetone, methylethlketone and mixture thereof. The extract is characterized by 1 part plant material and 2 parts liquid solvent. A second stage uses non-crystalline extract to produce a fine white crystalline extract ranging from about 5% to 0.05% weight o the initial dry plant powder (Hall, O'Brien et al., 2000).

16 Regeneration and domestication

This section summarises the status of initiatives to domesticate *Prunus africana* and the status of regeneration in natural forests, and subsequently makes recommendations for a local and national level actions.

16.1 State of knowledge

The CIFOR inventory and baseline study highlighted the hitherto un-reported, large scale of domestication and re-forestation activities. This was unrecognised in the CITES STR. Data provided by stakeholders in 2008 and 2009 indicates that more than 1.6 million *Prunus africana* trees have been planted since 1976 in Cameroon (Table 12). This highlights the importance of domestication and regeneration activities that have taken place and are ongoing (Awono, Manirakiza et al., 2008; Foaham, Dagobert et al., 2009). The scale also reinforces comments from a wide range of actors that domestication is one of the most critical pathways for continued and sustainable exploitation of *Prunus africana* (SNV 2007; (Ndam et al., 2000)Cunningham 1993; (Nkuinkeu, 1999; Tientcheu, 2007).

Prunus africana seeds have been considered as having a short life and recalcitrant. However (Sacandé et al., 2004; Schmidt, 2007)showed that methods to airtight seed storage and a controlled drying rate can extend storage over a year. Prunus propagation and domestication techniques are known both to indigenous farmers and to science (Tchoundjeu et al., 2002; Tchoundjeu et al., 2004; Tsobeng, Degrande et al., 2008). In areas such as Fundong, Oku and Buea, many of the simpler propagative techniques are also well mastered and disseminated, due to the work of a number of projects, research institutes and on farm extension organisations. It is estimated that 94% of the population in the main areas of Kilum Ijum and Mt Cameroon are involved in some way in domestication, but 90% of *Prunus africana* bark is still exploited from the forest and for the 10% domesticated, 45% of planting material for domestication are "wildings" collected from the neighbouring forest, with only 26% coming from nurseries (Tientcheu, 2007).

The reason for this paradox may be because although many actors indicate that the resource is becoming scarcer, it is still available in the wild, despite dire warnings of unsustainable exploitation and programmes to promote *Prunus africana* domestication and planting. There is as yet a low incentive for domestication on a large enough scale to match exploitation rates, especially the larger volumes exploited in the last decade (see Section **Error! Reference source not found.**), as the method of purchase and pricing is haphazard, prices are strongly differentiated by geographic locality and are a buyer led, rather than supplier led controlled (Ntsama, 2008). This combined with the lack of controls or sanctions on illegally harvested Prunus, means there is a low incentive for domestication. The EU suspension of *Prunus africana* imports in November 2007 and this Management Plan are expected to change the attitude of actors to create a more favourable climate to invest in domestication and regeneration on PAUs and on private land.

16.2 Genetic diversity

The genetic diversity of *Prunus africana* is important given that the major medicinal extract of *Prunus africana* is known to vary according to geographical source and that genetic similarity corresponds to geographical distribution. Studies have shown that there is considerable

phenotypic, genotypic, and chemical variation among and possibly within *Prunus africana* populations both across countries and within countries and that extracts vary with this variation (Hall, O'Brien et al., 2000; Dawson, Were et al., 2001; Avana et al., 2004; Muchugi et al., 2006). Cameroon's position as the largest exporter of Prunus for worldwide has always been underpinned by the fact that its Prunus is used in combination with that from other countries to create the most efficient pharmaceutical treatment. Until the EU and CITES suspensions in 2007 and 2008, blending was possible. If exports are to continue, possible only from Cameroon until other countries also obtain their Management Pans, a better understanding of the link between genetic diversity, geographic location and extract is essential for continued trade, and for domestication based on genetic management of the most commercially valuable cultivars, and not only morphology has been the case to date. This variation offers scope for selecting improved cultivars superior to the ones currently being planted. The advantage of practices to date is that a wide range of genetic material has been planted, usually often extending genetic resources from nearby forest based sources. The disadvantage is that no superior planting material is available. Critical selection criteria includes fast growth, resistance to disease, particularly at lower altitudes, ease of bark removal, and the concentration of 12 active ingredients for treating BPH. Experienced farmers, research organizations such as ICRAF and extension agents such as MIFACIG, bark harvesters and particularly the pharmaceutical industry needs to be consulted on desirable selection criteria and the degree of likely variation in tree populations.

Dawson and Powell (1999) assessed the genetic variation of P. africana in Cameroon from four sites: Mount Cameroon, Mount Kilum, Mendakwe and Ntingue using Random Amplified Polymorphic DNA (RAPD) analysis. The aim was to assess genetic variation within and among populations of *Prunus africana* in the areas where the species is most heavily exploited in Cameroon. They collected leaf material from all these sites and used silica gel to dry and preserved the samples before taken for analysis. Results from the study revealed that differentiation among stands was considerably less (approximately 23 % of variation among the populations), but genetic difference still highly significant when the other three populations were compared with Mount Cameroon. They concluded that the differences may reflect the geographical and ecological isolation of Mount Cameroon and show a direct relationship between genetic and geographical distance.

Further work on the genetic variation in Cameroon, compared to Kenyan Prunus, using RAPD analysis revealed that significantly more variation among Kenyan populations than in Cameroon, with a clear genetic disjunction showing between Kenyan stands. This data suggests both opportunities and concerns for genetic management (Muchugi, Lengkeek et al., 2006).

Bioversity International is currently working in collaboration with IRAD in Cameroon and the Department of Genetics of the Austrian Federal Research and Training Centre for Forests, Natural Hazards and Landscape (BFW) to measure and conserve the genetic diversity of *Prunus africana* improve its adaptability in plantation forestry. The first phase collected and shipped small samples of leaves and bark for analysis at the Federal Research and Training Centre in Austria, with analysis carried for 60 samples from Mt Cameroon, Mt Oku and Mt Danoua in Thcabal Gangdaba to know the concentrations of the active ingredients and genetic variation. A greater genetic variation was found between the Adamaoua Prunus compared to Mt Cameroon and Mt Oku Prunus. Bioversity International also organised a two week workshop in June 2008 on forest fragmentation and genetic diversity where three scientists from Cameroon participated (Tientcheu, 2007; BioversityInternational, 2009).

16.3 Domestication

Tree domestication is the process of whereby species from their natural state are adapted for wider cultivation. The procedure involves the identification, production, management, and adoption of high quality germplasm. Participatory tree domestication focuses on low technology

and local knowledge. It depends on market trends and the preferences of farmers. Participatory tree domestication needs to be supported by research, extension and community organizations to ensure understanding and uptake.

Planting activities have resulted at least 1,610,000 *Prunus africana* trees being planted in multiple sites across the North West and South West between 1976 and 2008, in an area of at least 625 hectares (Ingram and Nsawir, 2007), see Table 12, Figure 41 and

Figure **42**. In 1995, six years after two of the major projects and NGOs had started promoting the tree in the North West, at least 4,250 farmers had planted *Prunus africana* trees, about 50% of which were associated with projects and half not (Franzel, Ayuk et al., 2009). The majority of trees supported by projects were planted in Community Forests and communal spaces (e.g. watersheds), with non-project supported trees mainly being planted on farms and in family compounds. Given an average survival rate of about 32% in the plantations studied, it's estimated that 515,200 of these trees currently exist. This stock represents both an important genetic source and a critical stock for regeneration and demonstrates the previously unrecognised scale of domestication and planting outside of natural forests. (Foaham, Dagobert et al., 2009).

A number of project-based initiatives have promoted domestication and include;

- The Mount Cameroon Project (MCP) and International Centre for Research in Agroforestry (ICRAF) set up a gene-bank production in June 1995, collecting seeds from 80 randomly selected trees in three sites: Mendakwe, Kilum forest reserves and mount Cameroon. These seeds were sown in two nurseries: Limbe Botanic garden and ICRAF Mbalmayo. Results from the gene-banks in Limbe showed that the survival rates of all provenances varied from 60 % to 100 % for some accessions. There was statistically significant variation in early growth among the various accessions in terms of the height attained after 5 months. Thus regardless of seed source, the existence of such variation is a good indication that *Prunus africana* has a great potential for genetic improvement if carefully selected (Tchoundjeu et al, 2002, Sunderland & Nkefor, 1997).

- The Limbe Botanic Garden, via the Darwin Initiative, conducted nursery practices for seedling identification in the forest. The fundamental issue of the study was to provide a tool to facilitate field identification of P. africana seedlings and to increase seedling identification skills. To do this, they collected fruits and seeds from the forest floor, then, recorded their gross characters and cleaned off fleshy and fibrous parts. The objective was to use two shade levels 0 – 20 % and 30 – 60 % to describe the germination type, seedling morphological characters and other changes that occurred as they grow under the two shades so as to easily identify seedlings growing in the forest. Over 200 morphological characters were recorded such as the number of nodes, the first true leaves, leaf shape, venation and other morphological details were made throughout. The Conservation Technology Department of the LBZG in collaboration with ICRAF and CDC conducted experiments with the best conditions for germinating P. africana seeds and has used this research to initiate several plantation trials, in collaboration with the International Centre for Research in Agroforestry (ICRAF) and Cameroon Development Corporation (Nkefor et al. 1998; Nkuinkeu, 1999).

- ICRAF has carried out domestication of *Prunus africana* using generative and vegetative techniques. For the vegetative technique they examined which key factors which could influence rooting ability of juvenile cuttings using rooting media, auxin concentration and leaf area. Through this they were able to have a batch of many seedlings issued from cuttings and this can be provided to farmers for private forest plantation. ICRAF have produced a Technical Note that provides practical guidance for domestication, propagation and planting and was supplemented by training in nursery techniques (Tsobeng, Degrande et al., 2008). ICRAF studies have also shown that while *Prunus africana* is not as profitable as *Eucalyptus* spp, farmers do want to grow *Prunus africana* because it is compatible with many crops and has multiple uses (Franzel, Ayuk et al., 2009). It can also be cost effective and interesting on a small scale for this reason.

- HELVETAS, the Swiss Association for International Cooperation, assisted local communities to improve water supplies and management of watersheds in several areas in the North

West form the mid 1990s to 2007, including Bambui, Guzang, Belo, Nso, and Mbiame with one component of these projects being the provision of *P. africana* seedlings to farmers for planting, mainly on communal areas. In Bambui, the project supported 9 nurseries and trained 120 farmers in nursery management.

- The Fonta Rural Training Centre, Bambui provides training to farmers from all over the province. The centre collects *P. africana* seed and distributes it to its trainees (about 200 per year) and sells to NGOs and development projects. The Centre has collected about 10 kg of seed per year and reported that demand far outstrips supply in 2005.

- Trees for the Future, based in Kumbo, Bui division up to 2006 and now in Buea in the South West has worked with up to 63 different groups with about 1,950 members. By 1994, 275,000 trees were reported planted by these groups, and *P. africana* was the third most commonly planted tree, accounting for about 25,000 of them. Up to 2000 trees were planted in 2008.

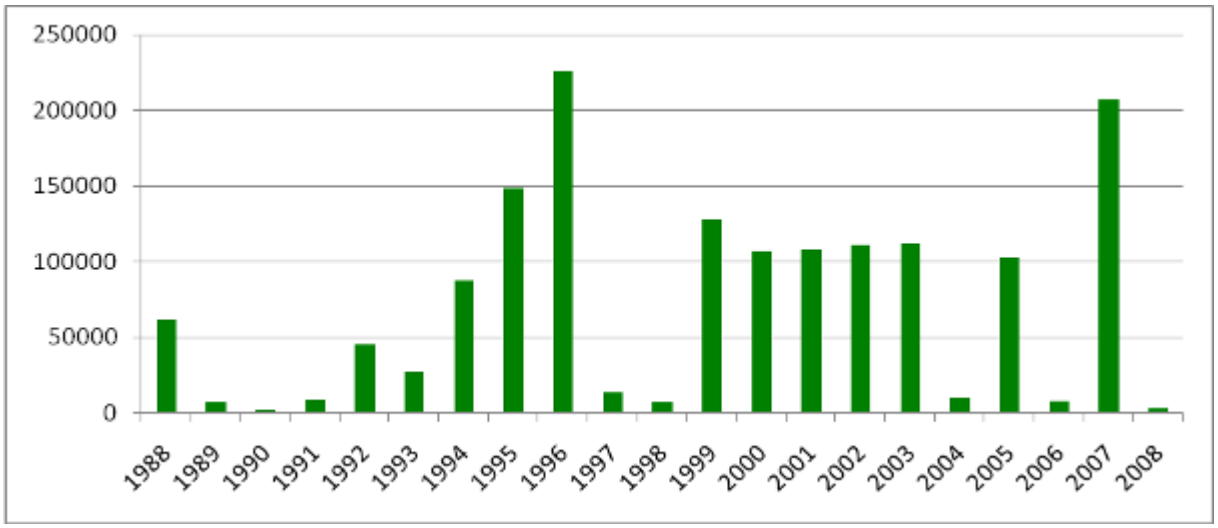
- Other groups in North West Province reported to be assisting farmers in planting *P. africana* contact include MESG, Shishong; VCP, Bafut; PAPSEC, Bamenda, and in South West Province: Greenfield Common Initiative Group and in the south West the Bova CIG, and Mosake Common Initiative Group, Buea.

- The World Agroforestry Centre has identified the best conditions for rooting of cuttings, including rooting medium, leaf area of cuttings, and optimum applications of auxin for promoting rooting for the vegetative propagation of *P. Africana (*Tchoundjeu et al. 2002). This has enabled a reduction in the age of seed production to 3 years through marcotting, that is, inducing roots to grow on a small branch while it is still attached to the larger tree.

Two government supported agroforestry initiatives have also been instrumental in planting *Prunus africana*. The ONADEF programme had extensive plantations in the West and NW between 1991 and 2007, with 504,000 seedlings sold for planting in private plantations in the NW during this period. The peak years were 1999 (19,452), 1996 217,584 and 1995 (133,254). ONADEF is currently compiling data on the success rate of out-planting and exact location of the seedlings[14]. ANAFOR, the successor of ONADEF, planned extensively in the NW and Adamaoua from 2007 onwards but no data of actual planting since 2004 have been made available to date. The PAFRA project also sold a significant number of Prunus seedlings at lower than rates, subject to requests from 2001 to 2007. This resulted in at least 92,000 Prunus planted mainly by individuals. Where data is available, this is summarised in Table 12.

Figure 41 Prunus planted in Cameroon 1988-2008

[14] Situation of Prunus africana in private plantations in NW 1991-2003, ANAFOR, Nov 2007


250000
200000
150000
100000
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0
1988
1989
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2002
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2004
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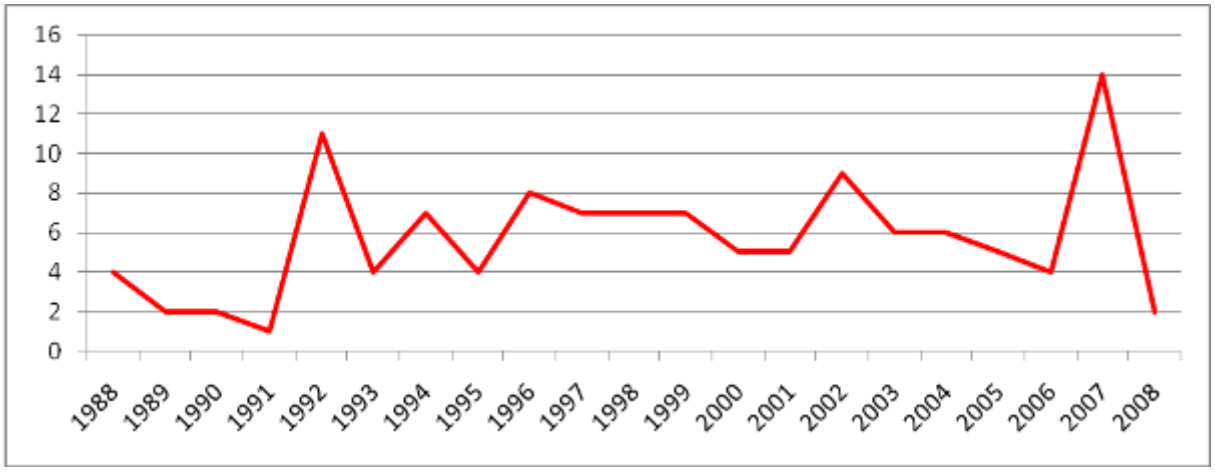
2007
2008

Figure 42 Numbers of Prunus plantations started in Cameroon 1988-2008



The interest in planting prunus, as shown by the numbers of Prunus trees planted by individuals, projects, communes and the number of plantations set up (shown in Figures Figure 41 and

Figure 42) correlates with peaks in annual export and production figures around 1995 and again a major peak in 2005.

Photo 10 ANAFOR Nursery, Bamenda

Over 4200 farmers were reported as planting in 1995 (Franzel, Ayuk et al., 2009). More recent data on planted Prunus in the Northwest and South West (Awono, Manirakiza et al., 2008; MinFoF, 2008; Tangem, 2008; Foaham, Dagobert et al., 2009) indicates that there are at least 433 farmers (individuals and/or groups) who in 2008 owned at least 143,290 planted *Prunus africana* trees. Where data exists on dates planted (n=54), the average age of tree is 14 years old and 41% of the trees (115,490 trees) were over this median age, approximately 70% (n=23) of trees planted recorded by CIFOR had never been harvested. Some 25% (n=33) were located in pure strands, the rest mixed with other agro-forestry species. The owner-farmers can be divided into several groups;

- A small group of pioneer farmers planted *Prunus africana* from the early 1970s onwards, planting with varying motives (for firewood, for traditional medicinal or for commercial use).
- Relatively high-income, progressive farmers who have become aware of the market for *Prunus africana* bark. These farmers, including traditional 'notables' (6% of total farmers), have bought seed, often from nurseries or individual collectors in Buea, Fundong, Kumbo or Oku, and have planted on a fairly large scale of up to 100 trees or more (Nkembi et al., 2008; Tangem, 2008; Franzel, Ayuk et al., 2009). 19% of owners (n= 84) had more than 100 Prunus 'plantations' with over 100 trees, ranging up to 8000, with an average of 993 each.
- Small scale 'opportunistic' farmers, forming the majority of owners, operating on a small scale, with 81% having less than 100 trees, on average 15 trees each. The majority of the plantations (n=9) have an average of 3 hectares per plantation.
- 12% of the farmers are organised into community groups (n=51), ranging from one of the largest, the Kumbo Council, with up to 52,000 trees, the Banso Baptist Hospital, Toga Community Group, and various water catchments such as Kiko Roh Vitangtaa.
- Small companies and the CDC constitute 3% of owners of planted Prunus.

Although the data summarised in Table 12 and 12 are incomplete, the long history and scale of domestication activities is clear. The majority of up to date, detailed, and verifiable data originates from the North West (Mezam, Bui and Donga Mantung divisions). The data gaps demonstrate the need for registration of privately owned *Prunus africana*. Nurseries appear more common in the North West than other regions and are managed often run by enterprises, but also by community forest based nurseries (also selling to the public) and NGOs. The current known nurseries and suppliers of *Prunus africana* are listed in Table 11.

Table 11 Nurseries in Cameroon 2009

Region	Name	Location	Seedlings
North West	ANAFOR	Kumbo, Bui	4300
	Kumbo Cooperative Union	Kumbo, Bui	18000
	Kumbo Council	Kumbo, Bui	1650

Region	Name	Location	Seedlings
	Laval Levia	Bui	22500
	Pa Elias	Bui	10200
	Ndzemo Group	Bui	6325
	Meta King Fonta Group	Bui	8450
	Bihkov CF	Bui	2600
	Emfeh Mih CF	Bui	4800
	Upper Shinga CF	Bui	3200
	Nformi Joesph	Bui	4000
	Nformi Aaron	Bui	1625
	Mih Henry	Bui	2685
	MIFACIG	Belo	30863
	RIBA	Kumbo	
	FAP	Ndop	
	ARIFACIG	Fundong	8749
	Bamonti	(Noni)	50
	Joesph Chiph	Aboh, Belo	300
	CIRDEN	Bamenda, Mezam	
	Goodwill Ngong Aaron	Belo	
	Sylvester Ngeh	Bandjong (Fundong centre)	100
	Total		*9534*
West	PROAGRO Blaise Kom	Nkoung-khi, Bayangam	
	APADER Roger Kwidja	Bangangte, Feutap	
	Total		?
South West	MOCAP	Buea	75000
	CAD	Bangem	
	RUDEC	Buea	
	BRCF Kumba	Kumba	
	EruDeF	Buea	
	PFPF	Bangem	
	CENDEP	Limbe	320
	Limbe Botanic Garden	Buea	
	Total		*>75,320*
TOTAL			

Sources (Awono, Manirakiza et al., 2008; MinFoF, 2008; Nkembi and Atem, 2008; Tangem, 2008; Tsobeng, Degrande et al., 2008; Foaham, Dagobert et al., 2009)
Pers comm. ARIFACIG, ERUDEF, CENDEP, MIFACIG and MOCAP, May 2009

Table 12 Domestication in Cameroon

Region	Location	Type of location	Organisation	No farmers/ groups	Approx N° Prunus planted	Approx area (ha)	Date planted
West	Bangangete	Individual plantations	PAFRA				2001-2007
	Ntingue, Sanctou, Menoue,	Plantation	ONADEF/Fonds Forestiere[15]			60	1976-1981
	Menoue	Forest reserve	ONADEF				2003
	Ndé division[16]	Planations & natural forest	Individuals			4.5	2000-2005
Littoral	Moungo	Délégation départementale	MinFoF				2007
Adamaoua		Individual plantations	PAFRA				2001-2007
SW	Bangem, Kupe Muanenguba	Nursery	RECODEV		800		2006-2007
	Mamfe	36 people, 3 groups	FORUDEF/Erudef[17]		5000?		2008
	Bangem[18]	Individual plantations/farms	ERUDEF/ TFTF[19]		2000		2008
		Individual plantations/farms	Individuals	17	11,612		1999-2005
	Buea	Individual plantations/farms	ERUDEF/ TFTF[20]		7500		2007
		?	MOCAP[35]				2008
	Mt Cameroon	Government land	CDC[21]			6.8	1998?
		Government land	Plantecam-ONADEF		800	2	1992?
		CFs, Mt Cameroon	CEXPRO - MOCAP		1,000		2006
NW		CFs, individuals farms & plantations	PAFRA[22]	3,250	92,329	198	2005
			ONADEF[23]		504,800		1991-2003
			ANAFOR[24]		15,000		2007
		Across NW individuals farms & plantations	ANAFOR[23]		9,000		1991
					20,000		1992
					24,010		1993
					62,162		1994
					133,254		1995
					217,584		1996
					7,445		1997
	Bui & Donga Mantung	Individuals, councils, plantations	CAMEP[25] MinFoF Bui[26]	373 33	75,176		Present in 2008
		Farmers & CIGs			17,494		1992
		BIKHOV			1,000		2003[27]
		Individual plantations	PAFRA[31]		15,540 1,500	38.6	2007
		7 communities	CENDEP[34]	7 groups	233	11.5	2008

[15] Cunningham & Mbenkum1993
[16] Pers.comm R. Kwidja, ONG APADER, Nov 2007
[17] Louis Nkembe, ERUDEF, TFTF Annual report May 2008
[18] Pers.comm A. Harrison, CERUT, Feb 2008
[19] Louis Nkembe, ERUDEF, TFTF Annual report May 2008
[20] Louis Nkembe, ERUDEF, TFTF Quarterly report April 2009
[21] Hall et al 2000
[22] Pers.Comm PAFRA Manager, Sept 2007
[23] Report Situation of Prunus in Private Plantations (ONADEF), 1997-2003, Nganteh Martin ANAFOR, November 2007
[24] Pers comm. Nganteh Martin, Bamenda annex Manager, 2007
[25] Per comm. CAMEP, 2008
[26] MinFoF Bui 2008
[27] Pers.Comm BIHKOV Board, Sept 2007

Region	Location	Type of location	Organisation	No farmers/ groups	Approx N° Prunus planted	Approx area (ha)	Date planted
		nursery	MinFoF Bui[28]	33	90,235		Present in 2008
	Bui, Kumbo Rohkimbo quarter	Nursery	SHUMAS[29]		40,000		2007
	Mbiame, Bui	Community forest	CENDEP[34]	1 CF	750	30	2009
	Kumbo, Bui	CIGs	TFTF[28]	63 groups	25,000		1994
		225 Individuals Bamenda	RIBA/Erudef[17]	8 groups	20,000		2009
		nursery	Kumbo Urban council [30]	1	15,000		1997-2007
		nursery	Himalayan Institute	1			
	Ngogketunia Sub Division	Individual plantations	PAFRA[31]		11,100 20,000	27.7	2007
	Momo Sub Division	Individual plantations	PAFRA[31]		16,570 1,500	41.4	2007
	Boyo, Jinkfuin[32]	Farm	Individual		1000		?
	Boyo	Nursery/farmers	Individual (Ijum Tree Farmers Union)		4,000		2004 to date
	Oku Sub division Kilim	Farmers			3,300		1997
		CFs	BHFP/KIFP[28]	600	5,348		1995
	Donga Mantung Sub division Njila, Ndu[33]	CF	BONOFOMACIG [34]	1 CF	1,000		2006
		CF	CF		1,000		2007
	Menchum Sub division	Individual plantations	PAFRA[31]		360 1,500	1	2007
	Ako	Individual plantations				5	1994
		116 Individual	SIRDEP/Erudef[17]	4 nurseries	20,000		2009
	Mezam Sub division Bamenda Nkwen Babanki Santa Santa,Mankon Mankon	Individual plantations	ANAFOR[23]		19,542		1999
		59 Individuals Bamenda	SIBADEF/Erudef [17]	7 nurseries	20,000		2009
		1 water catchment Santa	SOPHEA/Erudef[1] [7]	1 nurseries	5,000		2009
		Individual plantations Bafut Ngema Forest Reserve & Bambui	PAFRA[31]		47,742 5,000	119.4	2007
		Individual plantations				1	
		Individual plantations				5	?
		Individual plantations	ANAFOR[23]		6,000		2003
		Individual plantations	ANAFOR[23]		5,095		2005
		Individual plantation	[28]	1	5,000		2006

[28] MinFoF Bui 2008
[29] Pers.Comm Stephen Ndzerem, SHUMAS, 2008
[30] Etude De Base De Prunus Africana Dans Le Nord Ouest Et Le Sud Ouest Du Cameroun, CIFOR, Deb 2007
[31] Situation de reboisment dans le Nord Ouest, Ref No 260/minFOF :PDFWL/NWP/2 3 Oct 2007, MINFoF NW/PAFRA
[32] Pers.Comm Nsom Alfred Jam, 2008
[33] Pers.Comm Njila FMO, August 2007
[34] Pers.Comm BONFOMACIG Delegate & Secretary General, Sept 2007

Region	Location	Type of location	Organisation	No farmers/ groups	Approx N° Prunus planted	Approx area (ha)	Date planted
		Luta Albert in Santa					
		Individual plantations Mendankwe	[35]		>		2006
		Individual plantations				4	?
	ASSOKOFOMI Laikom[36]?/ Fundong, Boyo	Individual plantations	PAFRA[31]		47,100 2,000	117.4	2007
		101 Individuals, 6 nurseries	CIRDAF/Erudef [17]	6	10,000?		2008
		CFs	BHFP/IFP[28]	600	9,000		1995
		CFs	CFs		1,000		Not yet planted
		CF	Laikom CF	1 CF	1,500		2007
	Ijim	CFs	BHFP		5,000		?
	Baba II[37]	CF	BHFP	1 CF	1,600/ 600 survive		2004
Total					**1,698,481**	**673.3**	**1976-2009**

(Source; Ingram 2008, Ndam & Asgana 2008)

16.4 Regeneration

Regeneration, reforestation or enrichment planting refers to the replacement and replanting of trees that have been lost (due to natural or human causes) in natural forests.

The main regeneration activities have occurred in the North West in response to concerns about the over-exploitation in Kilum-Ijim (Parrott et al., 1989; Cunningham and Mbenkum, 1993) and resulting loss of highly important biodiversity and forest based livelihoods as part of the Kilum Ijim Project and subsequent Bamenda Highlands Forest Project from 1987 to 2004, often in combination with encouragements for domestication of both fruit trees, timber and non-timber trees (Abott et al., 2001; Franzel, Ayuk et al., 2009). This has resulted in approximately some 15,000 *Prunus africana* trees being planted within Community Forests and as boundary markers.

The PAFRA project planted out 35,000 Prunus saplings, along with other species, as part of its reforestation programme in forest reserves, communal spaces and council forests in an area of some 105 hectares between 2001 and 2007. Where data is available, this is summarised in Table 12.

16.5 Domestication and regeneration recommendations

The easiest route to building a sustainable, long-term trade in *Prunus africana* that does not threaten wild stocks is by encouraging domestication on a scale greater than that already in place in Cameroon. Whilst the scale of current regeneration is considerable, it is not sufficient to fulfil the current levels of demand from international pharmaceutical and health products industry.

[35] Franzel, Ayuk et al. 2009
[36] Report of Activities for Laikom CF July – Sept, September 16 2007
[37] Pers.Comm John & Constance FMOs, Baba II, March 2007
[34] Pers.Comm CENDEP, Wirsiy Eric Fondzenyuy, May 2009

Regeneration by enrichment planting and reforestation in managed natural forests (for example council and community forests), is also an important option for sustainable management.

ANAFOR as the government authority responsible for reforestation and agroforestry needs to incorporate *Prunus africana*, as a nationally protected Special Forestry Product, an internationally Red Data listed protected species and a CITES Annex II classified species, specifically into in a national plan.

Individuals and managers of community and communal forests also have an important role as suppliers, as do importers, exporters and traders, buyers and owners of land. Research institutes such as IRAD, ICRAF and Universities have a role in disseminating information on propagation and cultivation techniques and making available improved germplasm and seeds.

The following recommendations are therefore made;

ANAFOR and MinFoF

1. Develop and implement a national forestation plan, paying special attention to include *Prunus africana* and *Pericopsis elata.*
2. Disseminate information on procedures for registering *Prunus africana* plantations
3. Collaboration between ANAFOR and research scientific plant prunus
4. Provide incentives e.g. Zero regeneration tax payment for replacement regeneration planting for each PAU
5. ANAFOR to coordinate and disseminate information on domestication and cultivation techniques and monitor annually trends in quantities planed, pests and diseases and growth rates.
6. Obligation for PAU holders to plant equivalent *Prunus africana* trees every five years, to compensate for their quota of Prunus harvested.
7. ANAFOR together with National Herbarium to set up provenance seed banks from the 6 main PAU areas to ensure genetic diversity
8. Enrichment planting in protected areas affected by over-exploitation and inclusion in their Management Plan;
   - Mt Cameroon National Park (in process)
   - Mt Bakossi Ecological Reserve
   - Mt Oku Plant life Sanctuary
   - Mt Tchabal Mbabo National Park (in process)

Private sector (Importers, exporters, nurseries)

9. Exporters and importers set up collaborations with private owners, community forests, councils to plant Prunus and make long term arrangements for supply.
10. Establishment of new plantations by private sector
11. Set up incentive programmes for regeneration and domestication e.g. paying higher preferential prices for planted *Prunus africana* or for planting schemes

Forest and agroforestry research organisations (ICRAF, CIFOR, IRAD, Universities)

12. Provide information to ANAFOR regional delegations, MinADER extension agents and nurseries on cultivation techniques and seed selection
13. Provision of improved planting material to nurseries with link between genetic source and levels of extract.
14. Extension support to small holders and nurseries.
15. Build capacities of nurseries, extension agents and NGOs on vegetative propagation techniques

16. Research carbon sequestration potential of *Prunus africana* Plantations as an additional source of funding to farmers.
17. advice with on optimum seed selection from wild vs. planted *Prunus africana*

Community forests, Council forests and councils

18. Enrichment planting in natural forests and vulnerable areas e.g. water catchments
19. Encourage plantations and provide incentives to planting e.g. Kumbo tree for child scheme
20. Community involvement in wild seed collection and
21. Encourage individuals to plant *Prunus africana* on private land

16.5.1 Research needs

The following research needs have been mentioned in the Prunus platforms, meetings and consultations and in literature (Ndam and Asanga 2008, Cunningham 2002);

1. Selection of fast growing, high active ingredient yielding varieties for domestication- taking into account pharmaceutical and health product industries requirements.
2. Research into alternatives to bark harvest e.g. berries, roots, leaves and yields
3. Research into how to differentiate planted from wild prunus (eg genetic markers)

17 Recommendations

Implementing a new regime to manage and exploit *Prunus africana* sustainably is a challenge for all actors involved in the chain; communities, community forest institutions, traditional authorities, harvesters, nurseries, tree and plantation owners, permit holders, processing and export enterprises, the pharmaceutical and health industry, the government and regulators such as CITES and the EU, research and support organisations. To make it work, a coordinated effort and communication between all is necessary. The three year long process leading to this Plan has show that such collaboration, trust and comprehension between actors is possible and emerging. Given the 30 year history of both exploitation and unsustainable harvests in Cameroon, the country has both much to learn and to offer to other African states embarking on similar Management Plans. The plan aims to have a positive economic, social and health impact on thousands of livelihoods of those in both Cameroon and worldwide that depend on Cameroonian *Prunus africana*. Specific recommendations to ensure successful implementation of this plan include;

1. This Management Plan presents recommendations for technical aspects and institutional and regulatory issues. Implementation of institutional aspects is essential for this Plan to work.
2. Plantations should be encouraged, with technical and material incentives provided to divert focus from wild resources.
3. . The radical changes proposed in this National Management Plan will need commitment, strong controls and monitoring and extensive changes in both attitudes and behaviour.
4. Improved traceability is key to the success of the Plan and essential to build Cameroon's international image.
5. Distinguishing between active ingredients in wild Prunus and that plantation is a key aspect in long term sustainability.
6. Speedy implementation of this Plan is essential to avoid losing the valuable international market for Prunus extract based pharmaceutical and health products to alternative natural or synthetic products.
7. Carbon sequestration and avoided deforestation funds from Prunus plantations should be explored as potential source of funding for farmers and the government.
8. The challenges of increased costs due to the procedures for PAUs, investments in plantations, inventory and management plans, controls and monitoring compared to its current market value where these aspects have not been accounted for, will have to be addressed by actors at all part of the chain, whilst keeping the product competitive to alternatives.
9. Actors at all stages of the chain all benefit from continued collaboration and exchange of information on the sector, practices prices and developments.
10. Securing land title and protecting *Prunus africana* resources in non permanent forests needs to be addressed.
11. The PAU system proposed should be open to all enterprises and organisations, offering a fair opportunity for smaller and community based organisations to compete for PAU titles, whilst maintaining fair competition to enable an open access market and support fair product prices.
12. Certification of *Prunus africana*, although not unsuitable for the pharmaceutical market[38], maybe an option for the health and botanical products market. Recent studies and market links directly with Cameroon could enhance this and add to the traceability process.
13. Promoting exchanges of information on technical, price and buyers between groups of harvesters, nurseries and governors community forests, councils, private owners)

[38] Where the 'end-consumer' is a medical doctor prescribing prescription medicines, there is little scope for added value by registering Prunus africana bark or products with forest or fair trade certification schemes.

14. The challenge of establishing a stable and fair, equitable relationship between harvesters and buyers of prunus bark has to be overcome.

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