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PRELIMINARY REPORT ON SUSTAINABLE HARVESTING OF *PRUNUS AFRICANA* (ROSACEAE)
IN THE NORTH WEST REGION OF CAMEROON

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Report prepared for the National Forestry Development Agency (ANAFOR), the Cameroon CITES Scientific Authority for flora, in the frame of the project “Non-detriment findings for *Prunus africana* (Hook.f.) Kalman in Cameroon”..

By

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RESUME EXECUTIF

Prunus africana (Rosaceae) globalement connu sous le vocable *Pygeum*, est un arbre qui pousse dans les forêts afromontagnardes entre 1500 et 3000 m d'altitude, et sur sol volcanique et sous climat frais d'altitude. Son aire de distribution englobe la Côte d'Ivoire, Bioko, Sao Tom, Ethiopie, Kenya, Ouganda, Afrique du Sud, Madagascar, Congo, République Démocratique du Congo et Cameroun.

Au Cameroun, *Prunus* a été signalée dans 64 sites, distribués dans 23 départements et 6 régions (provinces). Le Nord Ouest (27 sites), l'Ouest (15), le Sud Ouest (8), et l'Adamaoua (7) restent dans cet ordre les quatre principales régions où l'on trouve cette espèce au Cameroun.

Des extraits de l'écorce de cette plante ont été identifiés et patentés comme étant actifs dans le traitement de l'hypertrophie prostatique bénigne. Des capsules contenant des extraits d'écorce sont en vente en Europe depuis plus de 30 ans.

Prunus africana a été classée par l'Union Internationale pour la Conservation de la Nature comme espèce vulnérable. Ce fait a conduit à son classement dans l'annexe II de la Convention sur le Commerce International des espèces de faune et de flore sauvage menacées d'extinction (CITES). Le quota annuel autorisé à être exporté au Cameroun est de 2 000 tonnes d'écorce.

Le Gouvernement du Cameroun a toujours montré un intérêt grandissant pour la gestion durable de *Prunus africana*. Ce fait peut être illustré par de nombreux textes et législations qui se sont succédés depuis les années 1972.

L'Agence Nationale de Développement Forestier (ANAFOR) a été désignée pour jouer le rôle de l'Autorité Scientifique CITES par décision n° 0104/D/MINFOF/SG/DF/SDAFF/SN du 02 Mars 2006.

Le présent document rapporte les premiers résultats du projet « **Avis de Commerce Non Préjudiciable sur *Prunus africana* (Hook.f.) Kalkman au Cameroun** », projet mis en œuvre par l'ANAFOR.

La région du Nord-ouest est située entre les latitudes 5°4' et 7°15' Nord de l'équateur et les longitudes 9°30' et 11°15' Est. Sur le plan administratif, la région du Nord-ouest comporte sept (7) Départements : Mezam (avec pour Chef -lieu, Bamenda), Boyo (Fundong), Bui (Kumbo), Ngoketunjia (Ndop), Donga Mantung (Nkambé), Menchum (Wum), Momo (Mbengwi).

Le Nord ouest est l'une des plus importantes régions du Cameroun qui regorgent d'énormes réserves de *Prunus africana*. A côté de *Prunus* sauvages, on trouve aussi de nombreuses plantations à *Prunus* dans les 7 départements de la région du Nord ouest.

Le mont Oku fait partie de l'« archipel » des montagnes camerounaises. Le mont Oku s'étend sur deux départements dans le Nord ouest : le Bui et le Boyo. La partie du mont située dans le Boyo est désignée « mont Ijim » tandis que la partie localisée dans le département du Bui est désignée « mont Kilum ». La zone d'Oku présente un paysage constitué d'une extrême variété de paysages constitués d'une succession de montagnes avec des pentes très fortes. Au-dessus de ces montagnes se trouvent des plateaux entrecoupés des vallées ou des plaines au niveau de Jakiri vers Dop et de Babungo vers Oku. L'altitude culmine à 3011 mètres au sommet du Mont Oku. La plus basse altitude se situe autour de 1169 vers Babungo. La végétation de la région du Nord-ouest est la conséquence directe du climat, de la topographie et des activités humaines. Les principaux types de végétation rencontrés sont: les savanes humides arbustives dans les hautes altitudes, la végétation peuplée de *Pennisetum purpurum* dans les vallées à faible drainage,

et les forêts de montagnes qui couvrent les monts de Nkom Wum, de Kilum Ijim au Mont Oku. L'effectif de la population, selon le recensement national de la population de 1987, est estimé à 1,5 millions d'habitants induisant une densité de population trois fois plus élevée que la moyenne nationale. Cette densité avoisine 25 habitants/ Km². Plus de la 75% de la population vit dans la zone rurale. Le mont Oku abrite l'unique forêt naturelle des deux départements qui entoure un lac de cratère avec exutoire (le lac Oku). Pour protéger cette forêt qui abrite deux espèces d'oiseaux endémiques *Touraco bannermani* et *Platysteira laticincta*, un projet dénommé « Projet Kilum Ijim a été mis en œuvre avec l'appui financier de BirdLife International en 1993. Pour impliquer les populations à la conservation des ressources forestières et au maintien du régime hydrique de cette montagne d'où naissent tous les cours d'eau, ce projet a appuyé la création des forêts communautaires attribuées aux communautés environnantes regroupées en groupes d'initiatives communes (GIC) dans lesquelles on retrouve *Prunus africana*. Le projet BirdLife International a aussi proposé la création d'une aire protégée autour du lac Oku. Aujourd'hui cette aire protégée a déjà été classée comme sanctuaire de flore de Kilum Ijim.

L'inventaire des forêts naturelles a porté sur 18 forêts communautaires, le sanctuaire de flore de Kilum Ijim et la zone du domaine national non concédé du Mont Oku uniquement (zone hors forêt communautaire). Cette zone couvre une superficie totale de 31 635 hectares (ha). La méthode qui a été utilisée est la méthode dite Adaptive Clusters Sampling (ACS) ou échantillonnage adapté aux grappes. Elle a pour base la méthode traditionnelle d'inventaire d'aménagement généralement utilisée en forêt dense au Cameroun. Au Cameroun, la méthode traditionnelle est normalisée que ce soit pour l'inventaire national de reconnaissance des ressources forestière ou encore de l'inventaire d'aménagement. L'ACS est indiquée en ce sens qu'elle permet de capter les grappes ou « clusters » de *Prunus*.

L'inventaire conduit sur *Prunus* sauvage a permis de recenser 1552 arbres sur une superficie de 330 ha. Un total de 195 arbres dépérissants ou morts ont été recensés dans cet échantillon représentant 10% du total. Les 1357 arbres vivants trouvés ont une densité de 3.84 tiges/ha. Les tiges vivantes exploitables ou alors celles qui ont plus de 30 cm de diamètre ont une densité de 0.5 tige/ha. Un total de 1007 009.72 tiges de *Prunus* sauvages vivantes, dépérissantes ou mortes a été estimé pour toute la région de Oku, c'est-à-dire dans l'ensemble des 31 635 ha indiqués plus haut. Le nombre de tiges vivantes est de 87 650.9 alors que celui des tiges dépérissantes ou déjà mortes est de 19 358.83. Parmi les tiges vivantes, 10 870.22 arbres soit 12.4% ont atteint le diamètre minimum d'exploitabilité qui a été fixé par l'administration forestière du Cameroun à 30 cm. Ces arbres peuvent donc faire l'objet d'exploitation. Une prédiction du rendement annuel soutenu de l'écorce de *Prunus* a été faite sur base du nombre de tiges exploitable, du rendement moyen par arbre et du temps nécessaire entre deux passages successifs sur le même arbre. Le rendement soutenu de *Prunus africana* sauvage en poids de matière fraîche sera de **301. 075 tonnes/an**. Un quota annuel de 150,53 tonnes d'écorce sèche de *Prunus* sauvage peut être défini pour le Nord ouest. Ce quota est considéré comme une moyenne entre le quota de 137.99 tonnes/an sous-estimé du fait notamment du long temps de rotation pour la couverture complète de l'écorce (6 ans) et celui de 165.591 tonnes/an sur-évaluée du fait du court temps de rotation qui devra séparer deux récoltes (5 ans) successives sur le même arbre. Toutes les forêts communautaires qui ne disposent pas des tiges vivantes de *Prunus* qui soient exploitables devront être suspendues de toute sorte d'exploitation. Il s'agit des six forêts communautaires suivantes : Abuh, Afua – Dichami, Bikhov, Mbai, Mboh Mboleng and Njuambun.

Dans la région du Nord-ouest, de nombreuses personnes sont intéressées par la domestication de *Prunus africana*. Cet intérêt se manifeste par le nombre impressionnant de paysans, groupes d'initiatives communes (GIC), organisations gouvernementales et non gouvernementales impliqués dans la plantation, la collecte et la commercialisation des graines et des plants de cette espèce. De ce fait, une grande majorité des paysans ont

intégré cette espèce dans leurs systèmes de production. Une évaluation de l'état de plantation de *P. africana* dans la région montre qu'au moins cinq départements en sont concernés, il s'agit des départements de la Mezam, Ndonga-mantung, Ngok etunja, du Bui et Boyo. Par ailleurs, *P. africana* serait la troisième espèce arborescente prioritaire pour la domestication de la région après *Dacryodes edulis* et *Cola spp.* Elle est plantée de préférence dans les systèmes agroforestiers simultanés en mélange avec les cultures vivrières et pérennes. Elle se présente de façon dispersée dans les champs, ou placée le long des bordures pour servir de haie vive ou de brise vent. L'on la trouve également en plantation mono-spécifique par endroit, mais aussi parsemer dans les jardins de case. La mise en place des plantations ne respecte pas les normes comme l'on devrait s'attendre en plantation car ici, ni les superficies, ni les écartements n'existent pas. Les arbres sont parsemés dans l'espace dans la plus part des cas sans suivi ni entretien. Ainsi l'estimation des superficies qu'occupe cette espèce en plantation reste assez difficile.

L'inventaire de *Prunus* domestiqué s'est déroulé dans les plantations privées situées dans les champs et autour des habitations dans le Département de Boyo au niveau des Arrondissements de Fundong, Belo et DjiniKom, le Département de Bui principalement dans les Arrondissements de Elak Oku, de Kumbo et de Jakri et le Département de Donga Mantung. La méthode a consisté à recenser toutes les plantations, leurs âges et la provenance des plants dans les villages autour du mont où la culture du *Prunus* est déjà suffisamment ancrée. Ce recensement était basé sur les enquêtes auprès des responsables locaux de l'administration forestière et des responsables de gestion des forêts communautaires et les vérifications sur le terrain. Des mesures des diamètres et appréciation de l'état de santé des tiges ont été faites sur certains sujets dans quelques plantations choisies en fonction de l'âge et de l'importance (effectifs).

L'échantillon porte sur 52 champs de *Prunus* dans les trois départements sus indiqués. Un total de 1896 tiges de *Prunus* ont été recensées dans cet échantillon, dont 1813 tiges vivantes et le reste dépourvues ou mortes (4.37%). Parmi les 1813 tiges vivantes, seulement 38 ont déjà atteint le DME, avec un pourcentage moyen de 2.42 %. Les 87.58% autres tiges sont petits en diamètre, malgré l'âge assez avancé de certaines plantations. Un total de 117 123 tiges de *Prunus* ont été déclarées avoir été plantées dans les trois départements de Bui, Boyo, et Donga Mantung. Un total de 1634.11 de tiges vivantes peuvent être exploitées car elles ont atteint le DME. Le rendement soutenu de *Prunus africana* domestiqué en poids de matière fraîche sera de **60,4 tonnes/an**. Les 3 023.14 tiges dépourvues ou mortes estimées peuvent également faire l'objet d'exploitation. La simulation du quota a également été faite selon l'approche indiquée plus haut dans les forêts naturelles. Un quota de annuel de 30,23 tonnes d'écorce sèche de *Prunus* domestique peut être défini pour le Nord ouest. Ce quota est considéré comme la moyenne entre le quota de 27.7 tonnes/an sous-estimé du fait notamment du long temps de rotation pour la couverture de l'écorce (6 ans) et celui de 33.2 tonnes/an sur-évaluée du fait du court temps de rotation qui devra séparer deux récoltes (5 ans) sur le même arbre.

Un rendement soutenu de *Prunus* en poids de matière fraîche de **361.4075 tonnes/an** peut être retenu pour la région du Nord Ouest. Le quota total qui pourrait être attribué aux opérateurs économiques dans la région du Nord ouest sera de **180,7 tonnes de matière sèche/an**. Ce quota n'inclut pas le pygeum domestique trouvé dans les autres quatre départements de la région du Nord ouest. Si les 997,61 arbres exploitables trouvés dans le sanctuaire de flore (aire protégée) de Kilum Ijim sont interdits d'exploitation, alors le quota annuel *Prunus* sera de **175,78 tonnes** d'écorces sèches. Si la zone hors forêt communautaire est exclue de toute forme d'exploitation du fait non seulement qu'on ne trouve pas de tiges vivantes exploitables, mais aussi et surtout du fait qu'il sera difficile pour l'administration forestière de contrôler l'exploitation dans cette zone qui reste dans le domaine non permanent de l'Etat, alors le quota annuel du Pygeum sera de **129,59 tonnes d'écorce sèche/an**. Et si les deux types de forêts sus relevés, c'est-à-dire l'aire protégée et

la zone hors forêt communautaire sont exclus, alors ce quota annuel va encore diminuer et atteindre **124.6 tonnes** d'écorce sèche. Il faut aussi relever que prêt de **250 tonnes de matière sèche** de *Prunus* sont stockés dans de nombreux magasins. Ces stocks qui avaient été récoltés avant la suspension n'ont pas pu être exportés.

Depuis 2007, le Gouvernement du Cameroun a pris d'importantes mesures pour limiter l'exploitation illégale du Pygeum au Cameroun : la restitution du cahier de chantier pour les récolteurs et exploitants, l'instauration des lettres de voiture pour la circulation des produits spéciaux, et l'érection d'une importante partie du mont Oku en aire protégée, le sanctuaire à flore de Oku. Cependant beaucoup de problèmes continuent encore à persister notamment dans le domaine du contrôle, et ce, depuis la forêt jusqu'aux points de sorties (ports) et depuis les services centraux de l'administration forestière jusqu'aux services déconcentrés.

Le mont Oku, principale réserve du Pygeum de la région du Nord ouest est cerné par 15 postes forestiers de contrôle. L'un des postes forestiers se trouve même presque au sommet du mont, le poste forestier de Mbockevu.

Pour permettre la conservation de *Prunus africana* dans la région du nord ouest Cameroun, il serait intéressant de :

- Renforcer tous les services forestiers dans la zone du mont Oku en capacités humaines, logistiques et en motivations financières pour mieux contrôler et suivre les opérations de récolte, de transformation et de transport de *Prunus* ;
- Faire un toilettage du nombre des opérateurs économiques qui font dans l'exploitation de *Prunus africana*, pour ne garder que des opérateurs soucieux de la gestion durable de la ressource ;
- Réfléchir sur les questions d'équité sur le plan des échanges commerciaux. Il faudrait s'assurer que les communautés locales sont suffisamment motivées pour conserver *Prunus* dans leurs forêts communautaires ;
- Les procédures d'attribution des permis doivent être accélérées et s'adapter aux exigences climatiques de la filière *Prunus*. Les commissions d'attribution des quotas devraient rapidement tenir leurs assises de manière à permettre la délivrance des permis assez tôt avant la saison sèche, période idéale pour l'exploitation de *Prunus* (terrains très accidentés) ;
- Revoir les modalités de fixation de la taxe de régénération qui du reste est très faible. Les 10 FCFA/kg perçus par l'administration forestière ne peuvent en aucun cas permettre à l'Etat de faire des inventaires de qualité et assurer le contrôle des produits. Les 330 ha de forêt effectivement échantillonnés dans ce travail ont coûté plus de 45 000 USD, ce qui dépasse de très loin les 20 000 000 de FCFA jadis perçus à titre de la taxe de régénération par l'Etat camerounais avec son quota qui était de 2 000 tonnes/an ;
- Suspendre toute forme d'exploitation de *Prunus* dans les six forêts communautaires ciblées du fait du manque de tiges vivantes exploitables ;
- N'autoriser le début de l'exploitation dans les autres 12 forêts communautaires restantes qu'après réalisation des inventaires d'exploitation en bonne et due forme sur la première parcelle ou assiette délimitée sur une périodicité ou rotation de cinq ans et demi;
- Assister les communautés locales dans la réalisation de ces inventaires d'exploitations pour éviter les problèmes de suivi et d'accompagnement relevés dans le projet BirdLife International ;

- Mettre sur pied un bon système de traçabilité des produits qui seront récoltés dans les forêts ouvertes à l'exploitation ;
- Accompagner les populations locales à développer les pratiques agricoles qui limitent l'extension des surfaces cultivées au détriment de la perte des forêts à *Prunus*, et notamment dans la zone hors forêt communautaire.

EXECUTIVE SUMMARY

Prunus africana is a species of the Rosaceae family, known under its trade/pilot name as pygeum or African chery. It is a montane tree species of the tropical Africa including the Côte d'Ivoire, Bioko, Sao Tome, Ethiopia, Kenya, Uganda, South Africa, Madagascar, Congo, the Democratic Republic of Congo, and Cameroon.

Prunus africana is classified by the World Alliance for Nature (IUCN) as a vulnerable plant species in Cameroon. This led to its listing in the Appendix II of the Convention on International Trade in Endangered Species of Fauna and Flora (CITES). The annual quota of export volume used in Cameroon is 2000 tons.

Prunus grows well in the sub-montane and montane forests at an altitude of 1500 – 3000 m. In Cameroon, the plant can be found in 6 regions. North west, west, South west and Adamaoua. In its distribution area the natural range of *P. africana* is discontinued. Pygeum forests appear fragmented in several isolated sub-stands distributed in afro-montane forests.

Cameroon Government has often shown a great concern for the sustainable exploitation of *P. africana*. This concern could be well-illustrated by the frequency of changes in regulations since 1972, suggesting that the administration is permanently searching for the best way to manage the resources.

The National Forest Development Agency (ANAFOR) was appointed to play the role of the CITES Scientific Authority for plants issues by Decision N° 0104/D/MINFOF/SG/DF/SDAFF/SN of 02 March 2006, providing the designation and definition of role of the CITES Scientific Authority in Cameroon.

This document reports preliminary results obtained within the ANAFOR's project/ activity entitled "Non-detriment findings for *Prunus africana* in Cameroon".

The North west region of Cameroon is one of the most important region hosting *Prunus africana*. Aside the wild *Prunus* found in community and non community forests, there are many plantations of *Prunus* in the seventh divisions of the North west region.

The mount Oku covers two divisions in the North west region: the Boyo and the Bui divisions to be précised. The side located in the Boyo division is called "mount Ijim" and the one located in the Bui division is called "mount Kilum". The *Prunus* inventory was conducted mainly in the mount Oku for what concerns natural forests and in its surroundings divisions for what concerns the plantations (domestic *Prunus*).

Mount Oku is up to 3011 m and belongs to the Cameroonian mountains group. The Oku vegetation is a direct consequence of the climate, topography and human activities. Following vegetation types can be found: the humid and arbustive savannahs in high altitudes, the *Pennisetum purpurum* vegetation in valleys of low drainage, and the mountain forests which cover the mounts of Nkom, Wum, Kilum and Ijim. Mount Oku hosts the unique natural forest which surrounds the volcanic lack of Oku called "Oku lack". The Oku region host a total number of 1,5 million of persons with a density of 25 inhabits/km². The natural forest inventory covered 18 community forests, the Kilum Ijim flora sanctuary, and the national domain area not allocated to communities (area out of community forests). This area covers 31 635 ha of forest. The method used in natural forests is called "Adaptive Clusters Sampling (ACS)". This method has its basis in the known classical/traditional forest inventory method often used for managements in dense forests. The ACS method is advised since it captures the *Prunus* clustering characteristics. Inventories carried out on wild *Prunus* allowed to record 1552 trees on 330 hectares of forests. Wilt or dead trees were 195 and represent 10% of the total number of trees. The 1357 living trees recorded have a density of

3.84 trees/ha, among which 0.5 trees/ha can be harvested since they reached the minimum exploitable diameter (MED) which is 30 cm for *Prunus* in Cameroon. A total number of *Prunus* trees (living, wilt or dead) estimated for the whole Oku region is 107 009.72 trees. The number of living trees is 87 650.9 while that of the dead or wilt trees is 19 358.83. Among living trees, 76 780.67 have not yet attend the MED. Only 10 870.22 trees representing 12.4% of the total living trees have reached the MED and can therefore be harvested. A prediction of the sustainable yield of *Prunus* bark was made from estimates of the natural population, the average yield per tree and the length of time between successive debarkings required to allow total recovery of the bark. The annual yield of fresh bark of the wild *Prunus* in the mount Oku region is 301 075.05kg/year or **301. 075 tons/year**. A total of 150.53 tons of dried barks of wild *Prunus* can be granted per year to trade companies in the North west region. This quota is considered as the medium, obtained from the lowest estimated with a rate of recovery of 6 years (137.99 tons/year) and the highest estimate with a rate of recovery of 5 years (165.591 tons/year). All community forests where there are no living trees with diameter \geq MED should be excluded from all kind of *Prunus* exploitation now. The following six community forests are concerned with that measure: Abuh, Afua – Dichami, Bikhov, Mbai, Mboh Mboleng and Njuambun.

In the North west region, many farmers are interested in the domestication of *Prunus africana*. This interest is manifested by the impressive number of peasants, common initiative groups (CIG), and non-governmental organizations involved in the planting, collection and marketing of seeds and seedlings of this species. Thus, a large majority of farmers have introduced this species in their production systems. *P. africana* is the third priority tree species for domestication in the region after *Dacryodes edulis* and *Cola spp.* It is preferably planted in agroforestry systems simultaneously mixed with food crops and perennial. But, the establishment of plantations does not meet the standards as would be expected in a normal plantation; the distances between trees are not respected. Trees are scattered throughout the space in most cases without monitoring or maintenance. Domestic *Prunus* was assessed in both farms and home gardens found in the subdivisions of Fundong, Belo and Djinikom in the division of Boyo, the subdivisions of Elak Oku, Kumbo and Jakiri in the division of Bui, and in the division of Donga Mantum. Inventories of domestic *Prunus* were carried out in 52 plantations. A total number of 1896 *Prunus* trees were recorded. A total number of 1813 trees were alive while 83 trees were wilt or died, occupying 4.37% of the entire population. Among the 1813 living trees, only 38 (2.42%) have reached the minimum exploitable diameter and can be harvested. The others (87.58%) are still small, which shows the young ages of those plantations. A total number of 117 123 *Prunus* trees are estimated to be planted in the three divisions of Boyo, Bui, and Donga Mantung. A total of 1634.11 living trees can be harvested, since they reached the MED. About 3 023.14 trees should be harvest, since they died or are being died (wilt trees). Simulation of annual quota was made as described above. The annual yield of fresh bark of the domesticated *Prunus* in the mount Oku region is 301 075.05kg/year or **60.4 tons/year** A total of 30.2 tons of dried barks of domestic *Prunus* can be granted per year to trade companies in the three divisions of Bui, Boyo and Donga Mantung in the North west region. This quota is considered as the medium obtained from the lowest estimated with a rate of recovery of 6 years (27.7 tons/year) and the highest estimate with a rate of recovery of 5 years (33.2 tons/year).

The total annual yield of fresh bark of *Prunus* in the mount Oku region is 301 075.05kg/year or **361. 475 tons/year**. The total *Prunus* quota to be granted to trade companies in the North west region should be **180.7 tons of dried barks/year**. Domestic *Prunus* also found in the remaining divisions is not included in this quota. If the 997.61 exploitable trees of *Prunus* found in the protected area are excluded from the exploitation, then the annual quota of the *Prunus* will be **175.78 tons** of dried barks/year. If the area out of the community forest is moved, then the quota for the wild *Prunus* in the north west will be **129.59 tons** of dried barks/year. If both the area out of the community forest and the protected area are excluded

from the exploitation, then the annual quota of wild *Prunus* in the North west will be **124.6 tons** of dried barks/year. It is interesting to note that there are about **250 tons of dried barks** of *Prunus* in the North west region. That *Prunus* was harvested and could not be exported due to the ban pronounced by the European Commission.

Since 2007, the forest administration took some important measures to alleviate poaching in the exploitation of *Prunus* including: the restoration of the field book for the harvesters, the instauration of specific way bills for the circulation of Special products, and the erection of an important part of the mount Oku in protect area, the Kilum Ijim flora sanctuary to be precised. But many problems still remain in the monitoring of the exploitation and exportation of *Prunus* in Cameroon. Problems are observed at all levels of the control, from the forest till the points of exports, and from the central administration to the external services.

The mount Oku is surrounding by fifteen (15) forest control posts. One of the forest control post is located inside the mount Oku, the forest control post of Mbockevu.

to ensure the conservation of *Prunus africana* in the region, following actions should be conducted:

- enforce capacities of all forest structures found in the area of mount Oku in terms of human resources, logistics, and financial incentives as to allow them to better control and monitor the exploitation, processing, and transport of *Prunus* products;
- filter the number of trade companies who are working in the field of *Prunus Africana* as to keep those who are interested in sustainable management of the resource;
- analyse the problem of equity in the trade exchanges on *Prunus africana*. It should be ensured that local communities are well motivated to conserve *Prunus africana* in their forests;
- the procedure of issuing the special permits should be in accordance with the reality of the sector, aiming to maximise the exploitation of the *Prunus* barks during the dried months which include: January, April, May, June, and December;
- propose a better system of taxation of *Prunus* products or the fiscality on *Prunus africana*. Till now, the Cameroon Government received only 10 FCFA per kilogram of *Prunus* barks. This tax is called the "regeneration tax". It is clear that, this amount cannot ensure the management of the resource by the Government. Inventories conducted in 330 ha of forest in the North west required more than 45 000 USD;
- forbid or ban the exploitation of *Prunus africana* in the six community forests indicated above;
- authorize the exploitation of community forest after the realization of the systematic inventories in the first plots on the basis of a rotation of 5.5 years;
- assist local communities in de realization of their systematic inventories as to avoid problems observed in past years in the same region within the BirdLife International project;
- develop and implement a fair tracking system to trace *Prunus* products from the forest till the exit points;
- assist local people in developing fair farming system that do not harm *Prunus* habitat, especially in the area out of the community forests..

CHAPTER 1. INTRODUCTION

1.1. Context and Problem

Prunus africana is a species of the Rosaceae family, known under its trade/pilot name as pygeum or African chery. It is a montane tree species of the tropical Africa including the Côte d'Ivoire, Bioko, Sao Tome, Ethiopia, Kenya, Uganda, South Africa, Madagascar, Congo, the Democratic Republic of Congo, and Cameroon.

Prunus Africana is classified by the World Alliance for Nature (IUCN) as vulnerable species, which led to its listing in the Appendix II of the Convention on International Trade in Endangered Species of Fauna and Flora (CITES). This decision had a significant impact on the revenues produced from this non timber forest product in the range countries. Since October 2007, the European Commission has banned the importation of *Prunus Africana* coming from Cameroon in Europe. This measure impacts both the economic operators and the local people for whom *Prunus* represents an important non timber forest product.

In various African countries, policies have been established to ensure the sustainable management of forests containing *Prunus africana* stands. However, enforcement issues and control problems do persist. The development of clear procedures to deliver Non-Detrimental Findings (NDFs) remains a priority for most producer countries.

Although the Cameroon Government has recognised the promotion of Non-timber forest products (NTFPs) as a means to alleviate poverty in rural areas and to generate revenue for the national economy, no adequate management regimes have been developed.

The Cameroon Government distinguishes two categories of NTFPs. The first group is composed of NTFPs that the Government does not require any taxes from the harvesters, and the second group is composed of those products from which the Government perceives taxes from any person willing to harvest or commercialize them. *Prunus africana* belongs to the second group, also known as "special products".

The exploitation of special products is regulated in Cameroon mainly by the forest administration, Ministry of Forest and Wildlife. Two main Directorates are concerned in this administration: the Directorate of forests is in charge of the management of the resource, while the Directorate of promotion and processing is concerned with the valorization of that resource. The Ministry of Economy and Finances ensures the collection of taxes and fees through the Forest Revenue Enhancement Program (FREP). The only tax set to date by the national financial law for the exploitation of special products is called the regeneration tax, which is 10 FCFA/kilogram of the product (1 euro = 650 FCFA), while the fee perceived is 5% of any product exported.

Moreover, the Cameroon Government has often shown a great concern for the sustainable exploitation of *P. africana*. This concern could be well-illustrated by the frequency of changes in regulations since 1972, suggesting that the administration is permanently searching for the best way to manage the resources.

These changes and measures include among others: the conception of a field book in 1986 (Ndibi 1996), and recently in 2007 (Akagou 2008, Betti 2007). This field book enables the forestry service to monitor the exploitation of the resource on a weekly basis.

The partial ban of *Prunus* exploitation in 1991, which was lifted in 1992; the ban on felling decided in 1993; and the reduction of quotas in 2008 were followed by the ban on the importation of Cameroon's *Prunus* into Europe space as a result of the decision undertaken by the European Commission in October 2007.

Prunus africana has been recognized as a "special product with particular interest". Article n° 2 of Decision n° 0336/D/MINFOF of the 06th July 2006 that give the list of "special products

with a particular interest” states that, these are products that are relatively less abundant in the forest or for which some additional measures are indispensable, due to the threatening caused by the non sustainable harvesting methods used by harvesters. The quotas for “special products with particular interest” are granted by an inter-ministerial commission comprising representatives from the forest administration, environment, research, finance, and other administrations.

In addition, the forest administration has identified *Prunus africana* as one of the six most important NTFPs in Cameroon that needs to be promoted for socio-economic development. Although, sometimes, with good regulations, they are unfortunately poorly implemented, or not at all. Most often, stringent measures were prescribed only in the face of a tragedy such as the recent destruction of *Prunus* in Mount Cameroon and North West, when the tendency was to consider only the immediate causes, forgetting the root cause of the problem. For example, despite the official ban in 1991, a greater quantity (3900 tons) of *P. africana* was harvested and exported between 1991 and 1992 than in any preceding year, indicating the lack of law enforcement and a high level of corruption in the production zone (Cunningham, 1997 cit. Tieguhong & Ndoye 2004).

Concerns on the future of *Prunus africana* led to its listing in Appendix II of the Convention on International Trade in Endangered Species of wild Fauna and Flora (CITES) in 1994, becoming effective in 1995 (Sunderland and Tako, 1999 cit. Tieguhong & Ndoye 2004). The impact of listing *Prunus africana* by CITES has been partially effective in reducing threats because it has helped to raise awareness about the problems posed by international trade.

A key requirement of CITES is the non-detriment findings made by the Scientific Authority of the range State prior to export, certifying that export is not detrimental to the survival of the species. This requires information on the location, stocking, growth and condition of the species and on its ecology, regeneration and subsequent protection. Such information is often lacking, incomplete or imprecise making a proper evaluation of the sustainable levels of utilisation and conditions attached to be difficult. The Scientific Authorities also face obstacles due to inadequately trained and resourced staff.

Another key requirement is that the designated Management Authority must certify that exports have been obtained legally, yet they often lack adequately trained staff and resources to implement tracking and compliance systems.

Following the results reported by some NGOs outlining the unsustainable harvesting of *P. africana* in Cameroon, the CITES committee on plants proposed to the Cameroon Government to revise from August 2006, the annual quota of *P. africana* based on scientific data (inventories) and to elaborate a strategy or an action plan for the sustainable harvesting of *P. africana* in Cameroon. The report prepared and sent by the Cameroon CITES Management Authority lacked accurate and scientific data to convince the CITES Committee on plants. The CITES Committee on plants then recommended to the Cameroon Government to reduce the current annual quota which is 2000 tons/year and to adopt a reasonable rotation period which allows the regeneration of the barks. These concerns still remain problematic for Cameroon (Akagou et Betti 2007).

Since 2007, FAO, CIFOR, SNV and ICRAF, have been collaborating with the Ministry of Forest and Wildlife, private sector, research and community based organizations in the *P. africana* market chain in the North West and South West of Cameroon to elaborate guidelines for management plan for *P. africana* in Cameroon. The work was conducted within the project GCP/RAF/408/EC entitled « Mobilisation et renforcement des capacités des petites et moyennes entreprises impliquées dans les filières des produits forestiers non ligneux en Afrique Centrale ». As proposed in previous studies (Betti 2008, Akagou et Betti 2007), the report proposes to the Cameroon Government to undertake the management of *Prunus africana* similarly to what is done for timber resources, with clear distinction between

the permanent and the non-permanent forest domains. The major landscapes of Cameroon containing *P. africana* have been agreed, defined and consolidated into *Prunus* Allocation Units that cover six montane areas. The problem is that, the designated PAU were defined based on citations of *Prunus* occurrence by some vultagers. No realistic field trips have been conducted to consolidate such PAUs (CITES Management Authority, pers. Com.). The guidelines for management plan of *Prunus* produced recommends that “the actual quantity of *Prunus* available for exploitation will only be known once inventories and Management Plans for *Prunus* Allocation Units (PAU) are conducted and approved, and the quantity of *Prunus* on private land is registered” (Ingram *et al.* 2009).

The National Forest Development Agency (ANAFOR) was appointed to play the role of the CITES Scientific Authority for plants issues by Decision N° 0104/D/MINFOF/SG/DF/SDAFF/SN of 02 March 2006, providing the designation and definition of role of the CITES Scientific Authority in Cameroon. The Cameroon CITES Scientific Authority for Plants being a rather young body, suffers from a shortage of technical, financial and material capacities.

This document reports preliminary results obtained within the National Forest Development Agency's project/ activity entitled “**Non-detriment findings for *Prunus africana* (Hook.f.) Kalman in Cameroon**”.

1.2. Objectives

This work aims to gather and analyse data for sustaining *Prunus africana* together with its natural habitats in the North west region of Cameroon. The main objectives are to summarize the basic information on this plant species, its management, utilization and trade, and to present a comprehensive description on the procedure followed to sustain *P. africana* in the North west Cameroon

1.3. Importance and compliance of the activity with the existing policies and strategies

The work goes in line with the Cameroon's Forest and Environment Sectorial Program (FESP) developed in 2003 (MINEF 2003). The FESP is a tool developed by the Cameroon Government as to bring strategic responses in the implementation of the 1994 forest law. The FESP is composed of 5 components. This initiative meets the objectives of two of the five components, including: Component 2 (Sub-component 2.4/Activity 2.4.1/Sub-activity 2.4.1.2: to undertake inventories to know the stocking of Non timber forest products (NTFP) in each ecological zone, Sub-activity 2.4.1.3: to identify production sites and the trade chain of principal NTFP, Sub-activity 2.4.1.4: to create a database on NTFP, Sub-activity, activity 2.4.2./Sub-activity 2.4.2.1: to develop and disseminate the sustainable harvest methods, processing and domestication, Sub-activity 2.4.2.3: to build CITES organs capacities and Component 5 (Sub-component 5.3: research and monitoring).

The work is in compliance with the recent guidelines developed for *Prunus* management plan in Cameroon (Ingram *et al.* 2009).

The work also goes in line with the ITTO/CITES program “ensuring that the international trade in CITES tropical listed tree species is non detrimental to their conservation” (ITTO – CITES 2006).

CHAPTER 2. MATERIAL AND METHOD

This section presents the milieu and the logical steps and procedures followed to ensure sustainable harvesting of *Prunus africana* in the North West region of Cameroon.

2.1. Study area

Cameroon belongs to the Congo basin, it is located at the centre of Africa near the Equator and covers about 475,000 km². It totals about 16.5 millions ha of dense rainforests. The flora component (higher plants) has more than 7,000 species of which 3000 are useful plants, ranking Cameroon 4th in Africa after the Democratic Republic of Congo, Tanzania, and Madagascar (MINEF 1995, Onana 2007). From South to North, there are various types of tropical rainforests, humid savannah, forest galleries, dry forests, dry savannah, steppes and yaeres. Apart from these natural ecosystems, there are also man-made agro-ecosystems (Letouzey, 1968; 1985). Figure 1 illustrates the main phytogeographical regions found in Cameroon including: the shrubbery steppe in the Far-north region, the wooded savannah in the North region, the forest savannah in the Adamaoua and West regions, the transition forests in the Adamoua and East regions, the semi-deciduous forests in the East and South regions, the mangrove and evergreen forests in the Littoral and South west regions (MINEF 1995). Cameroon's phytogeographical map can also be classified as follow: afro-mountain region, in South west, west and north west regions, the soudano-zambezi region in the North and Far north regions, the Guineo-congolese region found mainly in the Centre, South, south west and East regions, the Dja Congolese district found in the East and south regions, and the pery-forest savannah found in the Adamaoua region (Letouzey cit. Sonké 1998).

Cameroon is often considered as Africa in miniature due to its large variety of ecosystems and climates. The various ecosystems have always been inhabited by Cameroonians who have, some how, reshaped them through the years by harvesting this rich biodiversity for food, medication, construction of houses, etc.... The rate at which they are used varies from rural areas to towns.

According to the Cameroon's minister of forestry and wildlife, "the forest sector of Cameroon contributes to some 30% of total non-oil export revenues..." (Ngolle Ngolle 2008). This contribution is largely made of timber products. The Non timber forest products of plant origin composed of food, medicinal plants and others are less represented in the GDP. However NTFP play an important role in rural areas and constitute important tools for alleviating poverty.

The utilization of resources is not always rational and sustainable thus constituting a threat to biodiversity. Populations of some valuable NTFP such as *Prunus africana* has suffered from over harvesting and inadequate harvesting techniques such as debarking and total cutting (Betti 2008).

Among the ten regions of Cameroon, six, namely Adamaoua (Ngaoundéré being the capital), the Centre (Yaoundé), Littoral (Douala), North West (Bamenda), Southwest (Buea), and West (Bafoussam) regions, are regions where populations of *Prunus africana* occur. But the main reserves of *Prunus africana* are found in the Adamaoua, North West and South West regions.

2.2. Method/procedures followed to sustain *Prunus africana* in the North West region

Data presented in this document are based on the previous reports dealing with non detriment findings on *Prunus africana* in Cameroon presented at the "International Expert Workshop on Non detriment findings" held in Cancùn/Mexico, 17-22 November 2008 (Betti

2008). Those data were updated according to the results obtained during the ongoing “ITTO – CITES Program for Implementing CITES Listings of Tropical Timber Species”.

2.2.1. ITTO – CITES program in a nutshell

The overall objective of the ITTO – CITES Program (ITTO – CITES 2006) is to ensure that continuing international trade in CITES-listed timber species is consistent with their sustainable management and conservation. The specific objective is to assist national authorities to meet the scientific, administrative and legal requirements for managing and regulating trade in *Pericopsis elata* (Afromosia) – found in Central Africa, *Swietenia macrophylla* (Bigleaf mahogany) – found in Latin America, and *Gonystylus spp.* (Ramin) – found in South East Asia and, in particular, to develop guidance to ensure that utilisation is not detrimental to the survival of CITES-listed timber species.

The program has received funding from the European Commission, United States of America, Japan, Norway and New Zealand. The European Commission provided a grant worth 2.4 million euros for program implementation, with over US\$ 800,000 dollars provided from the other donors in aggregate. The EC grant duration is until mid-2010 and ITTO will seek additional funds from donors so this popular program can continue into 2011. The USA has indicated an on-going interest in continuing to provide funds to this program. ITTO will encourage other donors to do so as well since requests for support under the program now exceed available resources.

This action responds to calls made in both the ITTO Council and CITES Conference of the Parties for support to range states for implementation of CITES listings, and in particular will support a work programme element of the ITTO. The listing of commercial timber species is a relatively recent phenomenon in CITES, which brings new challenges of both a technical and institutional nature for organisations involved in forest management and the timber trade

2.2.2. *Prunus africana* activity/project in Cameroon

Recognizing the shortcomings in scientific information related to the sustainable harvesting of *Prunus africana*, the government of Cameroon has submitted to the International Tropical Timber Organization (ITTO) for funding one activity entitled “**Non-detriment findings for *Prunus africana* (Hook.f.) Kalman in Cameroon**”.

The Steering Committee (or National Technical Committee) of the project held its first meeting on 20 July 2010 in the conference room of ANAFOR, once the Cameroon Government received the first instalment of funding from ITTO (160 000 US \$).

The National Technical Committee (NTC) or the Steering Committee of the ITTO – CITES project on *Prunus aricana* in Cameroon held its first meeting on 20 July 2010 in the Conference room of the National Forest Development Agency (ANAFOR) at Yaoundé, once the Cameroon Government received the first instalment of funding from ITTO (160 000 US \$). The meeting was chaired by the General Secretary of the Ministry of Forestry and Wildlife (MINFOF), Mr KOULAGNA Denis. Some sixteen (16) members from the MINFOF (06), ANAFOR (04), Ministry of Scientific Research and Innovation (02), Ministry of Environment and Nature Protection (01), University of Yaoundé I (01), the Syndicate of Industries in charge of Harvesting, Processing, and Exportation of Special Products (SIHPESP) of Cameroon or trade companies (01) and the Regional Coordinator of the ITTO – CITES program in Africa attended this first meeting.

The meeting was organized in 6 main points including: (1) the opening ceremony (speech) of the chair-man, (2) the speech of the CITES management authority on the state of negotiations engaged between the Cameroon counterpart and the European Union on *P. africana*, (3) the speech of the CITES scientific authority on the implementation of the CITES in Cameroon, (4) presentation of the *Prunus* project by the deputy national coordinator, (5) presentation of the action plan by the deputy national coordinator, and (6) miscellaneous.

Setting export quotas of *Prunus africana* for the North west region of Cameroon: Report prepared by AMOUGOU AKOA, BETTI J.-L., EWUSI NJOMBE B., MBARGA N., AKAGOU ZEDON H.C., FONKOUA C., ESSOMBA E.R., NKOUNA ABIA C.

From discussions, following recommendations were made:

- (1) An *ad-hoc* technical group should work as quick as possible to finalize Terms of References (ToRs) and select experts under the supervision of the Regional Coordinator (RC) as to start implementing specific activities by the end of July 2010;
- (2) The National Coordination team should work with the Division in charge of Cooperation and projects in the Ministry of Forestry and Wildlife to ensure the Cameroon counterpart in the project for the 2011 financial year;
- (3) Examine the possibility of creating inside the ANAFOR, an organization which will assist closely in playing its role as the CITES Scientific Authority for plant species;
- (4) Be active in fund raising and be opened to other additional funds that may come from other donors, regarding the complexity of the *Prunus* problem in Cameroon;
- (5) Develop a suitable GIS database system to enhance the MINFOF's control on *Prunus* products from forest to exit points.
- (6) Start implementing specific activities as quick as possible as to get the preliminary results for the incoming regional workshop scheduled in Limbé, Cameroon from 29 September to 02 October 2010.

Following the recommendations of the Steering Committee, the Regional Coordinator assisted ANAFOR to go fast in the implementation of the specific activities identified in the project. This consisted of drafting Terms of References (ToR) of specific activities, identifying national experts, dressing contracts. A total of 10 terms of references (ToR) and 10 Contracts directly related to the implementation of specific activities have been dressed and signed by ANAFOR on 1st of August 2010 including: (i) study on a well-established state-of-the-art on production, processing, transport and trade on *P. africana* products, (ii) study on mapping and delimitation of *Prunus* Allocation Units (PAUs), (iii) study to estimated abundance/density of *Prunus* as well as scientifically calculated sustainable harvest quota, (iv) study to elaborate for each PAU, a simple management plans (v) study to promote sylvicultural operations, (vi) study to enforce capacities for CITES authorities (management and scientific), (vii) study to enhance the control system, (viii) research on biological and ecological aspects related to the sustainable management of *P. africana* in Cameroon, (ix) study of the policy framework for the implementation of the CITES regulations in Cameroon, (x) study of the soils and litter properties related to *P. africana* as important tool for sylviculture. Aside to those ToRs, a total of 10 junior experts or forest engineers and 12 students from the University of Dschang (06), Douala (05), Yaoundé I (02) were associated to the experts on specific topics.

Early in the beginning of August 2010, the first experts sent in the field encountered many problems with local communities. These communities were reluctant to the implementation of the project, since they were not informed of the ITTO/CITES project. As a response to this problem, the MINFOF sent a circular letter to all communities and forest officers in the field, inviting them to welcome the project and to collaborate with the experts committed to conduct studies within this project. This letter was not enough to convince different stake holder. Face to this situation, the implementing agency, ANAFOR, together with the Regional Coordinator (RC) and the CITES management authority (CMA) organized several meetings in the field to sensitize local communities and local forest officers and other administrations on the aims of the ITTO/CITES project in Cameroon. Meetings were organized with the support of the Governor of the North West region in the two main divisions where *Prunus* appear in high densities: the Bui and the Boyo division.

One month after the experts in charge of mapping and *Prunus* inventories have started working, the RC and the national deputy coordinator made a four days trip in the field to check how those specific activities were being implemented. The mission was repeated in

the middle of October 2010. During the missions, the coordination team (regional and national) verified the position and length of lines used for counting *Prunus* stems. Are the lines established according to the sampling design? How labourers appreciate the health of the *Prunus* stem, and how do they measure tree diameters?.

CHAPTER 3. BIOLOGICAL DATA

The genus *Prunus* belongs to the Rosaceae family group and consists of about 400 species mostly distributed in the north temperate one of America, Europe, and Asia. There are about 75 tropical species, mainly tropical Asiatic and tropical American (Mabberley cit. Nouhou Ndam 1996).

2.1. Scientific and common names

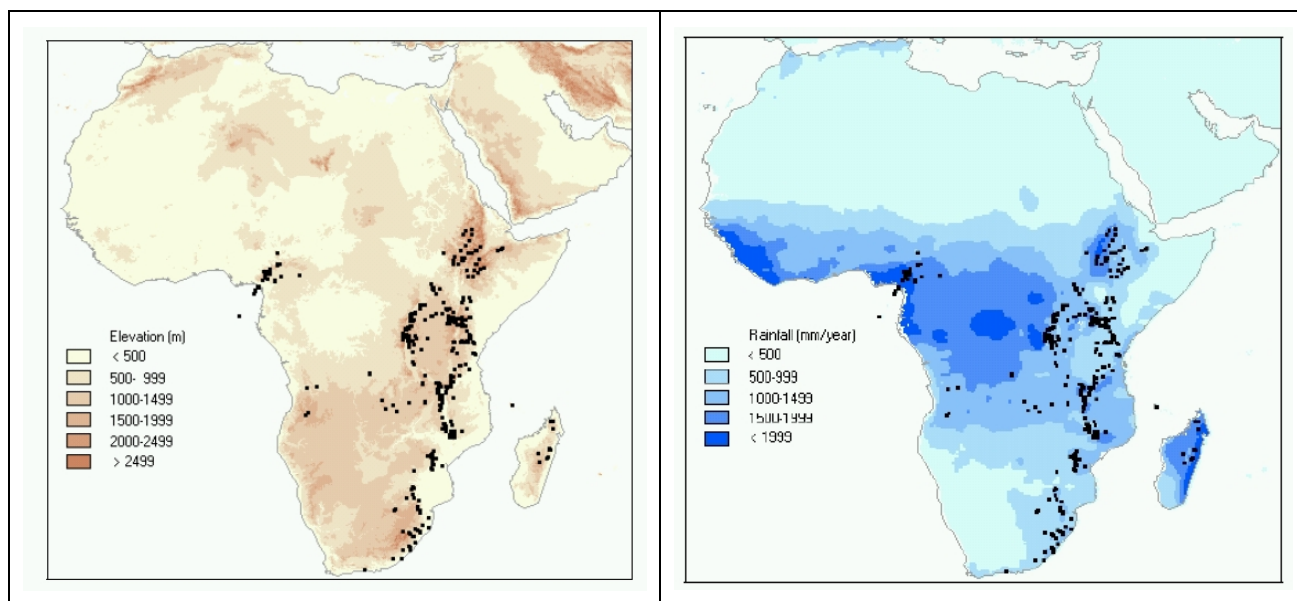
Prunus Africana (Hook.f.) Kalman (formerly *Pygeum africanum* Hook.f.) known under its trade/pilot name as *Pygeum* or African cherry, is the only sub-Saharan African species of the genus and is widely spread in mountain tropical Africa from west and East Africa to South Africa and Madagascar.

Common names: Pygeum, Iron Wood, (Red) Stinkwood, African Plum, African Prune, African Cherry, Bitter Almond.

Local or vernacular names for *Prunus africana* by region (Cunningham, 2006) in Cameroon are, *wotangue* (Bakweri) *dalehi* (Fulani), *ebtaa* (Oku), *elouo*, *mowom* and *sola* (Kom), *kanda stick* (Pidgin) and *kirah* (Banso).

2.2. Distribution

Range countries include Côte d'Ivoire, Bioko, Sao Tome, Ethiopia, Kenya, Uganda, South Africa, Madagascar, Congo, the Democratic Republic of Congo, and Cameroon (Vivien et Faure 1985).



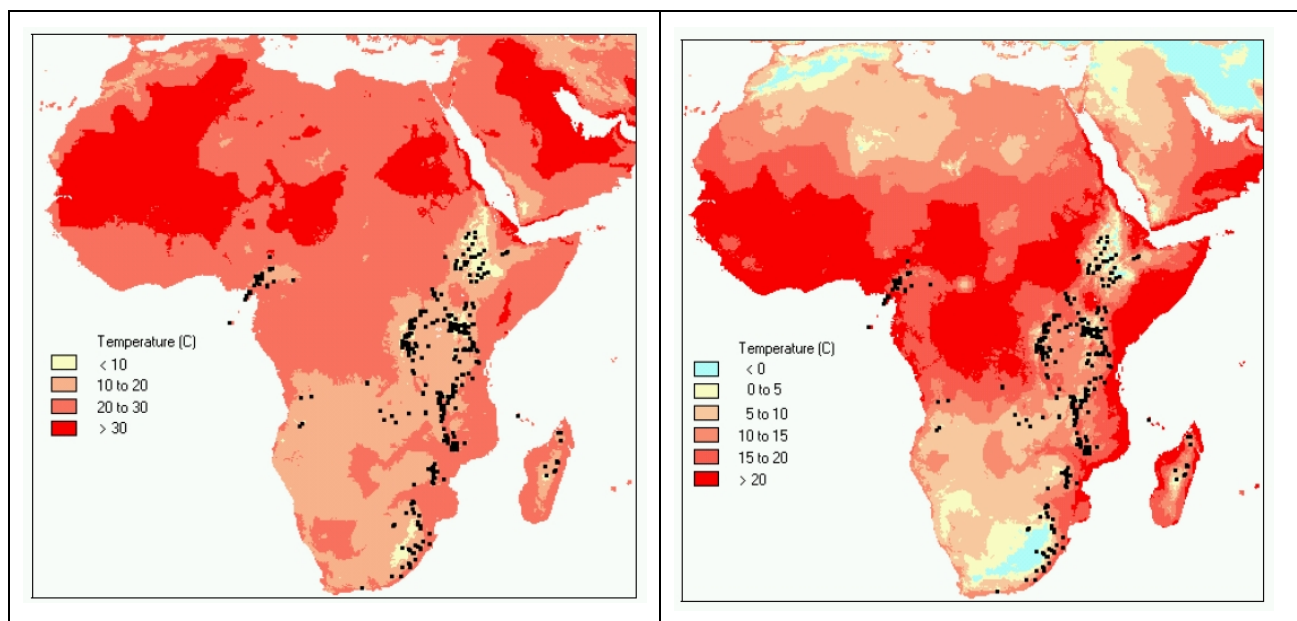


Figure 1.- Pan-african distribution of *Prunus africana* (Hall et al., 2000).

In the distribution area the natural range of *Prunus africana* is discontinued. Pygeum forests appear fragmented in several isolated sub-stands distributed in afro-montane forests (see Annex for Cameroon distribution)

In Cameroon, the plant can be found in some 64 sites, distributed in 23 divisions and 6 regions. North west (27 sites), west (15), South west (8) and Adamaoua (7) are in this order, the most important provinces in terms of number of sites of occurrence. The major landscapes of Cameroon containing *Prunus* (Ingram *et al.* 2009) have been defined and consolidated into *Prunus* Allocation Units (PAUs) that cover six montane areas (figure 2).

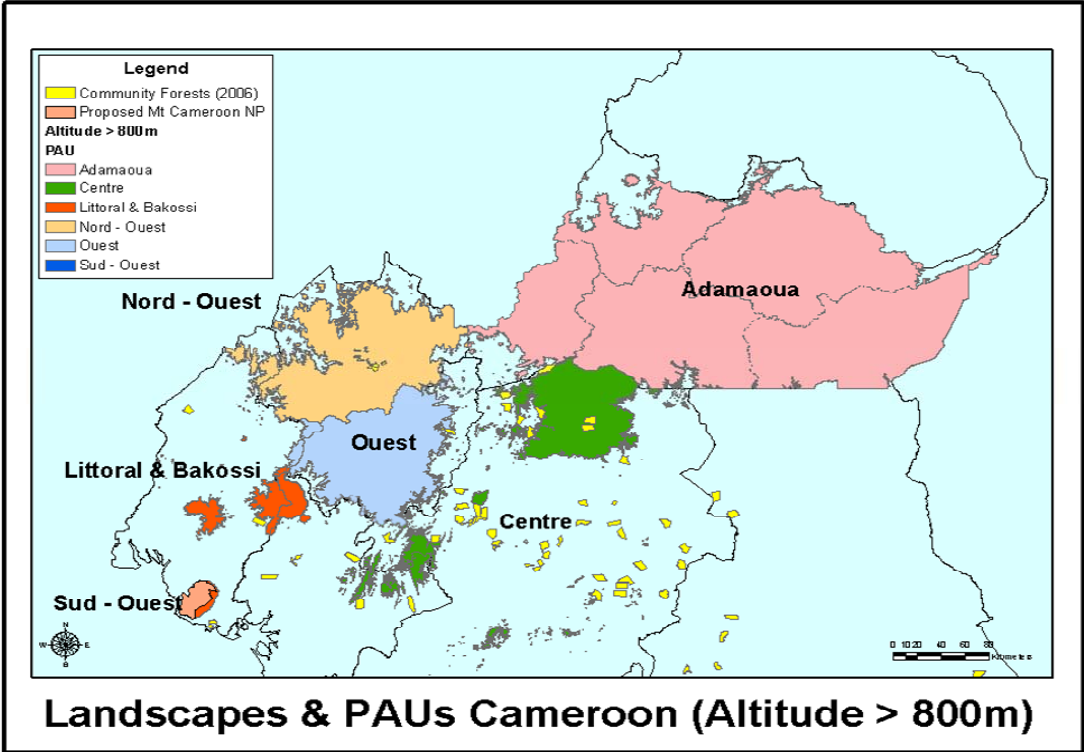


Figure 2: the six regions of *Prunus africana* in Cameroon

2.3. Biological characteristics

2.3.1. Life history

Prunus africana is an evergreen canopy tree to 30 m tall with thick, fissured bark and straight bole that can reach a diameter of 1.5 m. Its leaves are alternate and simple. The flowers are small, white and fragrant. The fruit, which is intensely bitter, is a small pinkish-brown bilobed drupe. Fruits are 11 mm x 9-10 mm, ellipsoid or transversely ellipsoid, indehiscent drupe, deep red to purple-black, 0.5 g. Stalk round, 6-7 mm x 0.1 mm. Skin (epicarp) squeezes off easily in fingers, exposing green flesh (mesocarp) surrounding the bony endocarp. Glabrous. Seeds have same shape as fruit, contained in a bony endocarp. Cotyledons are white, with a thin papery, dry, pale yellow-brown testa. There exists one seed per fruit. Germination is epigeal. (Fraser et al. The flowering period extends from June to November and fruiting period from February to May. It is light demanding and responds well to cultivation (Vivien et Faure 1985, Fraser et al. 1996, Tchouto 1996).

The bark is black to brown, corrugated or fissured and scaly, fissuring in a characteristic rectangular pattern. The leaves are alternate, simple, long (8-20 cm.), elliptic, bluntly or acutely pointed, glabrous and dark green above, pale green below, with mildly serrate margins. A central vein is depressed on top, prominent on the bottom. The 2-cm petiole is pink or red. The flowers are androgynous, 10-20 stamens, insect-pollinated, 3-8 cm., greenish white or buff, and are distributed in 70-mm axillary racemes. The plant flowers October through May. The fruit is red to brown, 7-13 mm., wider than long, two-lobed with a seed in each lobe. It grows in bunches ripening September through November, several months after pollination.

Poor establishment conditions for the seedlings, is known to be one of the main causes of the species population decline. Seedlings grow well when they are established on exposed sites with good moisture such as road collapse (Ndam 1996). On Mount-Cameroon, a study has indicated a density of 5.5 trees \geq 20 cm dbh par ha with a low level of recruitment such as seedling density of about five individuals/m² (Ewusi et al. 1992). The same study also showed that seedlings were most abundant where there was a good light penetration into the forest and the undergrowth was sparse.

2.3.2. Habitat type

According to Vivien et Faure (1985), *Prunus africana* grows well in the sub-montane and montane forests at an altitude of 1500 – 3000 m). For (Tchouto 1996), *Prunus* is found at an altitude of 900 – 2500 m above sea level, though it has been observed to grow at lower altitude of 600 m. Studies conducted within the Mount Cameroon project suggested that fallows are the suitable habitat type than primary forest for *Prunus africana* in terms of density (4.69 seedlings/m²), survivorship/mortality (48.18%), recruitment, growth rate (11.52cm/year) (Ndam 1966).

Although *Prunus africana* is reported to be a light demanding species, it is present in closed-canopy forest (up to 20% of canopy composition) on Mount Oku. The lack of associated recruitment in such closed-canopy forest suggests that it is a mid to late secondary successional species (Eben-Ebai cit. Tchouto 1996). This lack of recruitment is evidence that in closed-canopy forest Pygeum is not replacing et al mature individuals coming to the end of their reproductive life. This supports the theory that in fact, the presence of Pygeum in mature phase forest may indicate that these individuals represent a relic population from mid-late successional processes, with little or no reproductive future without significant disturbance and opening successional opportunities (Sunderland and Nkefor 1996). Light is said to be needed for the promotion of regeneration (Eben-Ebai et al. cit. Tchouto 1996) although Geldenhuys (1981) cited by Tchouto (opcit.) reports that direct light inhibits seed

germination and subsequent seedling development. Light is not necessary for germination but is vital for seedling development (Sunderland and Nkefor 1996).

2.3.3. Role of the species in its ecosystem

The fruits of *Prunus africana* are drupaceous, fleshy and red-purple in colours and are said to be eaten by a variety of birds and mammals (Cunningham and Mbenkum 1993). Most notable of these being the primate, Preuss Guenon (*Cercopithecus preussii*) and the Mount Cameroon Greenbul (*Andropogon montanus*) a montane bird, both of which are endemic to massif. According to Sunderland and Nkefor (1996), the suggestion by Cunningham and Mbenkum (1993) that the destruction of *Prunus africana* in a given area will affect frugivorous faunal populations significantly was an overstatement due to the irregularity of *Prunus* fruit production. It would be impossible to determine the reliance, and hence the effect of forest disturbance through the removal of Pygeum, of particular animal or bird on *Prunus* fruits given the masting fruiting characteristics exhibited by the species.

Frugivorous birds and mammals, however, must play an important role in seed dispersal. Observations indicated that dispersal from the parent tree was negligible and the majority of fruits had fallen within the crown line. Some villagers suggest that this might be due to intense hunting pressure, with not enough mammalian presence to disperse the fruits. However, caching of seed by small rodents seems to be common and this appears to account for the majority of predation of the seed set, although predation per seeds seems to be minimal (Sunderland and Nkefor 1996).

CHAPTER 4. BACKGROUND ON *PRUNUS AFRICANA* MANAGEMENT IN CAMEROON

4.1. National population size

Many independent inventories have been carried out in South west (Mount Cameroon) and Adamaoua (Tchabal Gang Daba and Tchabal Mbabo) provinces.

Two inventories were carried out in the Mount Cameroon (Ewusi et al. 1992, Tchouto 1996). Ewusi et al. (1992) recorded a total of 249 trees in 18 plots at between two and four elevations on seven transects. They estimated an average of 5.5 stems/ha of *Prunus africana* in Mount Cameroon. The population is not evenly spread on Mount Cameroon, with denser populations at higher altitude. While most of the 249 trees surveyed had survived debarking, some had died either from over-harvesting or from fire damage at the forest savannah boundary. The total exploitable population (with diameter ≥ 30 cm), was estimated at 3.5 stems/ha.

Tchouto (1996) reports the results from a general forest inventory conducted in 1992 in the Etinde Forest area, under the Limbe Botanic Garden and Rainforest Genetic Conservation Project. The density was 0.76 stems/ha with a mortality rate of 22%. The exploitable population is 7.2 stems/ha.

Results obtained from the recent inventories conducted with the “Adaptive Cluster Sampling” method within the project GCP/RAF/408/EC in the South west (Mount Cameroon and Mount Manengouba) and North west (Mount Oku) are presented as follow (FAO/SNV/CIFOR/ICRAFT 2008):

- Mount Cameroon: 11.40 stems/ha and 1.66 exploitable stems/ha;
- Mount Manengoumba: 1.89 stems/ha and 1.00 exploitable stem/ha;
- Mount Oku: 3.52 stems/ha and 3.35 exploitable stems/ha.

Inventories conducted by the National Office for Forest Development (Pouna & Belinga 2001) in two harvesting sites in the Adamaoua province revealed following results:

- Tchabal Mbabo: 12.29 stems/ha with 8.22 exploitable stems/ha;
- Tchabal Gang Daba: 2.15 stems/ha with 0.99 exploitable stems/ha.

The recent national forest resources assessment conducted by FAO/ICRAFT/SNV/CIFOR from 2003 to 2004 suggests the density of 0.01 stem/ha and the relative frequency of 0.00 % for *Prunus africana* in the whole country, which tends to show that this plant species is threatened in Cameroon (MINFOF - FAO 2005). This low density may be due to the fact that, the 2003 inventory covered many ecological zones of Cameroon, including those where *P. elata* does not occur. Also, this density includes trees with diameter less than 20 cm.

4.2. National population trends

Many authors outlined the decline in *Prunus africana* populations due to over-harvesting (Ewusi et al. 1992, Tchouto 1996, FAO/ICRAFT/SNV/CIFOR 2008). First observations regarding the declining of natural population inherent to overexploitation were made by Ewusi et al. (1996). Reports confirmed the fact that the natural population has suffered major damage from both legal and illegal exploitation (Ewusi et al. 1996), reducing the population from all previous inventory estimates by up to 50% in two years (1994 – 1996) (see fig. 2).

In 2007, the SNV Highlands in collaboration with the Western Highlands Nature Conservation Network (WHINCONET) assessed *Prunus* individuals in one transect of 3 km x 6 m covering the community forest of Emfveh Mii, Kedjem Mawes, meadows, and Mt Oku in the North west province (*Prunus* platform Meeting Report, Bastos Yaoundé, 16 January 2008). This work aimed to assess the impact of the exploitation on the fate of *Prunus* trees.

Setting export quotas of *Prunus africana* for the North west region of Cameroon: Report prepared by AMOUGOU AKOA, BETTI J.-L., EWUSI NJOMBE B., MBARGA N., AKAGOU ZEDON H.C., FONKOUA C., ESSOMBA E.R., NKOUNA ABIA C.

Results indicated that about 90% of trees have been harvested using irrational techniques (debarking from roots to the branches) and 25% of those trees died or were dying.

Data compiled from the 1995 inventories conducted in the Mount Cameroon showed that the summit of the curve of overall distribution by diameter class was at 40-50 cm diameter class (Sunderland and Nkefor 1996), while the 2008 inventory revealed that this summit was reduced to 20-30 cm diameter class (FAO/SNV/CIFOR/ICRAFT 2008) in the same area (Figure 3a and 3b), which is a reduction of two diameter classes. This means that, the populations of *Prunus africana* are continuously declining due to over harvesting and inadequate techniques practised. Mature trees have been destroyed following over exploitation with inadequate harvesting techniques such as debarking and total cutting.

Several threats can be observed for *Prunus africana* in Cameroon: habitat loss/degradation, inadequate techniques of harvesting, over harvesting.

Prunus bark exploitation started in 1972, and many trees around the Mt. Cameroon have been exploited several times with four-year intervals. Legally for all trees above 30 cm dbh, only two quarters of the bark are taken from the main stem up to the first branch. However, since 1985, many people were involved in the exploitation and the harvesting was done by untrained villagers. Many trees were debarked up to the smallest branches and others were felled with negative impact on the limited wild population of this tree species.

Forest clearance leading to population fragmentation, slash and burn cultivation, burning of the upper grassland, and commercial plantations are said to be also threats for *Prunus africana* (Ndam 1996).

Annual quotas proposed for the sustainable exploitation of *Prunus africana* in the Adamaoua province was 493 tons/year (Pouna Belinga 2001). These quotas are not currently applicable, due to over harvesting.

To promote the conservation of *Prunus* in the North west province, some initiatives (Birdlife project, and SNV) have assisted local people in the process of community forests. The problem is that, the harvesting campaigns were not monitored in good manner. Many of those community forests were totally debarked, before their simple management plans have been approved by the forest administration.

Although available data do not allow to establish the decline in extent area of occurrence, it is clear that *Prunus* population decreases over the time in Cameroon in term of tree density, declining in area of occupancy, decline in habitat quality, and decline due to actual level of exploitation. In Cameroon, *Prunus africana* can therefore be considered at least as **an endangered plant species according to population reduction as outlined in the IUCN check list for Non-Detriment Findings (IUCN 2001)**. This explains the ban recently pronounced by the European Commission on Cameroon's *Prunus*.

4.3. Management measures

4.3.1. Management history

4.3.1.1. The legal Framework

Some important official texts drawing the legal framework for the exploitation of *Prunus* are presented in table 5.

Table 5. Important official Texts

Reference number	Date of Signature	Observation
Decree No. 74/357	17 April 1974	(Sections: 74, 97, 98) to regulate the exploitation of medicinal plants. - a "factory (cahier d'entrée des produits à l'usine) to monitor the quantity of bark which enter the factory was made available.
Law No. 81-13	27 November 1981	To lay down Forest, Wildlife and Fisheries Regulations
Decree No. 83-69	12 April 1983	To lay down Forestry Regulations
Arreté No. 11/A/MINAGRI/DF/SEF	28 February 1991	To ban the exploitation of <i>Prunus</i> in Cameroon (except Plantecam)
Arreté No. 48/MINAGRI/DF	14 February 1992	To lift ban on the exploitation of <i>Prunus</i> exploitation
Decision No. 0045/D/MINEF/DF	11 January 1993	To ban felling in the exploitation of <i>Prunus</i>
Law No. 94/01	20 January 1994	To lay down Forestry, Wildlife and Fisheries Regulations
Decree No. 15/531/PM	23 August 1995	To lay down forestry Regulations
Decision No. 0336/D/MINFOF/DF	06 July 2006	To fix the list of special products of a "particular interest"

4.3.1.2. Procedure for the exploitation of *Prunus africana* according to the law No. 81-13 of 27 November 1981 (Former law)

Any person or Company interested in the exploitation of *Prunus* had to be holder of a special permit. They had to submit, and file an application to the Ministry in charge of Forest.

Attached documents

- 1) Stamped application specifying:
 - a. full name, nationality, occupation and place of residence (for individuals);
 - b. name, articles of Association, Head Office, Registered Capital and its distribution, and name of the Director or Manager (for companies).
- 2) The capita

- 3) Invested (Attestation):
- 4) The investment plan and the financing guarantee (means of transportation envisaged, existing storage facilities and other facilities to be set up. Measures taken to process part of the products locally).
- 5) List of species and quantities to be exploited as well as the location.
- 6) A statement of honour stipulating that the applicant has acknowledged the laid down regulations; that he undertakes to respect them and to co-operate with the forestry services.

In case of renewal of permit the attached documents are as follows:

4. A stamped application;
5. a copy of a former permit;
6. Receipts testifying the payment of the registration fee and the selling price of the product;
7. Copies of certificates of origin if the holder exports the product;
8. A detailed report of the activities of the previous season, specifying the quantities of products exported or produced locally.

The application was forwarded to the Minister in charge of forest (Ministry of Agriculture) with comments from the Provincial Chief of forestry (Conservator of Forests).

The special permit was issued by the Minister in charge of forest following recommendations of the technical commission.

Holders of special permit had to obtain from Forestry services specifications whose clauses indicate:

- the conditions of exploitation of the products;
- the conditions of transporting them;
- the terms and conditions of paying taxes.

The permit was notified by the Provincial chief of Forest (Conservator of Forest) following the presentation of a copy of the permit and the receipt of payment of taxes. (This was not however stated in the law).

4.3.1.3. Procedure for the exploitation of *Prunus* according to the current law (Republic of Cameroon 1994, 1995).

The procedure is almost the same with only two main changes:

1. The applicant must be granted approval first for forest exploitation activities;
2. The Provincial Chief of Forest must attach his technical report. This technical report specifies the species to be exploited, their quantities as well as the area and the harvesting modalities.

According to Ndibi (1996), three main causes explained the irrational exploitation of *Prunus africana* in the Mount Cameroon.

4.3.2. Management plan

If the Cameroon policy is sufficiently well defined for what concerns timber, wildlife and more recently community forestry, the policy concerning Non timber forest products (NTFPs) remains globally vague and lack of some precisions (Betti 2004).

Although the Cameroon Government has recognised the promotion of NTFPs as a means to alleviate poverty in rural areas and to generate revenue for the national economy, no adequate management regimes have been developed.

Cameroon Government distinguishes therefore two categories of Non timber forest products. The first group is composed of non timber forest products that the Government does not require any taxes from the harvesters, and the second group is those products from which the Government perceives taxes from any person willing to harvest or commercialize them. *Prunus africana* belongs to the second group, also known as “special products”.

The exploitation of special products is regulated in Cameroon mainly by the forest administration, Ministry of Forest and Wildlife. Two main Directorates are concerned in this administration: the Directorate of forests is in charge of the management of the resource, while the Directorate of promotion and processing is concerned with the valorization of that resource. The Ministry of Economy and Finances ensures the collection of taxes and fees through the Forest Revenue Enhancement Program (FREP). The only tax fixed twilt date by the national financial law for the exploitation of special products is called the regeneration tax, which is 10 FCFA/kilogram of the product (1 euro = 650 FCFA), while the fee perceived is 5% of any product exported.

Prunus africana has been recognized as a “special product with particular interest”. The article n° 2 of the Decision n° 0336/D/MINFOF of the 06th July 2006 giving the list of “special products with a particular interest” states that, those are products that are relatively less abundant in the forest or for which some additional measures are indispensable, due to the threatening caused by the non sustainable harvesting methods used by harvesters. The quotas of “special products with particular interest” are granted by an inter-ministerial commission comprising representatives from the forest administration, environment, research, finance, and other administrations.

In addition, the forest administration has identified *Prunus africana* as one of the six most important NTFPs in Cameroon that needs to be promoted for socio-economic development.

Prior to 1987, Plantecam Medicam, as it was known then, operated within a strict monopoly in the exploitation of *Prunus africana* in Cameroon. They set and adhered to strict harvesting guidelines such as no felling and no girdling but only the stripping of opposite quarters of the tree to allow for bark regeneration. Thereafter, a breakdown in this monopoly came with the issuance of licenses to a number of companies and individuals. This led to a dramatic increase in field operatives working in an area with corresponding increase in unsustainable practices, notably the felling of trees, total bark removal and non-respect for quotas set.

The lesson to be learnt here may be that increasing commercial competition without putting in place adequate management regimes, based on sound inventory data may probably lead to a corresponding increase in the amount and intensity of bark exploited. Therefore, the issuance of permits is not necessarily a guarantee of sustainability, especially when permits are issued with no harvesting controls being implemented (Sunderland and Tako, 1999 cit. Tieguhong & Ndoye 2004).

4.3.3. Restoration alleviation measures

4.3.3.1. Evolution in the alleviation measures on *Prunus*

Moreover, the forest administration has often shown a great concern for the sustainable exploitation of *Prunus africana*. This concern could be well illustrated by the frequency of the regulation changes since 1972, suggesting that the administration is in permanent searching for the best way to manage the resources.

These changes and measures include among others: the conception of a field book in 1986 (Ndibi 1996), and recently in 2007 (Akagou 2008, Betti 2007). This field book enables the forestry services to monitor the exploitation weekly.

The partial ban of *Prunus* exploitation of 1991 which was lifted in 1992, the ban of felling decided in 1993, and the reduction of quotas in 2008 following the ban on the importation of Cameroon's *Prunus* in the Europe, after the decision undertaken by the European commission in October 2007.

But, even when the regulations were quite good, they were unfortunately insufficiently implemented, or not at all. Most often, the measures were prescribed only in the face of a tragedy such as the recent destruction of *Prunus* in Mount Cameroon and North west, when the tendency was to consider only the immediate causes, forgetting the root of the problem. For example, despite the official ban in 1991, a greater quantity (3900 tons) of *Prunus africana* was harvested and exported between 1991 and 1992 than in any preceding year, indicating the lack of law enforcement and a high level of corruption in the production zone (Cunningham, 1997 cit. Tieguhong & Ndoye 2004).

Concerns on the future of *Prunus africana* led to its listing in Appendix II of the Convention on International Trade in Endangered Species of wild Fauna and Flora (CITES) in 1994, becoming effective in 1995 (Sunderland and Tako, 1999 cit. Tieguhong & Ndoye 2004). The impact of listing *Prunus africana* by CITES has been partially effective in reducing threats because it has helped to raise awareness about the problems posed by international trade. Several nongovernmental, governmental and international bodies were involved in programmes to promote sustainable management of wild populations, cultivation and monitoring of the trade. For example, for some years the Mount Cameroon Project has been working with villagers to promote the sustainable management of *Prunus* South west provinces. Villagers were involved in monitoring the forest to guard against *Prunus* poachers and to help ensure, in the event of legal harvest, that only a part of the bark is removed (Ndam, 2004 cit. Tieguhong & Ndoye 2004).

Same initiatives were conducted in the North west province by the Birdlife International. Birdlife initiated two main projects in the North west province. The first project led from 1987 to 1992 and covered 10 000 ha in the Bui division, while the second project led from 1992 to 2004 and covered the same area in the Boyo division. The project aimed to protect the mountain forests as the principal habitat of two birds, endemic and threatened in the Mount-Cameroon: Banded-water eye and Banama Touraco. For this, the project focused its activities on the conservation of *Prunus africana*, important plant species for local people and for the two birds. The project adopted two main approaches: delimitating the perimeter of the 20 000 ha of the forest covering the two divisions by a *Prunus* hedge and promoting the rural forestry.

Prunus africana was planted together with *Podocarpus sp*, another useful plant species for local people, along the perimeter of the forest using a distance of 5 m within the trees.

The strategy of the rural forestry consisted of encouraging villagers in the domestication and development of *Prunus* plantations in their own forests. For that, the project confectioned nurseries from seeds, and distributed seedlings or small plants of 8 months (high to 50 cm) to villagers. To encourage villagers to plant and conserve their *Prunus* against the bush fires and against cheeps (cheeps appreciate to eat seedlings and young *Prunus*), the project provided incentives to those of the villagers who presented good results. The incentives were as follow: 25 FCFA/plant at the end of the first year, 15 FCFA/plant at the end of the second year, 10 FCFA/plant at the end of the third year, and 5 FCFA/plant at the end of the fourth year. The idea here was to allow the young plants to attend a certain age and high as to be able to resist to the concurrence of undesired plant species. The dead plants were not paid.

So, the villagers built fences to protect their plantations against bushfire, identified as one of the main threat on *Prunus* in those humid savannas.

Birdlife project also trained local people on the suitable techniques of harvesting of the barks of *Prunus*, such as: harvesting trees of at least 17 years old, move the ½ opposite side, and return 4 – 6 years later to move the remaining sides on the same trees. According to Mr NKENGLA, the local divisional delegate of forest and wildlife for the Bui division who has been working for the Birdlife project for a long time, research activities conducted within the Birdlife project revealed that the length of the rotation varies with the zone (division). Hence, in the Boyo division where the weather is too hot, results obtained tend to show that the harvester can return to the same tree after 4-5 years, while in the Bui division where it is too cold, this harvester must wait 5-6 years before returning back to the same tree. At 15 -17 years old without any fertilizer, *Prunus* can reach a diameter of 30-35 cm at high breast.

The problem is that, the villagers did not feel responsible for the development of those plantations. They did not wait until the plants get 17 years old as suggested before engaging in harvesting their *Prunus*. This exploitation started early by 1999 – 2000 (at 12-13 years old), so the product was not good in term of both quantity (volume of the barks) and quality (concentration on active compound). By 2002, so 15 years after the first plantations have been settled (1987), the forest administration who was working in partnership with the Birdlife project, initiated a circular letter asking to villagers to wait the control of the forest officers before harvesting their *Prunus* barks. The terms used in this letter were not appreciated by the villagers, who thought that the forest administration was trying to have the total control of their plantations. Also, the problem of distinction between the conditions of harvesting domestic *Prunus* and wild *Prunus* was not clarified by the forest administration. According to the current forest legislation, products of domestic origin are not subject to the payment of the regeneration tax. This tax is only required for the wild *Prunus*. But the forest administration has never applied this in the field. As a consequence of all those problems, villagers started engaging negotiations with some companies to harvest their *Prunus* out of the control of the forest administration. Villagers sold their plantations to the companies who used easily to fell trees and move the maximum of barks. The price of tree varied from 4000 FCFA to 8000 FCFA, while that of the kilogram of the barks oscillated between 60 FCFA and 100 FCFA.

For the *Prunus* hedge strategy, the trees were destroyed more early, at 8-10 years old, than the rural forestry strategy. Villagers knew that the *Prunus* hedges did not belong to a specific person, but to the forest administration or to Birdlife. They therefore decided to destroyed those plantations and sell the products to companies, which illustrates once again the problem of lack of responsibility observed for those *Prunus*.

It is in such a situation that all the *Prunus africana* trees planted by the Birdlife project and villagers were destroyed in the North west province.

By 2000, when the planted trees were destroyed in the two former strategy, Birdlife profit of the clauses of the new forest law (Republic of Cameroon 1994, 1995) and the publication of the manual of procedures for community forests. The project therefore decided to experiment a third strategy, which was the community forestry. This strategy aimed to enhance the implication of villagers in the forest management, to enhance the appropriation of their plant trees, and to facilitate the transition between the project management phase and the local community management phase.

To make the villagers more responsible of their trees, Birdlife divided the 20 000 ha of the space in 17 community forests, with the *Prunus* exploitation being the main activity to conduct in those forests. As an international NGO, Birdlife made lobbying towards other NGOs and international organisms to ban the exploitation of *Prunus africana* barks in this forest. All was done well, as planned, since the forest administration did not allocated any

special permits for *Prunus* in this forest. Birdlife financed and assisted local communities in the development of the simple management plans of those community forests. The first management plans were developed in 2002, the last in 2003. The inventories conducted for drafting those plans were the multi-resource inventories types, consisting mainly of prospecting the forest. The beginning of the activity in the community forests is conditioned by the approbation of the simple management plan and the signature of the management convention by the forest administration. Birdlife incited the forest administration to quickly approve those management plans and sign the convention. But the condition made by the forest administration was that, Birdlife should assisted communities in the realization of a fair and rigorous systematic inventory (at 100%) in each forest, before the villagers begin to harvest. This was possible, since the Birdlife project was planned to end by 2008. The five-years management scheme drawn in each simple management plant was as follow:

- year 1 (2003): organization of the community;
- year 2 (2004): systematic inventory (100%) of the community forest;
- year 3 (2005): research of the market, waiting that the forest administration approves the inventory;
- year 4 (2006): beginning of the exploitation of *Prunus* barks in the forest;
- year 5 (2007): exploitation of *Prunus* barks continues.

The problem is that, in 2004, the Birdlife project was closed. The only project on which was built all the hopes of the local populations ended, before the villagers have realized the systematic inventories planned the same year (2004). Local people started therefore to harvest the *Prunus* in their community forests with irrational techniques. Villagers faced the lack of funds to realize the systematic inventories.

Some communities such as the Emfveh-mii Forest Management Common Initiative Group (EMIFOMA) were assisted by the local forest administration to conduct their systematic inventories and win their annual certificate of exploitation. But these inventories were not conducted in fair manner. It consisted mainly to "the research of the resource", than to a systematic inventory. Only trees with diameter ≥ 35 cm were counted. In spite of those weakness in the realization of the inventory, the forest administration delivered the annual certificate of exploitation to EMIFOMA. It is in such a way that, many community forests received their annual certificate of exploitation, which will be in the future detrimental to the conservation of the resource in the North west.

By 2005, some companies which exploit special products were informed by the departure of the Birdlife project. They also were informed by the existence in the area, of many community forests which were under management convention with the Government. And the companies were informed of the detention by those communities, with the annual certificate of exploitation. The companies therefore made pressure to the forest administration, to obtain to exploit *Prunus* barks in these zones. By February 2006, the forest administration signed four special permits to the following companies: CEXPRO, CATRACO, NNA & SONS, and FONGANG. Harvesting of *Prunus* barks began well, and the funds generated from the exploitation were used to develop community projects.

The problem is that, in two permits (FONGANG and NNA & SONS), the precision was not made to the target community forest. The forest administration has just put, the Kumbo forest, in the Bui division. This detail encouraged those companies to practice illegal harvesting, with some villagers. In fact, some villagers who were not satisfied with the way by which the funds raised towards the exploitation of the community forest, were used, used to return in the forest by night and move barks on the sides left by legal harvesters during the day. The poachers, used to sell their products to the two companies (FONGANG and NNA & SONS), which was detrimental to the conservation of *Prunus* in the North west province.

Also, legal permits holders used to stay far from the harvesting sites, often in the city of Kumbo. Some poachers used to come to Kumbo to sell their products to these permit holders. The permit holders were not often in the field to control and monitor the harvesting of barks. Due to the weakness observed in the realisation of the systematic inventories, many communities have finished all their *Prunus* potential before the term of the management plans in the North west province. The local forest services did not undertake any control.

The SNV Highlands in collaboration with the Western Highlands Nature Conservation Network (WHINCONET) examined the impact of the exploitation on *Prunus* trees (*Prunus* platform Meeting Report, Bastos Yaoundé, 16 January 2008). About 90% of trees have been harvested using irrational techniques (debarking from roots to the branches) and 25% of those trees died or were dying, which confirms what is saying here.

Following what precedes, it can be observed that both legal and illegal exploitation have led to the destruction of *Prunus* population in the North west province.

It was hoped that these and similar efforts made by both the Mount Cameroon project in the South province and the Birdlife project in the North west province, will suffice to ensure that future supplies of the bark are harvested in sustainable ways. But it was not the case, since these efforts stopped with the close of those projects.

Unsustainable harvesting of *Prunus* was also observed in the Adamaoua province where some sites hosting *Prunus* have been totally destroyed due to high poaching (Akagou & Betti 2007).

The lesson to be learnt here may be that inviting local communities to earn the community forests is not enough. The Government may explore associated measures to assist these communities in the development and implementation of those management plans.

4.3.3.2. Simulation of sustainable yield of *Prunus africana*

Simulation of sustainable yield of *Prunus africana* was proposed for the Thabal Mbabo and Tchabal Gang Daba in the Adamaoua province (Pouna & Belinga 2001) and for Mount Cameroon in the South west province (Ewusi et al. 1996).

In the two provinces, a prediction of the sustainable yield of *Prunus* bark was made from estimates of the natural population, the average yield per tree and the length of time between successive debarkings required to allow total recovery of the bark.

In Mount Cameroon, quotas proposed are presented in table 6.

Table 6. Sustained Yield calculation in Mount Cameroon: most pessimistic and most optimistic estimates (Ewusi et al. 1996)

	(D) Population density (stems/ha)	(A) Area of exploitable forest (ha)	(H) Sustained yield per tree (kg)	® Rate of recovery (years)	(Ys) Sustained Yield (tons/year)
Lowest Estimate	3.5	12 000	55	7	330
Highest Estimate	7.2	18 000	137	4	4 438

Estimates from the results of inventory conducted in the Adamaoua province are presented in table 7.

Table 7. Sustained yield calculation in the Adamaoua province (Pouna & Belinga 2001)

	(N) Exploitable stems	(D) Population (stems/ha) density	(H) Sustained yield per tree (kg)	® Rate of recovery (years)	(Ys) Sustained Yield (tons/year)
Tchabal Mbabo	833	8.22 (5.45 – 11.57)	55	10	493.6 (at the lowest estimate)
Tchabal Gang Daba	29	0.99 (0.41 – 1.57)	55	10	8.8 (at the lowest estimate)

For the both provinces, a wide range was extremely observed between the lowest estimate and the highest estimate, illustrating the lack of information on the size of the population (3.5-7.2 stems/ha in Mount Cameroon, 0.41-1.57 in Tchabal Gang Daba and 5.45-11 for Tchabal Mbabo), the sustained yield per tree and the rate of recovery of harvested trees. The calculation for Mt-Cameroon was based on inventory data from 1992, which have already been criticised (Cunningham and Mbenkum cit. Ewusi et al. 1996) for being biased towards the areas rich in *Prunus africana* thus giving over-estimates of the average population density over the licence area. Moreover, up to 50% have been reported to be dying or already dead, due to previous over-exploitation. Large scale felling by illegal exploiters has also taken place in extensive areas (Ewusi et al. 1996).

The Tchabal Gang Daba site has never been subject to any exploitation. Trees were not debarked. But the Tchabal Mbabo site has been subject to large and irrational exploitation. Poachers attacked trees (23.67%) with diameter less than the minimum exploitable diameter (MED) fixed by the forest administration and which is 30 cm. Further, 11.3% of trees were fell or totally debarked twilt branches (Pouna & Belinga 2001).

4.3.3.3. Comparison of harvests with estimates of sustainable yield in Mount Cameroon

1970s to 1994

During this period exploitation was done by Plantecam employees from the west province, and the quantity granted in their exploitation licence was 6 500 tons over a period of five years (1 300 tons/year). This quota was initially given for three provinces including South west, North west, and West. But at subsequent renewal, this same quota has been maintained for much restricted zone of Mt-Cameroon. Available data from Plantecam records indicated that they have been exploiting below this figure. The estimated yields for ten year period are 4.478 tons, or 448 tons per annum (Ewusi et al. 1996).

1994-1996

Since June 1994, a major outbreak of illegal exploitation has considerably increased the offtake of bark of *Prunus* from Mt-Cameroon. From their figures, during the period 1 January 1994 to 30 June 1995, Plantecam harvested 1 388 tons of bark. This corresponds to an annual harvest of 926 tons (Ewusi et al. 1996).

During almost the same period (June 1994 to December 1995), reports from viltages around Mt-Cameroon estimated a further 884 tons of bark exploited illegally. This corresponds to an annual harvest of 590 tons (Ewusi et al. 1996).

Thus over 1994 – 1995, total annual exploitation levels from Mt-Cameroon have increased to 1.516 tons per annum. This is more than three times higher than the previous exploitation

level of the previous ten years, and is much higher than the lower estimate of the sustained yield from Mt-Cameroon which was 330 tons/year.

Reports confirmed the fact that the natural population has suffered major damage from both legal and illegal exploitation (Ewusi et al. 1996), reducing the population from all previous inventory estimates by up to 50% in two years (1994 – 1995).

4.3.3.4. Synthesis and recent alleviation measures

Data discussed in the precedent section tend to show that, the exploitation of *Prunus africana* has never been conducted in sustainable manner in Cameroon, in spite of the effort made by the forest administration.

The development of simple development plans for the sustainable harvesting and trade of *Prunus* and other special products remains the gap and the challenge for the Cameroon Government.

Since 2007, the forest administration took some important measures to alleviate poaching in the exploitation of *Prunus africana*. These measures include: the restoration of the field book for the companies and harvesters, the instauration of specific way bills for the circulation of Special products, the erection of an important part of the Mount Cameroon in national park, and the reduction of quotas granted for *Prunus*.

CHAPTER 5. SUSTAINABLE HARVESTING OF *PRUNUS AFRICANA* (ROSACEAE) IN THE NORTH WEST REGION OF CAMEROON

Data discussed in this section were gathered within the current ANAFOR's project entitled "Non-detriment findings for *Prunus africana* (Hook.f.) Kalman in Cameroon". Results presented are coming from studies related to (ii) mapping, delimitation of *Prunus* Allocation Units (PAUs), estimation of abundance/density of *Prunus* as well as scientifically calculated sustainable harvest quota (Belinga 2010, Samba 2010).

5.1. The North west region

The North West region of Cameroon is located between 5°4' and 7°15' latitude North and 9°30' and 11°15' longitude East. It covers a total area of 17 910 km². The North west region is composed of 7 divisions including: Mezam (Bamenda being the capital), Boyo (Fundong), Bui (Kumbo), Ngoketunja (Ndop), Donga Mantung (Nkambé), Menchum (Wum), Momo (Mbengwi).

The *Prunus* inventory was conducted mainly in the Mount Oku for what concerns natural forests and in the surroundings divisions for what concerns the plantations (domestic *Prunus*).

The mount Oku covers two divisions in the North west region: the Boyo and the Bui divisions to be précised. The side located in the Boyo division is called "mount Ijim" and the one located in the Bui division is called "mount Kilum".

Domestic *Prunus* was assessed in both farms and home gardens found in the subdivisions of Fundong, Belo and Djinikom in the division of Boyo, the subdivisions of Elak Oku, Kumbo and Jakiri in the division of Bui, and in the division of Donga Mantum.

As it can be observed, assessment of both wild and domestic *Prunus* was carried out in the Mount Oku and its periphery.

5.2. The Mount Oku area

Mount Oku is up to 3011 m and belongs to the Cameroonian mountains group (White 1983), closed to the Mount Cameroon (4095m), Bamboutos (2740 m), Manengoumba (2411 m), Koupé (2064 m), and Tchabal Mbabo. The area is composed of a variety of landscapes including small and high mountains with high slopes and valleys. The lowest altitude is about 1169 m towards Babungo. Mount Oku is an inactive volcanic mount and comprises three types of soils: volcanic soils which are black and suitable for agriculture in spite of their low capacity of water retention due to their permeability (porosity), iron and granitic soils which are red and less fertile for agriculture in the Donga Mantung division, and hydromorphic soils found in the flat landscapes of Ndop, Jakiri, Mbaw and Babungo.

The position of the region in the tropical area implies a humid and warm climate, which is however transformed to a temperate and warm climate on the mountains. The Oku region is characterized by two distinctive seasons including the dried season with humid and dried winds which lasts from mid-November to mid-march, and the rainy season going from mid-March to mid-November. The annual rains is about 2000 mm, July and August being the most rainy months. In low levels, the most high temperature is 23°C. Temperatures are low in high levels. December and January are the two months where temperatures are too low. The water network is less dense, composed mainly of small rivers which bear in rocks in mountains and which become bigger in valleys. This gives priority to the protection of those mountains for the regulation of the water regime. There also exists a volcanic lack on the summit of the mount Oku.

The Oku vegetation is a direct consequence of the climate, topography and human activities. Following vegetation types can be found: the humid and arbustive savannahs in high altitudes, the *Pennisetum purpurum* vegetation in valleys of low drainage, and the mountain forests which cover the mounts of Nkom, Wum, Kilum and Ijim.

Prunus africana is often found on slopes of the mount Oku, in association with many other plant species including: *Podocarpus milanjanus* (which abunds between 2700 - 3000 m), *Syzygium staudtii* (1800 - 3000 m), *Nuxia congensta* (1100 - 3100 m), *Rapanea melanophloeos* (1200 - 3100 m), and starting from 2800 m, *Adenocarpus mannii*, *Gnidia glauca*, *Impatiens sakerana*, *Hypericum revolutum*, *Crassocephalum mannii*, *Dipsacus narciseanus*, *Euphorbia schimperana*, *Discopodium penninervium*, *Mimulops solmsii*.

Due to high population density, the fauna of the Oku region is no longer rich. Most of large mammals have almost been extinct. Nevertheless, there exist some endemic and protected birds species such as *Touraco bannermani* and *Platysteira laticincta*. There also exist some rats and small monkeys in the mountain forests.

The populations of the Oku region are largely composed of « Grassfields » groups with the English as the principal language. The “Bororos” group also came from the North Cameroon for searching grasslands for their cows. The main ethnic groups include Bansa, Oku, and Kom. Other Cameroonian and Nigerian groups are also found in small quantities. According to the 1987 population statistics, the Oku region host a total number of 1,5 million of persons with a density of 25 inhabits/km². This population density is considered as one of the highest density in Cameroon, it is thrice more high than the national average density. More than 75% of that population leaves in rural areas.

The mount Oku is surrounding with many villages as shown in figure 3.

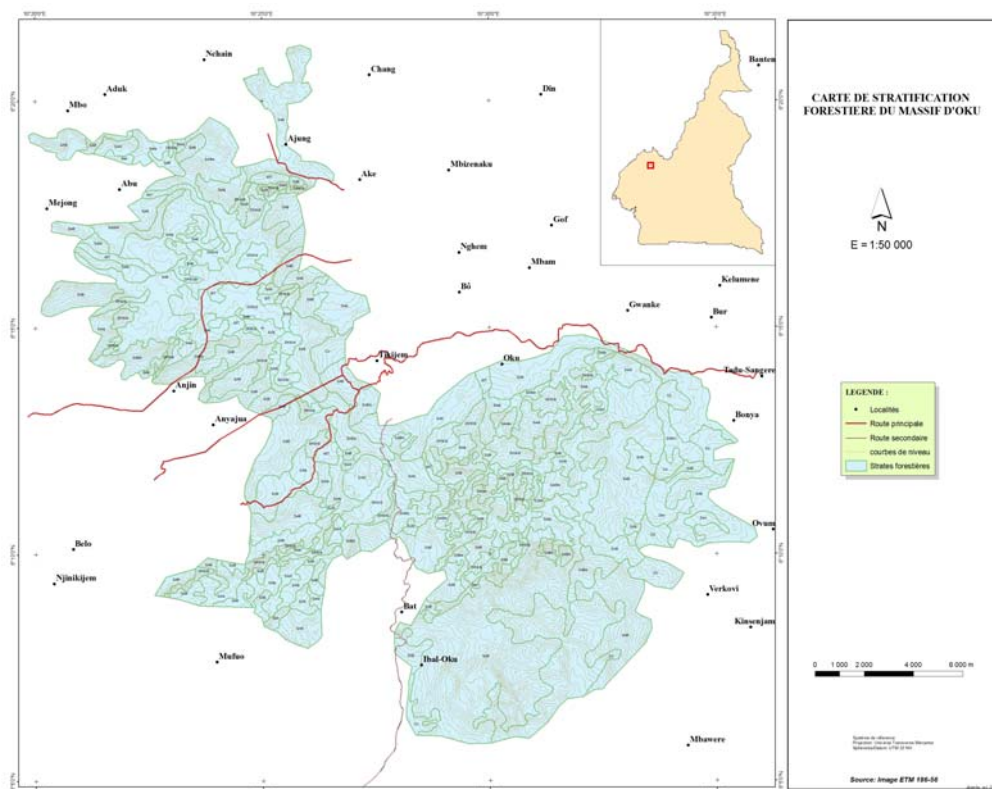


Figure 3 : Villages located around the mount Oku

The Oku peoples practise mainly agriculture. The main crops are maize, bean, cassava, cocoyams, plantain, banana, sugar cane, legumes composed mainly of Bitter leaf and Njamajama. Domestic animals are composed of cows, cheeps, porcs, and chicken.

The summit of the mount Oku is subjected to bush fires, used by “Bororos” or Foulani farmers for grazing. The Foulanic farmers are nomadic. There exists many conflicts for lands between farmers. Bush fires constitute one of the main threat for *Prunus africana* in the Northwest region.

As outlined before, the mount Oku covers two divisions in the North west region: the Boyo and the Bui divisions to be précised. The side located in the Boyo division is called “mount Ijim” and the one located in the Bui division is called “mount Kilum”.

This mountain hosts the unique natural forest which surrounds the volcanic lack of Oku or the “Oku lack”. To protect this forest which constitutes the scarce habitat of the two endemic and endangered bird species *Touraco bannermani* and *Platysteira laticincta*, one project entitled “the Kilum Ijim project” was launched with the financial support of the BirdLife International in 1993. To imply local people to the conservation of the forest resources and to the maintenance of the water regime which bears from the mountains, the “Kilum Ijim project” assisted local populations in the acquisition of community forests. The project also proposed the erection of one important part of the forest in a protected area, the flora sanctuary of Kilum Ijim to be précised. A total number of seventeen (17) community forests were created with the *Prunus* exploitation being the main goal. The simple management plans of all the 17 forests were developed. The problem is that, those simple management plans were developed without suitable *Prunus* inventories.

Table 1 presents the 17 community forests with their surface area

Table 1 : Community and non community forests of the Mont Oku

Forest	Surface area (ha)
Abuh	354
Afua-Dichami	1121
Ajung	630
Akah	294
Anyajua	1034
Bikhov	357
Emfehv Mii	1377
Ijim	468
Kedjem Mawes	1717
Laikom	651
Mbai	122
Mboh Mboleng Ilung	475
Muteff	595
Nchily	435
Njuambum	350
Upper Shinga	1556
Yang Tinifoin Bimulo	431

Forest	Surface area (ha)
Kilum Ijim	1081
Area out of the community forests	18585

5.3. Material and methods

Prunus inventories were carried out in both natural forests and plantations.

5.3.1. Method used in natural forests

The natural forest inventory covered 17 community forests, the Kilum Ijim flora sanctuary, and the national domain area not allocated to communities (zone out of community forests).

The method used is called “Adaptive Clusters Sampling (ACS)” method. This method has its basis in the known classical forest inventory method often used in dense forests. In Cameroon, the classical/traditional forest inventory method is standardised for management inventories (see arête n° 222).

5.3.1.1. Description of the classical method

5.3.1.1.1. Mapping

Materials used for mapping are composed of: GPS Garmin C76 x, topographic map of the Nkambe at 1/200 000 produced by the National Institute for mapping (INC), the forest photo interpretation book produced by the former National Forest development Office (ONADEF 2007), aerial photos at 1/20 000 dating from 1983 to 1987 (6/21 km² are analysed) obtained from the CETELCAF, aerial photos at 1/50 000 dating from 1949 to 1970 (21/28 km²) acquired from INC, one Landsat image of 2007 with 30 m of the resolution (15 m panchromatic), the report of *Prunus* inventory produced by CIFOR in 2007. The GIS used was composed of the ERDAS IMAGINE 9.3 ARCGIS 9.3 computer packages.

The method use is: photo-interpretation by stereoscopy, supervised classification of the satellite image in view to update the strata shown by the forest map, the classification of the Landsat image (supervised classification beginning from 7 multi-spectral lines), field visits for habitats description (Samba 2010).

5.3.1.1.2. Sampling device and intensity

According to the national standards, the sampling is systematic and stratified to 1 degree when the statistical unit is the plot. The samples or plots of 0,5 ha (250 m long x 200 m large) are distributed systematically throughout the entire population and not by stratum (Forest type). The stratification is done definitively after the sampling. The systematic disposal of plots allows to assume that the intensity of sampling for each stratum is proportional to its area in the forest. Results of the inventory and their accuracy are calculated for each stratum.

In practice, sampling is carried along straight and continuous axes called “layons” or lines or transects. These “layons” are oriented along a predetermined magnetic direction but are systematically arranged in such a way that they are mostly parallel, equidistant and perpendicular to the general direction of both drainage and slopes.

Rectangular plots arranged along a “layon” are contiguous (without alley or corridor of separation) and measure 250 m in the direction of the “layon” (length) and 20 m in the direction perpendicular to the “layon” (width). This gives a surface area of 0.5 ha for each

plot. For the ACS method, additional circular plots of same area (0,5 ha) will be added in respect of the conditions that will be clarified later.

The formula which allows to calculate the distance or interval between two “layons” is as follows:

$$\text{interval} = \frac{\text{Net Area to probe or to survey (ha)} \times 20 \text{ m}}{\text{Area actually probed (ha)}}$$

The sampling intensity is the ratio between the area surveyed and the total area of the CU. It must provide for the parameters studied, values which are representative of the general population and this, according to precisions criteria set in advance. But this precision of the results obtained with a given sampling intensity depends on the variability of the parameter measured in this population. Fixing in advance the desired precision, one must have some idea of this variability as to calculate the number of samples which will be collected (chosen). The surveys conducted so far in Mount Oku and using the technique presented here have estimated the number of sample plots required to achieve the required accuracy. Based on the national standards, the following sampling intensity were retained: community forests (3%), the flora sanctuary of Kilum and Ijim (3%), and the area of non permanent forest domain not allocated as community forest (0,5%). The low sampling intensity in the area out of the community forests was guided by the fact that, that forest has suffered from over exploitation of its *Prunus*, therefore, the density of *Prunus* will be low compared to community forests where there were some control measures (Akagou 2010).

Table 2 shows the detail sampling design per forest.

Table 2 : Detail sampling design/device (Samba 2010)

Forest	Total surface area	Sampling rate	Surface area to be really inventoried	Number of plots	Length of lines (m)	Distance between two consecutive lines (m)
Abuh	354	3%	11	21	5310	667
Afua-Dichami	1121	3%	34	67	16815	667
Ajung	630	3%	19	38	9450	667
Akah	294	3%	9	18	4410	667
Anyajua	1034	3%	31	62	15510	667
Bikhov	357	3%	11	21	5355	667
Emfehv Mii	1377	3%	41	83	20655	667
Ijim	468	3%	14	28	7020	667
Kedjem Mawes	1717	3%	52	103	25755	667
Laikom	651	3%	20	39	9765	667
Mbai	122	3%	4	7	1830	667
Mboh Mboleng Ilung	475	3%	14	29	7125	667
Muteff	595	3%	18	36	8925	667
Nchily	435	3%	13	26	6525	667
Njuambum	350	3%	11	21	5250	667
Upper Shinga	1556	3%	47	93	23340	667

Forest	Total surface area	Sampling rate	Surface area to be really inventoried	Number of plots	Length of lines (m)	Distance between two consecutive lines (m)
Yang Tinifoin Bimulo	431	3%	13	26	6465	667
Kilum Ijim	1081	3%	32	65	16215	667
Area out of the community forests	18585	0.50%	93	186	46463	4000

The sampling device is also illustrated in figure 4.

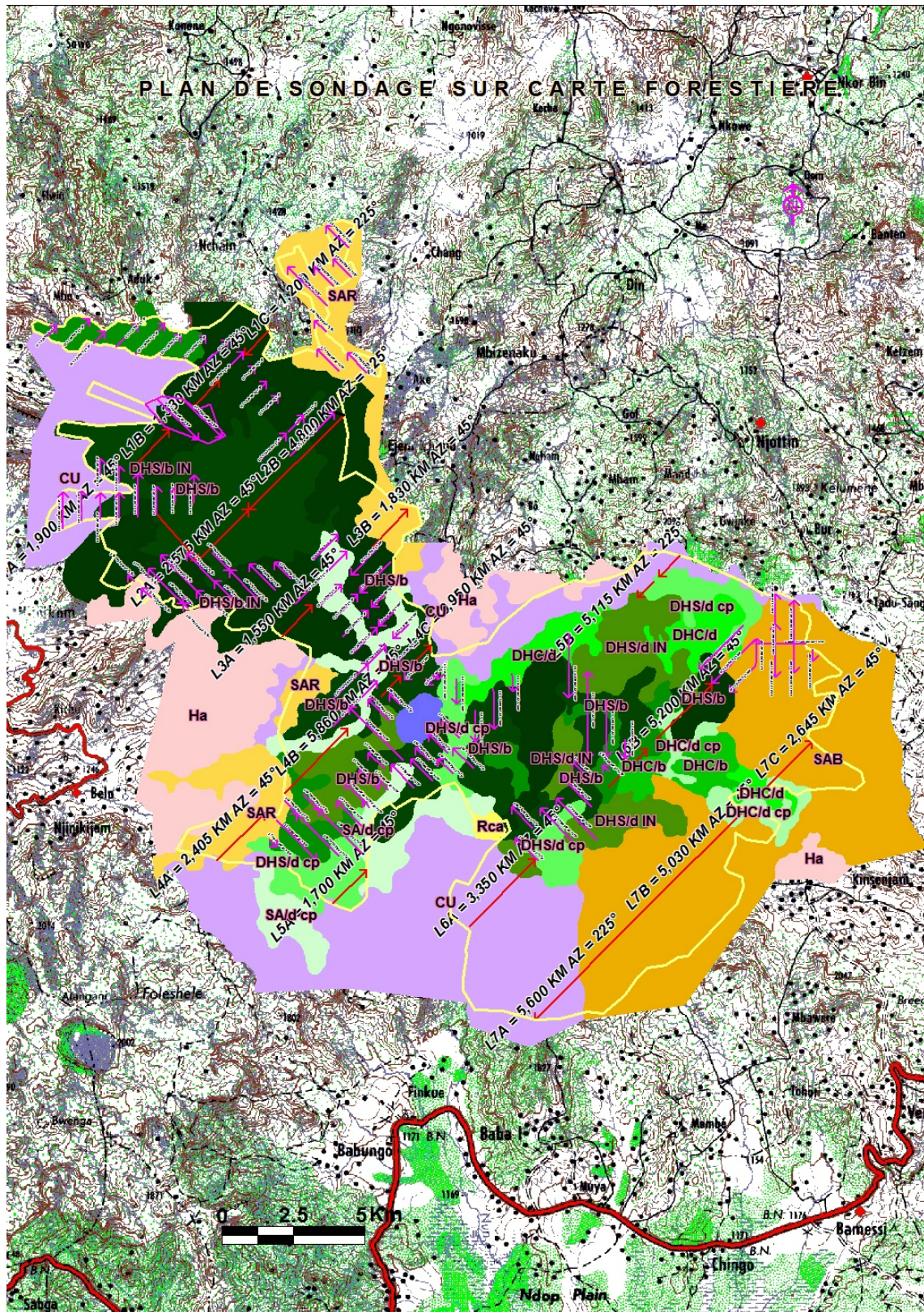


Figure 4 : Map of sampling design for *Prunus* inventory on the Mount Oku.

Setting export quotas of *Prunus africana* for the North west region of Cameroon: Report prepared by AMOUGOU AKOA, BETTI J.-L., EWUSI NJOMBE B., MBARGA N., AKAGOU ZEDON H.C., FONKOUA C., ESSOMBA E.R., NKOUNA ABIA C.

5.3.1.1.3. Implementing the sampling device

The survey or prospection consists of two stages : “layons” or line opening/transect cutting and counting (Belinga 2010).

a) Line opening/transect cutting

This step consists of opening or cutting according to a defined magnetic direction, corridors or alleys of 1.5 m wide. These corridors are clearly cleaned by cutting shrubs, vines and branches that obstruct the passage. They are then identified by marks. “Layons” constitute the reference system which will be used by the subsequent counting team. It is during the “layons” opening that details on topography, habitat types, rivers and the corrected horizontal distance of the “layon” (after reading the slopes) are given. It is also during this stage that the sample plots are identified and numbered. The data collected are recorded on specific file.

b) Counting

The counting step includes all operations relating to dendrological and dendrometric records. During the counting in rectangular and circular plots, several operations are made including: identification of stems of *Prunus africana*, the measurement of stems with diameter at breast height (dbh = 1.50 m) \geq 5 cm, appreciation of the health state of the tree in three classes (dead trees, damaged trees, and living trees). The appreciation of the health of the tree is mainly based on the health of the leaves and number of dried branches. Lines and plots are identified and numbered with their geographical coordinates and altitudes.

5.3.1.2. Theoretical basis of the “Adaptive Clusters Sampling (ACS)” method

The ACS method is advised to capture the *Prunus* clustering characteristics.

Considering y (total number of stems for example), the value of the parameter in the sampling unit (plot) of the traditional method, and C the condition (a limit number of stems for example) required to initiate an adaptive sampling. If $y > C$ in the indicated plot, additional circular plots are established in its periphery. If other units (circular plots) of the periphery have their $y > C$, then the process continues till obtaining a network of circular plots. The process stops when the condition can no longer be verified ($y < C$). If many units satisfy the conditions, then the sample will have many units in the entire population. The ACS sampling device is illustrated in figure 5.

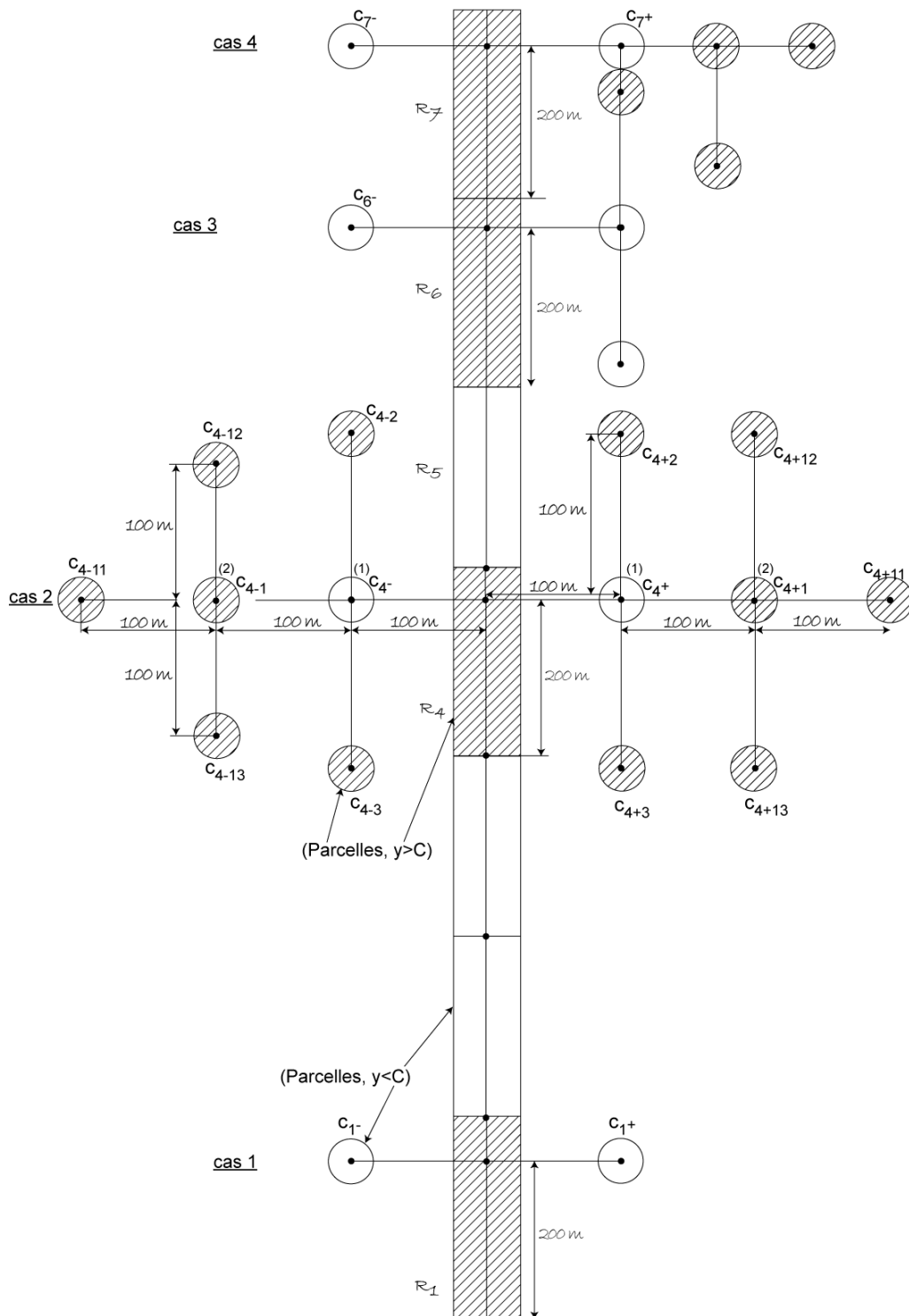


Figure 5: sampling device of the ACS method

The ACS method has many advantages: it allows to have a good idea on the distribution of *Prunus* clusters, it provides many data, and good precisions, it is almost similar to a systematic or total inventory mostly when the sample becomes too large, it is more efficient on statistical basis compared to the traditional method (Fiona & al. 2000). The problem with the ACS method is that it is difficult to determine in advance the sampling intensity, and also that method requires many efforts and funds.

For the inventory carried out in the mount Oku, all the area was assessed following the traditional inventory approach. Data analysis led to fix the condition C at 3 stems. This means that, all plots with $C \geq 3$ stems were subjected to ACS method. It is in such way that ACS method was applied in 9 community forests and 2 lines in the area out of the community forests (not allocated).

5.3.2. Method used for domesticated *Prunus*

The method used for domesticated *Prunus* consisted of recording all *Prunus* plantations found around the mount Oku where the *Prunus* sylviculture has been largely promoted and encouraged by the "Kilum Ijim project". This survey was conducted among the local forest services, the community forest managers, and the farmers. Field visits were also conducted in some plantations. Measurement of diameters of stems at high breast were conducted and data were recorded on the age of the plantation and the health state of the trees as described above.

5.3.3. Simulation of sustainable yield of *Prunus africana*

As for the Adamaoua (Pouna & Belinga 2001) and South west (Ewusi et al. 1996) regions, a prediction of the sustainable yield of *Prunus* bark was made from estimates of the natural population, the average yield per tree and the length of time between successive debarkings required to allow total recovery of the bark (Ondigui 2001).

$$Y_s = (D \times A \times H)/R.$$

Y_s = sustainable yield of bark per annum for the area;

D = population density of exploitation trees (stems/ha);

A = area of exploitable forest containing *Prunus*;

H = average sustainable yield of bark per tree (kg freshweight/tree/harvest) = 55 kg/tree;

R = rate of total recovery of the bark (in years).

5.4. Results

5.4.1. Natural forests

5.4.1.1. Real sampling intensity

The mount Oku forest concerned in present work is about 31 635 ha. A total of 330 ha out of that surface area was totally covered by forest inventories. The average sampling intensity is 2.54% (table 4).

Table 4. Sampling intensity and number of plots per forest (Belinga 2010)

Order n°	Forest	Total surface area (ha)	Proposed or previous sampling rate (%)	Realised sampling rate (%)	Number of rectangular plots	Real surface area surveyed (ha)	ACS plots
1	YANG TINIIFOIN BIMULO	431	3	3.25	28	14	
2	AFUA - DICHANI	1121	3	1.20	27	13.5	
3	MUTEF	595	3	1.85	22	11	
4	ANYAJUA	1034	3	2.81	58	29	
5	IJIM	468	3	4.06	32	19	6
6	ABUH	354	3	2.12	15	7.5	
7	LAIKOM	651	3	2.99	39	19.5	
8	AJUNG	630	3	2.54	32	16	
9	NCHILY	435	3	4.13	24	18	12
10	MBAI	122	3	1.64	4	2	
11	MBOH MBOLENG ILUNG	475	3	2.52	24	12	
12	UPPER SHINGA	1556	3	1.86	52	29	6
13	BIKHOV	357	3	4.76	22	17	12
14	NJUAMBUM	350	3	2.71	19	9.5	
15	KEDJEM MAWES	1717	3	1.72	53	29.5	6
16	KILUM IJIM	1081	3	1.20	26	13	
17	AKEH	294	3	5.27	19	15.5	10
18	EMFVEMI	1377	3	1.49	39	20.5	2
19	AREA OUT OF THE COMMUNITY FORESTS	18585	0.5	0.19	69	34.5	3
	AVERAGE			2.54			
	TOTAL	31635				330	

5.4.1.2. Density of *Prunus* stems

5.4.1.2.1. Living trees

In this work, living trees are those which are looking well, without dried branches. A total of 1 357 living trees of *Prunus africana* were recorded in the field. (table 5).

Table 5. Distribution of Living *Prunus* stems in different diameter classes;

Forest	Diameter classes (cm)											Total	
	C<10	C10-20	C20-30	C30-40	C40-50	C50-60	C60-70	C70-80	C80-90	C90-100	C100-110		C110-120
ABUH													0
AFUA-DICHAMI	3	7											10
AJUNG					2								2
AKEH	23	39	6	2									70
ANYAJUA	26	69	17	2	3								117
BIKHOV	11	23	2										36
EMFVEMI	110	54	65	25	21	9	4	1	1	1			291
IJIM	7	21	23	10	1	6	4	1		1			74
KEDJEM MAWES	67	69	67	36	18	4	6	4	2		2		275
KILUM-IJIM		28	14	3	1	1	2	1				1	51
LAIKOM	28	46	13	1									88
MBAI	2												2
MBOH MBOLENG ILUNG	6	2	2										10
MUTEFF	15	35	24	5									79
NCHILY	24	38	2	2									66
NJUAMBUM	0												0
UPPER SHINGA	6	34	16	3	1	1	1	1				1	64
YANG TINIIFOIN BIMULO	11	43	20	4									78
AREA OUT OF THE COMMUNITY FORESTS	25	18	1										44
TOTAL	364	526	272	93	47	21	17	8	3	2	2	2	1357

Table 6 shows the distribution of the density of living stems in different diameter classes. The minimum exploitable diameter applied for *Prunus* in Cameroon is 30 cm. The average density obtained from the 18 forests is 3.84 living stems/ha. The average density of exploitable living stems is 0.5 stems/ha. Inventories carried out with the traditional method in mount Cameroon proposed a density of 3.5 stems/ha (Ewusi et al. 1996). Those carried out in the same region with the ACS method proposed a density of 3.52 stems/ha (Ingram et al. 2009). Inventories carried out in Tchabal Mbabo found a density of 8.22 stems/ha.

Emfvemi (14.20 stems/ha), Kedjem mawes (9.32), Mutef (7.18), Yang (5.57), Akeh (4.52), Laikom (4.51) and Anyajua (4.03) are in this order, the seventh forests where the density of *Prunus* is high. But Emfvemi (3.02 stems/ha), Kedjem mawes (2.44), and Ijim (1.21) are forests which have high densities of exploitable or mature *Prunus* trees.

Table 6. Distribution of density of Living *Prunus* stems in different diameter classes;

Forest	C<10	C10-20	C20-30	C30-40	C40-50	C50-60	C60-70	C70-80	C80-90	C90-100	C100-110	C110-120	Total	Density_stems < MED	Density_stems >= MED
ABUH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AFUA-DICHAMI	0.22	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.74	0.74	0.00
AJUNG	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.13
AKEH	1.48	2.52	0.39	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.52	4.39	0.13
ANYAJUA	0.90	2.38	0.59	0.07	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.03	3.86	0.17
BIKHOV	0.65	1.35	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.12	2.12	0.00
EMFVEMI	5.37	2.63	3.17	1.22	1.02	0.44	0.20	0.05	0.05	0.05	0.00	0.00	14.20	11.17	3.02
IJIM	0.37	1.11	1.21	0.53	0.05	0.32	0.21	0.05	0.00	0.05	0.00	0.00	3.89	2.68	1.21
KEDJEM MAWES	2.27	2.34	2.27	1.22	0.61	0.14	0.20	0.14	0.07	0.00	0.07	0.00	9.32	6.88	2.44
KILUM-IJIM	0.00	2.15	1.08	0.23	0.08	0.08	0.15	0.08	0.00	0.00	0.00	0.08	3.92	3.23	0.69
LAIKOM	1.44	2.36	0.67	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.51	4.46	0.05
MBAI	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00
MBOH MBOLENG ILUNG	0.50	0.17	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.83	0.00
MUTEFF	1.36	3.18	2.18	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.18	6.73	0.45
NCHILY	1.33	2.11	0.11	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.67	3.56	0.11
NJUAMBUM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UPPER SHINGA	0.21	1.17	0.55	0.10	0.03	0.03	0.03	0.03	0.00	0.00	0.00	0.03	2.21	1.93	0.28
YANG TINIIFOIN BIMULO	0.79	3.07	1.43	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.57	5.29	0.29
AREA OUT OF THE COMMUNITY FORESTS	0.72	0.52	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.28	1.28	0.00
AVERAGE													3.84	3.34	0.50

Figure 6 illustrates the specific curve of living *Prunus* stems in the natural forest of the mount Oku.. We are in front of a normal situation where young individuals abund. This shows that *Prunus africana* does not globally encounter problems of regeneration in the mount Oku region.

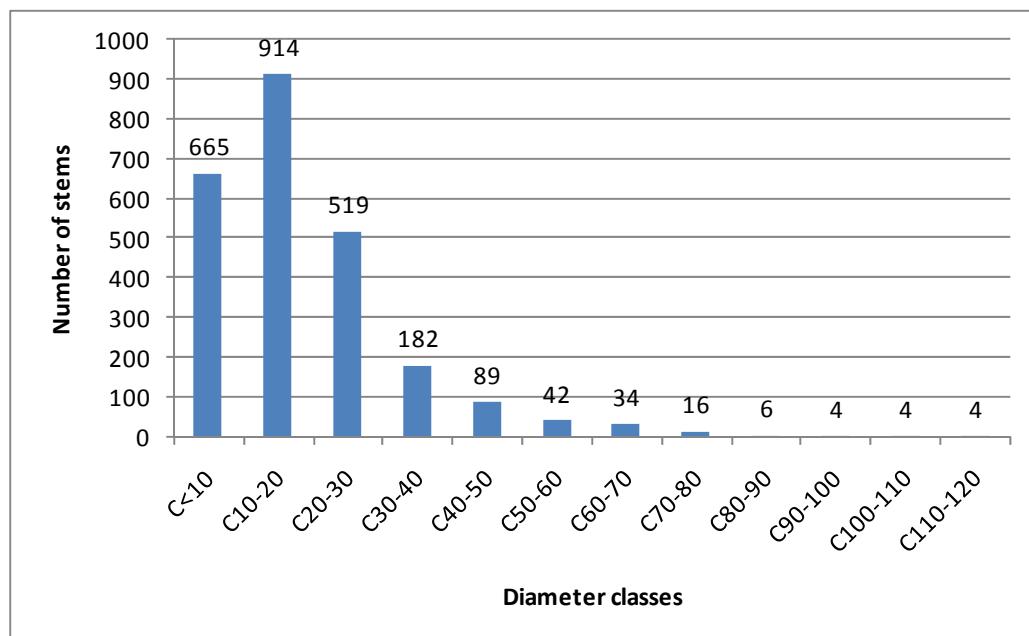


Figure 6. Distribution of living *Prunus* trees per diameter classes in the mount Oku region.

Specific curves of all the 18 forest are illustrated in appendix. Some forest can be considered as threatened regarding the lack of regeneration.

5.4.1.2.2. Dead and wilt trees

In this analysis, we group all stems described in the field as being wilt (with some branches dried) or died. The number of dead and wilt stems is presented in table 7 with their densities per forest. A total of 195 dead or wilt *Prunus* trees were recorded in the mount Oku. The average density of those trees is 0.5 stems/ha. The percentage of dead or wilt trees is $100 \times 195/1552 = 10\%$.

Table 7. Number of dead and wilt *Prunus* trees in the mount Oku region

Forest	Surface area surveyed (ha)	Number of stems	Density (Number of stem/ha)
ABUH	7,5	0	0
AFUA-DICHAMI	14	0	0
AJUNG	16	1	0.1
AKEH	16	6	0.4
ANYAJUA	29	11	0.4
BIKHOV	17	1	0.1
EMFVEMI	21	55	2.7

Forest	Surface area surveyed (ha)	Number of stems	Density (Number of stem/ha)
IJIM	19	0	0
KEDJEM MAWES	30	34	1.2
KILUM-IJIM	13	3	0.2
LAIKOM	20	16	0.8
MBAI	2	1	0.5
MBOH MBOLENG ILUNG	12	1	0.1
MUTEFF	11	15	1.4
NCHILY	18	11	0.6
NJUAMBUM	9,5	0	0
UPPER SHINGA	29	12	0.4
YANG TINIIFOIN BIMULO	14	9	0.6
AREA OUT OF THE COMMUNITY FORESTS	35	19	0.6
TOTAL	330	195	
AVERAGE	17	10	0.5

The distribution of dead or wilt trees per forest is illustrated in figure 7. Emfvemi (55 stems), Kedjem mawes (34), area not defined as community forest or area out of the community forests (19) Laikom (16) and Upper shinga (12) are in this order forests where the number of dead or wilt trees is high. The average number of dead or wilt trees per forest is 10. Many studies confirm that *Prunus* trees have been harvested using irrational techniques (debarking from roots to the branches) and 25% of those trees died or were dying (Akagou 2010, Ewusi et al. 1992, 1996, Tchouto 1996).

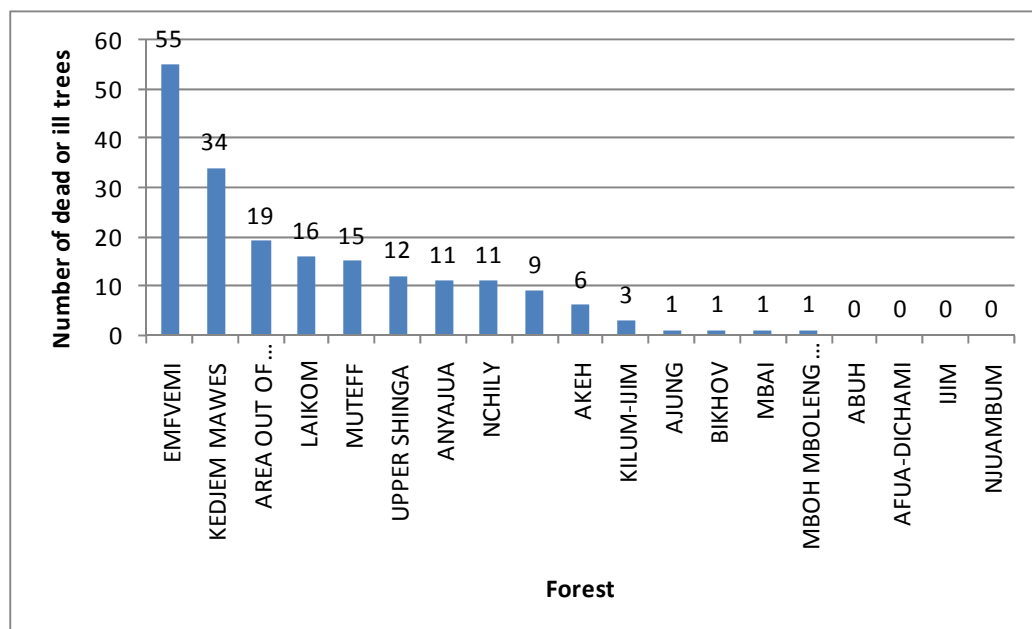


Figure 7: Distribution of dead or wilt trees in the sample surveyed in different forests.

5.4.1.3. Total number of stems

Estimation of number of stems at the scale of the all mount Oku forest is done in table 8. A total number of *Prunus* trees (living, wilt or dead) estimated for the whole Oku region is 107 009.72 trees. The number of living trees is 87 650.9 while that of the dead or wilt trees is 19 358.83. Among living trees, 76 780.67 have not yet attend the minimum exploitable diameter (MED) which is 30 cm. Only 10 870.22 trees representing 12.4% of the total living trees have reached the MED and can therefore be harvested.

If we consider wilt and dead *Prunus* trees as the bonus that should be harvested, then the total number of trees to be harvested in the mount Oku region is 30 229.05 trees.

For quota simulation and regarding the principle of conservation, all community forests where living trees with diameter \geq MED were not found can be excluded from all kind of *Prunus* exploitation now. Those forests include: Abuh, Afua – Dichami, Bikhov, Mbai, Mboh Mboleng and Njuambun. The area out of the community forests was not included in this list assuming that the forest administration will assist local people in harvesting the 10 235.44 wilt or dead *Prunus* trees found there as a tool for enhancing regeneration of the remaining *Prunus*.

The total number of *Prunus* trees retained therefore for the simulation of the sustainable yield or harvesting quota is 30 107.5 trees.

Table 8: total number of *Prunus* stems estimated in the mount Oku region

FOREST	Real surface area surveyed (ha)	Total surface area	Total number of living stems (LS)	Total number of dead and wilt stems (or the bonus)	Number of living stems < MED	Number of living stems \geq MED	Number of living stems > MED + Bonus	Number of stems retained for simulation of quotas (SRSQ)
ABUH	7.5	354.00	0.00	0.00	0.00	0.00	0.00	0.00
AFUA-DICHAMI	13.5	1121.04	830.40	0.00	830.40	0.00	0.00	0.00
AJUNG	16	629.80	78.73	39.36	0.00	78.73	118.09	118.09
AKEH	15.5	294.38	1329.45	113.95	1291.47	37.98	151.94	151.94
ANYAJUA	29	1033.60	4170.05	392.06	3991.84	178.21	570.26	570.26
BIKHOV	17	357.48	757.02	21.03	757.02	0.00	21.03	0.00
EMFVEMI	20.5	1377.29	19550.77	3695.16	15385.31	4165.46	7860.62	7860.62
IJIM	19	467.75	1821.75	0.00	1255.53	566.22	566.22	566.22
KEDJEM MAWES	29.5	1717.02	16006.13	1978.94	11815.43	4190.70	6169.63	6169.63
KILUM-IJIM	13	1080.75	4239.86	249.40	3491.65	748.21	997.61	997.61
LAIKOM	19.5	651.40	2939.64	534.48	2906.23	33.40	567.88	567.88
MBAI	2	121.83	121.83	60.91	121.83	0.00	60.91	0.00
MBOH MBOLENG ILUNG	12	475.29	396.08	39.61	396.08	0.00	39.61	0.00
MUTEFF	11	594.88	4272.32	811.20	4001.92	270.40	1081.60	1081.60
NCHILY	18	435.34	1596.24	266.04	1547.86	48.37	314.41	314.41
NJUAMBUM	9.5	350.05	0.00	0.00	0.00	0.00	0.00	0.00
UPPER SHINGA YANG TINIIFOIN BIMULO	29	1556.29	3434.58	643.98	3005.25	429.32	1073.30	1073.30
AREA OUT OF THE COMMUNITY FORESTS	14	431.30	2402.93	277.26	2279.71	123.23	400.49	400.49
TOTAL	330.00	31634.90	87650.89	19358.83	76780.67	10870.22	30229.05	30107.50

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5.4.1.4. Simulation of sustainable yield

In mount Oku region, research activities conducted within the Birdlife project revealed that the length of the rotation varies with the zone (division). Hence, in the Boyo division where the weather is too hot, results obtained tend to show that the harvester can return to the same tree after 4-5 years, while in the Bui division where it is too cold, this harvester must wait 5-6 years before returning back to the same tree.

Simulation of sustainable yield of *Prunus africana* in the mount Oku region will therefore be based on two figures according to the rate of recovery: lowest estimate will be calculated using the rate of recovery of 6 years, while the highest estimate will be calculated based on the rate of 5 years. The average medium of the two figures will be used to simulate the sustainable yield or annual yield of fresh bark.

The sustainable yield of fresh bark per annum for each forest will be = ((exploitable stems x average sustainable yield of bark per tree (= 55 kg))/ rate of total recovery of the bark (5 or 6 years)).

Table 9 shows the simulation of the sustainable yield of fresh bark per annum for each forest according to different level of estimates. From the table, it can established that the annual yield of fresh bark of the wild *Prunus* in the mount Oku region is 301 075.05kg/year or 301.075 tons/year.

Table 9: Simulation of the sustainable yield of fresh bark of *Prunus africana* per annum for each forest in the mount Oku region.

FOREST	Real surface area surveyed (ha)	Total surface area	Number of stems retained for simulation of quotas (SRSQ)	Annual Sustainable yield_lowest estimate (R = 6 years) (kg)	Annual Sustainable yield_Highest estimate (R = 5 years) (kg)	Annual Sustainable yield_medium estimate (R = 5.5 years) (kg)
ABUH	7.5	354.00	0.00	0.00	0.00	0.00
AFUA-DICHAMI	13.5	1121.04	0.00	0.00	0.00	0.00
AJUNG	16	629.80	118.09	1082.47	1298.97	1180.88
AKEH	15.5	294.38	151.94	1392.76	1671.31	1519.38
ANYAJUA	29	1033.60	570.26	5227.41	6272.89	5702.63
BIKHOV	17	357.48	0.00	0.00	0.00	0.00
EMFVEMI	20.5	1377.29	7860.62	72055.66	86466.79	78606.18
IJIM	19	467.75	566.22	5190.34	6228.40	5662.18
KEDJEM						
MAWES	29.5	1717.02	6169.63	56554.99	67865.98	61696.35
KILUM-IJIM*	13	1080.75	997.61	9144.79	10973.75	9976.14
LAIKOM	19.5	651.40	567.88	5205.61	6246.73	5678.85
MBAI	2	121.83	0.00	0.00	0.00	0.00
MBOH						
MBOLENG						
ILUNG	12	475.29	0.00	0.00	0.00	0.00
MUTEFF	11	594.88	1081.60	9914.67	11897.60	10816.00
NCHILY	18	435.34	314.41	2882.09	3458.51	3144.10
NJUAMBUM	9.5	350.05	0.00	0.00	0.00	0.00
UPPER SHINGA	29	1556.29	1073.30	9838.63	11806.35	10733.05
YANG TINIIFOIN						
BIMULO	14	431.30	400.49	3671.15	4405.38	4004.89

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FOREST	Real surface area surveyed (ha)	Total surface area	Number of stems retained for simulation of quotas (SRSQ)	Annual Sustainable yield_lowest estimate (R = 6 years) (kg)	Annual Sustainable yield_Highest estimate (R = 5 years) (kg)	Annual Sustainable yield_medium estimate (R = 5.5 years) (kg)
AREA OUT OF COMMUNITY FORESTS	34.5	18585.41	10235.44	93824.89	112589.87	102354.43
TOTAL	330	31634.90	30107.50	275985.46	331182.55	301075.05

5.4.1.5. Simulation of the annual quota

In Cameroon, *Prunus africana* is exported in two forms: the raw bark and the “powder”. Powder here is referred to the bark shavings or the grinded barks. Whatever be the form, *Prunus* is exported in dried matter. The driedweight of *Prunus* barks to be exported is = 50% of Freshweight.

Table 10 shows the simulation of the annual quota according to different level of estimates. From the table, it can established that the annual quota of wild *Prunus* in the mount Oku region is 150 137.52 kg/year or **150.14 tons/year**. This quota is considered as the medium, obtained from the lowest estimated with a rate of recovery of 6 years (137.99 tons/year) and the highest estimate with a rate of recovery of 5 years (165.591 tons/year). The area out of the community forests (51.17 tons/year), EMFVEMI (39.3), and KEDJEM MAWES (30.8) are forests which have the high quota of *Prunus africana*.

Table 10: Simulation of the annual quota for *Prunus africana* in the mount Oku region.

FOREST	Real surface area surveyed (ha)	Total surface area	Number of stems retained for simulation of quotas (SRSQ)	Annual Quota_lowest estimate (R = 6 years) (kg)	Annual Quota_Highest estimate (R = 5 years) (kg)	Annual Quota_medium estimate (R = 5.5 years) (kg)
ABUH	7.5	354.00	0.00	0.00	0.00	0.00
AFUA-DICHAMI	13.5	1121.04	0.00	0.00	0.00	0.00
AJUNG	16	629.80	118.09	541.24	649.48	590.44
AKEH	15.5	294.38	151.94	696.38	835.66	759.69
ANYAJUA	29	1033.60	570.26	2613.71	3136.45	2851.32
BIKHOV	17	357.48	0.00	0.00	0.00	0.00
EMFVEMI	20.5	1377.29	7860.62	36027.83	43233.40	39303.09
IJIM	19	467.75	566.22	2595.17	3114.20	2831.09
KEDJEM MAWES	29.5	1717.02	6169.63	28277.49	33932.99	30848.17
KILUM-IJIM*	13	1080.75	997.61	4572.40	5486.87	4988.07
LAIKOM	19.5	651.40	567.88	2602.80	3123.37	2839.42
MBAI	2	121.83	0.00	0.00	0.00	0.00
MBOH MBOLENG						
ILUNG	12	475.29	0.00	0.00	0.00	0.00
MUTEFF	11	594.88	1081.60	4957.33	5948.80	5408.00
NCHILY	18	435.34	314.41	1441.05	1729.26	1572.05

FOREST	Real surface area surveyed (ha)	Total surface area	Number of stems retained for simulation of quotas (SRSQ)	Annual Quota_lowest estimate (R = 6 years) (kg)	Annual Quota_Highest estimate (R = 5 years) (kg)	Annual Quota_medium estimate (R = 5.5 years) (kg)
NJUAMBUM	9.5	350.05	0.00	0.00	0.00	0.00
UPPER SHINGA YANG TINIIFOIN	29	1556.29	1073.30	4919.31	5903.18	5366.52
BIMULO	14	431.30	400.49	1835.58	2202.69	2002.45
AREA OUT OF COMMUNITY FORESTS	34.5	18585.41	10235.44	46912.45	56294.93	51177.21
TOTAL	330	31634.90	30107.50	137992.73	165591.27	150537.52

* protect area: exploitation of *Prunus* in the flora sanctuary of Kilum Ijim should be subjected to special clauses.

The Kilum Ijim forest is a protect area, a sanctuary for plants to be précised. This means that this area is in the permanent forest domain and therefore in the total control of the forest administration. As it is, the area can be excluded from *Prunus* harvesting by the forest administration. If the 997.61 exploitable trees of *Prunus* found there are excluded from all kind of exploitation, then the annual quota of the wild *Prunus* will drop to **145.55 tons** of dried barks/year.

The area out of the community forest yields a quota of 51.17 tons year. This quota is totally composed of wilt or dead trees. If this quota is moved due to the lack of exploitable living trees and due to the difficulties that could raise for its control and monitoring by the forest officers, then the quota for the wild *Prunus* in the north west will be **99.36 tons/year**.

If both the area out of the community forest and the protected area are excluded from the exploitation, then the annual yield of the wild *Prunus* will be limited to the 12 community forests retained, which gives a total quota of **94.37 tons** of dried barks/year.

5.4.2. Plantations

5.4.2.1. States and total number of domestic *Prunus* trees

In the North-west, many farmers are interested in the domestication of *Prunus africana*. This interest is manifested by the impressive number of peasants, common initiative groups (CIG), and non-governmental organizations involved in the planting, collection and marketing of seeds and seedlings of this species. Thus, a large majority of farmers have introduced this species in their production systems. An assessment of the state of plantations of *P. africana* in the region shows that at least five departments are concerned: these are the departments of Mezam, Mantum-Ndonga, Ngok etunja of Bui and Boyo. Moreover, *P. africana* is the third priority tree species for domestication in the region after *Dacryodes edulis* and *Cola spp.* It is preferably planted in agroforestry systems simultaneously mixed with food crops and perennial. It occurs in a scattered manner in the fields, or placed along the edges to serve as a hedge or windbreak. It is also found in monospecific plantations in places, but also sprinkle in home gardens.

However, domestication initiatives are limited by difficulties in the supply of planting material. The wildings is the material of *P. africana* most used for regeneration by the planters. However, transplantation of such material usually results in very high mortality rate from the farmers we met and after the first results that we obtained. Production of plants and is quite delicate, hence the motivation of some NGOs, GIC and nursery individual to engage in the

collection and sale of seeds, and in the production of plants from wildings. Unfortunately, they are hampered by lack of reliable information on the pre-treatment of seeds, the factors that influence germination in the nursery and conservation of the germination of seeds and other propagation techniques of seed of *P.africana*. It should be noted that the establishment of plantations does not meet the standards as would be expected in a normal plantation; the distances between trees are not respected. Trees are scattered throughout the space in most cases without monitoring or maintenance (Tchatat 2010).

Data gathered in different services and local resource persons reveal that there exist a total of 117 123 trees of domestic *Prunus* in the divisions of Boyo, Bui, and Donga Mantung.

5.4.2.2 Number of domestic *Prunus* in the sample

A total number of 52 plantations of *Prunus* were surveyed in the three divisions of Boyo, Bui, and Donga Mantung.

A total number of 1896 *Prunus* trees were counted in those plantations. A total number of 1813 trees were alive while 83 trees were wilt or died, which is 4.37%.

Table 10 shows the distribution of the *Prunus* trees in different diameter classes per farmer. The Boyo union, Garba Daladi and Nfor Hilary are owners who get the high number of *Prunus* trees.

Table 10. Distribution of Living domestic *Prunus* stems in different diameter classes per farmer;

Farmer	Diameter classes					Total
	C<10	C10 - 20	C20 - 30	C30 - 40	C 40 - plus	
ALEX ZUH MUBANG	8	9	3			20
BBH1	16	12	4	1		33
BBH2	7	4				11
BBH3	8	14				22
Bongfan henry	11					11
BOYO UNION	208					208
DAVID FONTAMOH	8	15	1	1		25
Dewainkimbo Jimmy	1	2	7			10
EMMANUEL MAGENEY	7	8				15
FAI	33	15	4	3		55
FAI KIDIN	7	15	2			24
FAI Polycarpe	7	15	12	2		36
Fatouma shee	1	1	6	2		10
FRANCIS NGAM	54	27				81
FUL EMMANUEL	2	12		2		16
FUL JOHNSON	2	4				6
GAM EMMANUEL	2	5				7
GAM PETER		4				4
GARBA DALADI	197	6	3	1		207
Jantat Elata	20					20
JAVNJONG FONTAYA		8	5		1	14
Joseph Keusalu		3	8			11

Farmer	Diameter classes					Total
	C<10	C10 - 20	C20 - 30	C30 - 40	C 40 - plus	
LEVAL LEVIA	2	6	5	2		15
LINDA DZE DZE		2	4			6
Lukong emmanuel	11	3	1			15
LUKONG FESTUS	32					32
Mabah Martin	1	7	4	1		13
MAHALAM YENIGHA	3	8	1			12
Mairie de kumbo1	15	47	9			71
Mairie de kumbo2	30	5				35
MFOR HILARY	61	38	7	3	2	111
Mih John Vuh	50	10	7			67
Minang Mohamadou	7					7
MUBANG AUGUSTINE AYEAH	16	21	2			39
Nanguéh Elisabeth	44	2				46
NDELEY BOBE		6	7	2		15
Ngoran christopher			15	2		17
NGUEH SYLVESTER	16	28	5	1		50
Njoh Gideon	46	14	3	1		64
Nkain Isidore	22					22
NYAH JEIREW	14	4				18
Patrick Many	4	10				14
Prince Yibam Emmanuel	91					91
SHUFAI 2	5	14				19
SHUFAI ROKOV 1	8	9	3			20
SIMON KITCHA	1	5	7	5	2	20
TEH ERIC ATOINI	17	4	1			22
TETANG	1	13	10			24
Vincent Chiaga	17	10	3			30
YAM ERNEST	19	3				22
YEIN SIMON	8	16	7	2		33
YENG DOR Leonard	8	5	2		2	17
TOTAL	1148	158	469	7	31	1813

Table 11 shows the distribution of the *Prunus* trees per division. The Boyo division is the area where there exists a high number of planted trees of *Prunus* (1 220 trees, 67.3%). This is linked to the work done by the BirdLife International project.

Table 11. Distribution of Living domestic *Prunus* stems in different diameter classes per division;

	Diameter classes					Total
	C<10	C10 - 20	C20 - 30	C30 - 40	C 40 – plus	
BOYO	876	248	78	16	2	1220
BUI	211	183	73	12	3	482
DONGA MANTUM	61	38	7	3	2	111
Total	1148	469	158	31	7	1813

Figure 8 illustrates the distribution of living stems in different diameter classes. This structure has the shape of the structure relatively close to “J” reversed curve characterized by strong presence of young stems mostly at the level of classes [0, 10 [and [10, 20 [. Many trees have not yet reach the minimum diameter of exploitability (MED) which is 30 cm. Only 38 trees can be harvested.

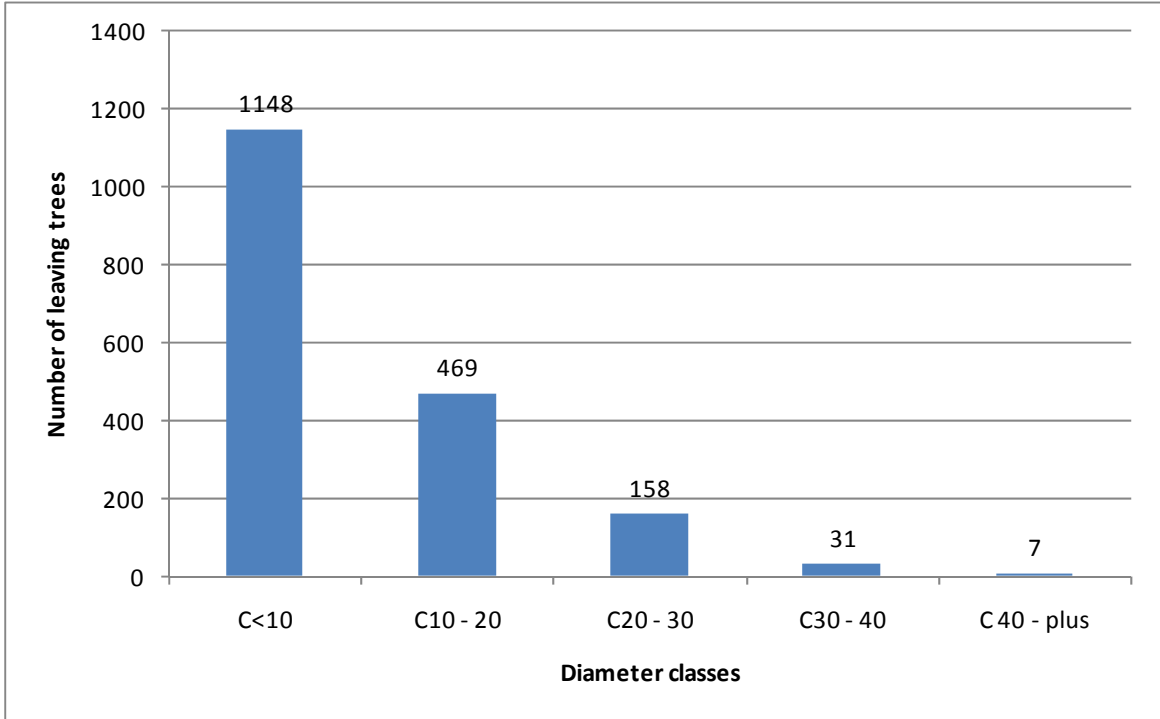


Figure 8: Distribution of living domestic *Prunus* trees in different diameter classes



Photo Tchatat (2010): *Prunus* plantation belonging to the Kumbo council

5.4.2.3. Simulation of annual quota for domestic *Prunus*

Table 12 presents estimation of *Prunus* stocks based on the sample's data in each division. Of the 117 123 *Prunus* trees estimated to be planted in the three divisions of Boyo, Bui, and Donga Mantung (see section 5.4.2.1), 1634.11 living trees can be harvested, since they reached the MED. A total of 3 023.14 trees should be harvest, since they died or are being died (wilt trees). The mixture of both the exploitable living trees and the died or wilt trees can be considered as the exploitable stock of *Prunus* in the three divisions. It is the exploitable stems or Number of stems retained for simulation of quotas (SRSQ) for domestic *Prunus*.

Table 12: Total trees of *Prunus* to be exploited in Boyo, Bui, and Donga Mantung divisions

Division	Living stems inventoried	Wilt or dead stems inventoried	Total number of stems inventoried	Living stems < MED	Living stems >= MED	% living stems > = MED	% Wilt or dead stems	Total number of stems	Living exploitable stems	Total number of wilt or dead stems	Total exploitable stems (living and non living)
BOYO DONGA- MANTUNG AND BUI	1220	45	1265	1202	18	1,48	3,56	35945,00	530,34	1278,68	1809,01
TOTAL	1813	82	1895	1775	38			117123,00	3268,21	6046,27	9314,48
AVERAGE	906,50	41,00	947,50	887,50	19,00	2,42	4,72	58561,50	1634,11	3023,14	4657,24

The simulation of the annual quota for the domestic *Prunus* is done in table 13.

From the table, it can be established that the annual quota of domestic *Prunus* in the three divisions of Boyo, Bui, and Donga Mantung is 30 231.36 kg/year or 30.23 tons/year.

Table 13: Simulation of the annual quota for domestic *Prunus africana* in the three divisions of Boyo, Bui, and Donga Mantun

DIVISION	Total exploitable stems (living and non living)	Annual Quota_lowest estimate (R = 6 years)	Annual Quota_Highest estimate (R = 5 years)	Annual Quota_medium estimate (R = 5 years)
BOYO	1809,01	5860,60	7032,72	6393,38
DONGA-MANTUNG AND BUI	7505,47	21851,49	26221,78	23837,98
TOTAL	9314,48	27712,08	33254,50	30231,36

5.4.3. Total *Prunus* quota in the North West region

The total annual yield of fresh bark of *Prunus* (wild and domesticated) in the mount Oku region is 301 075.05kg/year or **361. 475 tons/year**. Table 14 synthesises the total quota in dried barks for *Prunus africana* in the North west region for both wild and domesticated trees. The annual quota for *Prunus* in the North west region of Cameroon can be estimated at 180.77 tons. This quota includes all wild *Prunus* found in community and non community forests, and also domestic *Prunus* found in the three divisions of Boyo, Bui, and Donga Mantung. Domestic *Prunus* found in the other 4 divisions including : Mezam, Ngoketunjia, Menchum, Momo.

Table 14: Total annual quota for wild and domestic *Prunus* found in the North west region of Cameroon.

Origine	Stems retained for simulation of quotas	Annual Quota_lowest estimate (R = 6 years)	Annual Quota_Highest estimate (R = 5 years)	Annual Quota_medium estimate (R = 5 years)
Wild <i>Prunus</i>	30107.50	137992.73	165591.27	150537.52
Domestic <i>Prunus</i>	9314.48	27712.08	33254.50	30231.36
Total	39421.98	165704.81	198845.77	180768.88

As discussed in section 5.4.1.5., if the 997.61 exploitable trees of *Prunus* found in the protected area are excluded from the exploitation, then the annual quota of the *Prunus* will be $145.55 + 30.23 = 175.78$ tons/year of dried barks/year.

If the area out of the community forest is moved, then the quota for the wild *Prunus* in the north west will be $99.36 + 30.23 = 129.59$ tons/year.

If both the area out of the community forest and the protected area are excluded from the exploitation, then the annual quota of *Prunus* will be $94.37 + 30.23 = 124.6$ tons of dried barks/year.

It is interesting to note that there are about **250 tons of dried barks** of *Prunus* in the North west region stocked in many houses. That *Prunus* was harvested and could not be exported due to the ban pronounced by the European Commission.

CHAPTER 6. ATTRIBUTION OF QUOTA IN *PRUNUS* BARK

6.1. Special permits

Plantecam was the largest single exploiter of *Prunus* bark in Cameroon. This firm had the monopoly on exploitation until 1987.

The economic crisis in the latter half of the 1980s and the structural adjustments implemented subsequently contributed in enhancing massive forest operations (both timber and non timber forest products) and accelerating the forest degradation. All economic sectors being affected by the crisis, the forest sector (timber and non timber forest products) was representing the one that was still going well and was attracting everybody. The importance of the forest sector at this period did not only attract formal companies, but also citizens from towns and villages, thus leading to the proliferation of illegal logging and poaching in *Prunus Africana* (Betti 2007).

As a result of the high demand, in 1987, 50 new licences were issued to contractors who began to sell to Plantecam themselves. This led to an increase in exploitation, much of it uncontrolled.

The 50% devaluation of CFA, was now worth only 400 CFA. It then became far more profitable for other companies, especially in Italy, to import bark from Cameroon. The national contractors, eager to supply, began to exploit *Prunus* bark around Mount Cameroon. The majority of this exploitation was illegally undertaken with entire trees being felled and/or stripped completely (Sunderland and Nkefor 1996).

Table 15 presents the quotas (tons) of *Prunus* barks attributed by the inter-ministerial Commission for quotas for the period 2004 – 2007.

A total of 33 companies have been authorized to exploit *Prunus africana* between 2004 and 2007. Some 6 544 tons of barks were granted to those companies, with the year 2005 being the most important in terms of the quantity of bark (2000 tons).

Table 15. Attribution of quotas (in tons) in *Prunus* to different trade companies by the Inter-ministerial Commission of Quotas from 2004 to 2007.

COMPANY	YEAR- 2004	YEAR- 2005	YEAR- 2006	YEAR- 2007	TOTAL
ETS EFFA JBP & Cie	50	50			100
ETS ERIMON	50	75	50		175
ETS ESSAM & FILS		10			10
ETS ESSAMA	10				10
ETS FONGANG & FILS	30	100	50		180
ETS IK NDI & BROS Enterprise	50	50			100
ETS KAMDEM	30				30
ETS KOPGUEP	50	50		44	144
ETS MEDOU NJEMBA & FILS	50	50	40		140
ETS NAH & SONS	50				50
ETS NFORKEMBA	20	5			25
ETS NGAH DIMA DAMIEN	50	50			100
ETS NGAKO & FRERES	50	50			100
ETS NGUENANG EMMANUEL	50	50	20		120
ETS SOCAMBA	20	20			40

Setting export quotas of *Prunus africana* for the North west region of Cameroon: Report prepared by AMOUGOU AKOA, BETTI J.-L., EWUSI NJOMBE B., MBARGA N., AKAGOU ZEDON H.C., FONKOUA C., ESSOMBA E.R., NKOUNA ABIA C.

COMPANY	YEAR-2004	YEAR-2005	YEAR-2006	YEAR-2007	TOTAL
ETS TAY & FRERES	20	20			40
STE AFRICA PHYTO INTERNATIONAL	50	200		160	410
STE AFRIMED	500	500	520	550	2070
STE BOIS & METAL DU CAMEROUN			50		50
STE CATRACO	100	100	10		210
STE CEXPRO	100	100		200	400
STE CRELICAM	20				20
STE GENERALE DES PRODUITS				300	300
STE ITTC	100	100		50	250
STE MARCO				20	20
STE MOCAP		100			100
STE MPL	100				100
STE MUKETE PLANTATION		100	10		110
STE PHARMAFRIC			170	170	340
STE PRODEGON				20	20
STE SACO	50	50			100
STE SGPA	150	150	340		640
STE SIFAM	20	20			40
TOTAL	1770	2000	1260	1514	6544

As it can be observed in figure 9a, the number of companies decreases from 2004 (25 companies) to 2007 (9). Many companies which have not paid their taxes for the previous years were eliminated by the Commission.

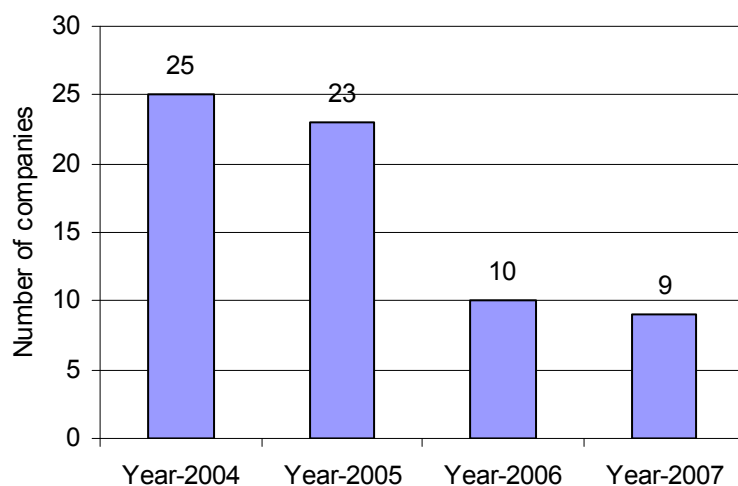


Figure 9a. Distribution of number of companies per year

Figure 9b illustrates the relative importance of companies in term of percentage of quotas attributed during the four years. Only the ten most important companies were selected. AFRIMED (31.63% of quotas) and SGPA (9.78%) appear to be the two most important companies to whom the Government has allocated quotas for *Prunus* between 2004 and 2007.

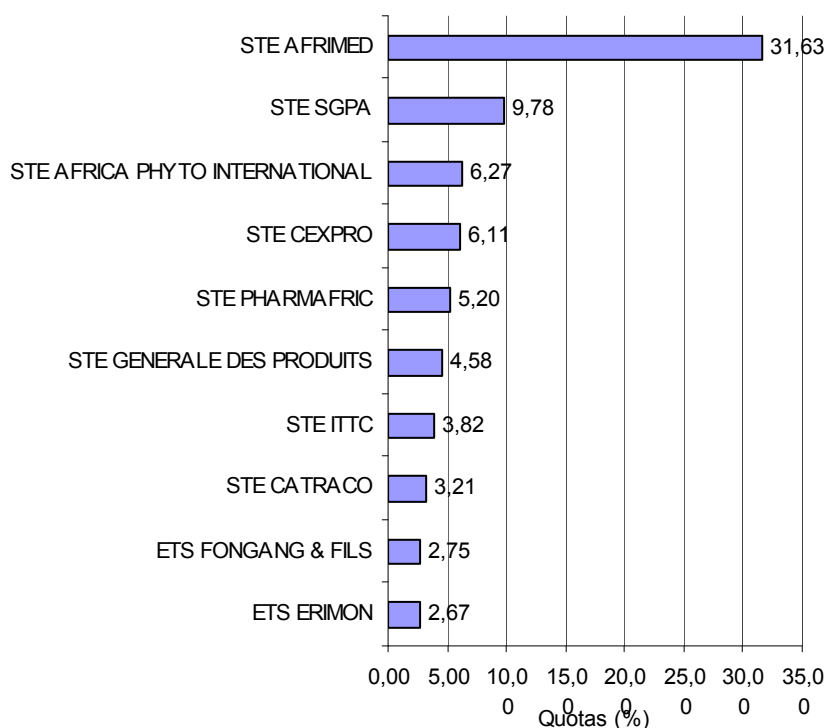


Figure 9b. Relative importance of companies according to quotas allocated between 2004 and 2007.

6.2. Harvest zones, seasons and harvesting techniques

Permits for *Prunus* barks as for other special products are granted to companies for one year. The area of exploitation is vague, just at the level of the region. Before, permits were allocated for three regions: West, North west, and South west. Now, those permits are restricted to the two last regions. Nothing is said about the precise site where the product may be collected. This is one of the causes of weakness in the actual system of control and monitoring at the local level.

The season of harvesting is not specified also in the permits. This depends on the conditions of the milieu. For example, exploitation on Adamaoua can only be possible during the dried season, due to the bad conditions of roads.

One of the problems outlined by trade companies of *Prunus* is related to the administrative procedures. The Administrative procedures for issuing special permits are lengthy and complicated. These procedures are not adapted to the local context. Special permits are issued for one year. Really, the holder of this permit works for only three to four months during the year, since he cannot work in the rainy season. More often, the inter-ministerial Commission in charge of attribution of quotas holds its meeting by the month of January, and permits are issued by February or March of the same year. By November, the holder of the special permits is requested to submit his annual activity report to the forest administration.

This means that the months of January and December which are considered as dried months are not effectively exploited by the company.

The lesson to be learnt here may be that the procedure of issuing the special permits should be in accordance with the reality of the sector, aiming to maximise the exploitation of the *Prunus* barks during the dried months which include: January, April, May, June, and December. Also, the forest administration should enhance the synergy between its external services and provide them with sufficient logistics for enhancing control and monitoring of the harvesting of *Prunus* bark.

6.3. Exportation

Data recorded for two years (2005-2006) by the Trade forest products database (COMCAM) based at Douala, are presented in table 16. These data are recorded from the specific bulletins (bulletins de specification in french) dressed by the Chief of Forest and Wildlife post n°1 based at the entrance of the Port of Douala.

A total of 2558.37 tons of *Prunus* bark exported from the Douala port was recorded by the COMCAM database. The most important quantity of the barks was exported in 2005 (1498.5 tons) and the remaining (1059.87 tons) was exported in 2006.

Table 16. Exportation of *Prunus* from the Port of Douala (COMCAM cit. Betti 2007, 2008)

COMPANY	Weight (tons)	Destination	Year
AFRIMED	346,87	France	2006
AFRIMED	270	Espagne	2006
CEXPRO Sarl	160	France	2006
CEXPRO Sarl	38	Madagascar	2006
PHARMAFRIC	60	France	2006
SGPA	185	France	2006
AFRICAPHYTO	50	France	2005
AFRICAPHYTO	60	Espagne	2005
AFRIMED	361	France	2005
AFRIMED	662	Espagne	2005
CEXPRO Sarl	139	France	2005
CEXPRO Sarl	27	Madagascar	2005
CEXPRO Sarl	18,5	Maroc	2005
CEXPRO Sarl	14,5	Espagne	2005
ETETKAM	3,5	USA	2005
IK NDI & BROS	13	France	2005
SGPA	150	France	2005
TOTAL	2558.37		

Whatever be the year, AFRIMED, CEXPRO Sarl, and SGPA are in this order, the three most important and regular companies exporting *Prunus* barks from the Douala port (figure 10).

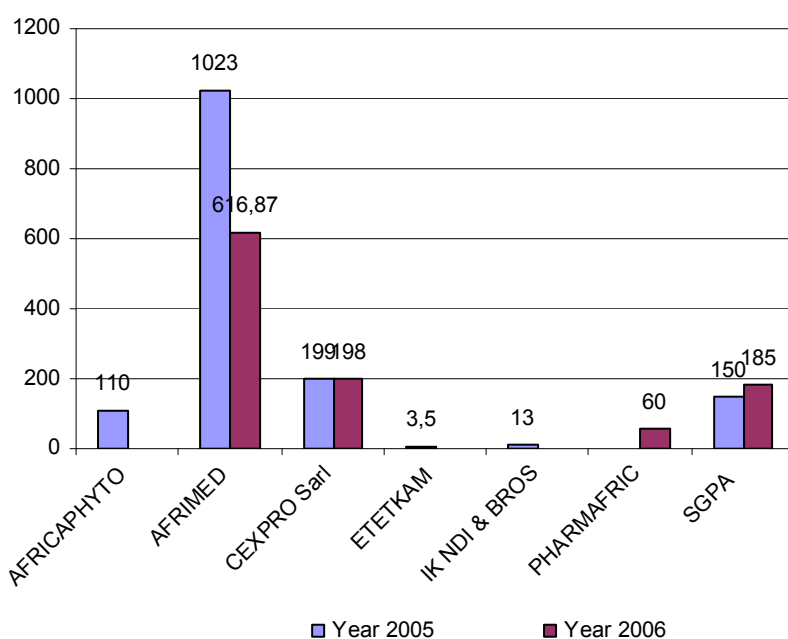


Figure 10. Distribution of quantity of *Prunus* barks in different companies in 2005 and 2006.

Table 17 presents data from the CITES permits issued by the Forest administration in 2006 and 2007 (Betti 2007, 2008).

According to the Cameroonian CITES management authority, a total of six companies exported 2144 tons of *Prunus* barks from Cameroon in 2006 and 2007. The most important quantity was exported in 2006 with 1497.5 tons, which is largely different from the records of the COMCAM database (1059.87 tons).

Only 646.5 tons were exported in 2007, following the ban observed by the European Commission on the Cameroon *Prunus* in October 2007.

Table 17. Records from the CITES permits on *Prunus* for 2006 and 2007.

COMPANY	QUANTITY	
	(ton)	YEAR
AFRIMED	709	2006
AGRODENREE	40	2006
CEXPRO	284,5	2006
IK NDI	9	2006
PHARMAFRIC	120	2006
SGP	335	2006
AFRIMED	245	2007
CEXPRO	161,5	2007
PHARMAFRIC	120	2007
SGPA	120	2007
TOTAL	2144	

Six companies obtained CITES permits on *Prunus* in 2006, which is less than the 10 companies to whom the inter-ministerial commission allocated quotas of the same product.

Figure 11 illustrates the repartition of the quantity of *Prunus* barks within the six exporting companies in 2006. AFRIMED, SGPA, and CEXPRO appear to be in this order, the three most important companies which exported *Prunus* bark from Cameroon in 2006.

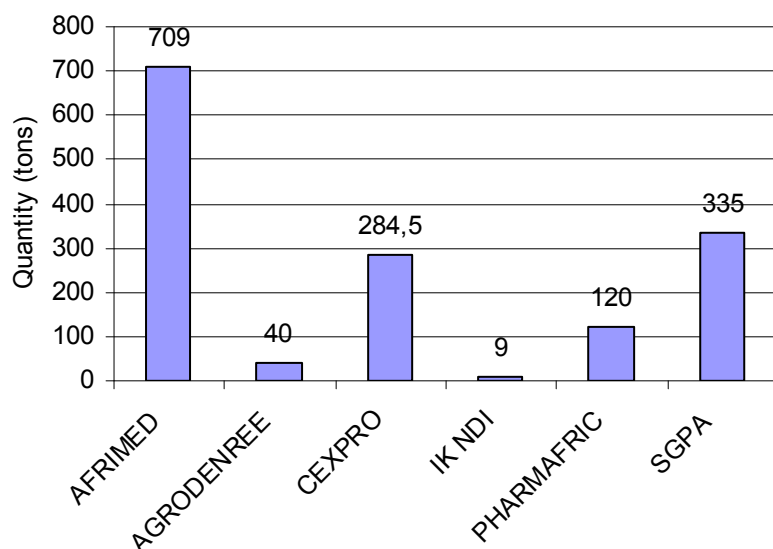


Figure 11. *Prunus* barks recorded in CITES permits and per company in 2006.

Data from the COMCAM database and from the CITES management authority are presented in table 18. As it can be observed, the quantity of *Prunus* bark recorded by the CITES management authority is more high (1497.5 tons) than those recorded by the COMCAM database (1059.87 tons). Some 437.63 tons of *Prunus* barks exported in France (270.63 tons), Spain (120), Madagascar (38) and China (9) were not registered in the COMCAM database, which tends to confirm the weakness of the control and monitoring system of the Cameroon authorities on forest products. COMCAM/Douala is for the moment, the only database in charge of gathering forest products trade data for the forest administration, forest companies, and for the National Institute for Statistics (NIS). The NIS is in charge of the compilation of data on trade products in the whole country.

Table 18. Comparison of data recorded by the trade products database (COMCAM) and the CITES Management authority for the year 2006.

COUNTRY	COMCAM	CITES PERMITS	DIFFERENCE
Espagne	270	390	120
France	751,87	1022,5	270,63
Madagascar	38	76	38
Chine		9	9
TOTAL	1059,87	1497,5	437,63

What ever be the source of data, France, Spain, Madagascar, and China are in this order the main importing countries for *Prunus* barks coming from Cameroon.

The lesson to be learnt here may be that issuing the special permits without a good system of traceability to monitor the quotas can be detrimental to the resource.

CHAPTER 7. MONITORING SYSTEM

7.1. Circuit of special products in the country

The main services working in the classical circuit of exploitation, transport, and exportation of special products belong to the Ministry of Forestry and Wildlife/Fauna (MINFOF), Ministry of Agriculture and Rural Development (MINADER), and Ministry of Economy and Finances (MINEFI). This circuit is described as follow (Betti 2008, b):

- MINFOF/Service in charge with agreements and titles: issuing of agreements and titles (special permits);
- MINEFI/ Forest Revenue Enhancement Program (FREP): issuing of receipts of the payment of the regeneration tax (= 10 FCFA/kg = 0.02 \$US/kg);
- MINFOF/Service in charge with the management of the forest database: issuing of the carnets for the way bills, monitoring of the quotas;
- MINFOF/ regional Delegation: issuing of the notification for the beginning of the exploitation (harvesting) of the resources granted and listed in the permit at the scale of the region;
- MINFOF/Divisional Delegation: issuing of the notification for the beginning of the exploitation (harvesting) of the resources granted and listed in the permit at the scale of the division;
- MINFOF/Control post n°1: issuing of the notification for the beginning of the exploitation (harvesting) of the resources granted and listed in the permit at the level of the post (Subdivision), monitoring of the exploitation of the resource in the field (respect of the standards according to the current forest law, rigorous planning of harvesting in the space and time taking in to account, the rhythm of growing of individuals to avoid over exploitation), respect of the quotas attributed, issuing of the certificate of origin and signature of the way bill;
- MINFOF/ Control post n°2: verification of the authenticity of the way bill, verification of the conformity of data of way bill with the products really transported by the vehicle, signature (or visa) of the way bill and report of the data of the way bill in the register of the post;
- MINFOF/ Control post n°3: same;
- MINFOF/ Subdivision for Non Timber Forest Products: issuing of the certificate for exportation after having verified that the exporter has present the permit and the receipts for the payment of the regeneration tax issued by the FREP ;
- MINFOF/ Control post of the Port n°1 at Douala: verification of the way bill, and the receipts issued by the FREP, issuing of the specification bulletins after verifying that the tonnage is in conformity with data contained in the way bill, report of the data of the way bill in the register of the post;
- MINFOF/ Control post of the Port n°2 at Douala: verification of the bulletins for specification, signature of the report of "connaissance" together with the customs service, issuing of "See Good or Vue Bon" before the packing of the products in the container;
- MINFOF/ Trade products database or COMCAM at Douala: registering data of the permits, way bills, bulletins for specification, reports of "connaissance", production

and dispatching of reports to the forest administration, and economic operators (exploiters and exporters);

- MINADER/Post for plants health police: verification of plants health documents accompanying the products inside or outside the country, issuing of plants health certificates;
- MINEFI/Customs service: issuing of the “connaissance” and perception or gathering of export allowances.

Documents required for the exploitation of special products in Cameroon are précised in the forest law (Republic of Cameroon 1994, 1995).

In 2000, a Unité Centrale de Contrôle (UCC) was set up by the forest administration to coordinate forestry controls nationally and to support provincial Brigades de Contrôle. Since 2004, that unit (UCC) became the National Brigade of Control (Brigade Nationale de Contrôle in French). To reinforce transparency in control measures the forest administration has appointed an independent observer, Global Witness (MINEF, 2002). Global Witness is currently working together with the National Brigade for Control to ensure the sustainable harvesting of forest products (timber and Non timber forest products).

The North west region is made of several forest services (offices) belonging to the Ministry of Forestry and Wildlife. At the regional level, there exists a delegation which comprises a forest service and a control and monitoring service. At the divisional level, the forest services are coordinated by a delegation which comprises a forest section. Each subdivision hosts a local forest control post.

The mount Oku is extends in two divisions: Boyo and Bui. It is surrounding by fifteen (15) forest control posts. One of the forest control post is located inside the mount Oku, the forest control post of Mbockevu. The mount Oku also hosts a protect area, a flora sanctuary of Kilum Ijim to be précised. The kilum Ijim sanctuary is managed by a conservator. All those measures show that the harvesting of *Prunus africana* can be carefully controlled and monitored, which will avoid over exploitation.

7.2. Problems observed in the field on control

Many problems are observed in the monitoring of the exploitation and exportation of special products in Cameroon (Betti 2008, b). Problems are observed at all levels of the control, from the forest till the points of exports, and from the central administration to the external services.

At the level of the central services (in Yaoundé), the quotas attributed by the inter-ministerial Commission are based on no scientific data. Further, the Commission does not take in consideration the reports coming from the external services or from the legal harvesters, and giving an approximate situation of the abundance of the products in their zone. The forest database (SIGIF) settled in the Directorate of Forests only gathers data on logs. Data regarding special products are not concerned. Reports published every year by the National Institute for Statistics do not reflect the real data on special products in Cameroon.

In the field, and mainly at the level of control posts and check points, control on special products is not done in fair manner. The lack of precisions on the area of harvesting in the permits, the multiples prolongation of some permits, the lack of security on way bills (contrary to what is done for logging with the way bill being issued by the forest administration, way bills for special products are edited by trade companies themselves), the lack of sufficient norms and standards for the sustainable harvesting as tools for control and monitoring, the lack of sufficient and qualified personal, and the lack of motivation for the forest agents are among many problems observed in the field of special products.

Along the transport routes, problems observed include the lack of sufficient and qualified personnel, the lack of material of control, the lack of motivation for the forest agents, the competence conflicts with other administration. In many forest posts and check points settled along the road, there are one, two or three forest agents who are currently doing control. This number is not enough to ensure the control of log trucks all days and nights (24 hours/24). Also, many of the agents affected in those posts are too old now and do not get sufficient material for staying awake and resisting to cold all night long. Many forest agents do not record data from checking in their register book, as required by the forest administration. So many of these register books cannot be used, for further verifications.

Special products can be exported from the ports of Douala, Kribi, Limbé, Tiko. The first and main problem observed here is the lack of synergy between the custom officers and the forest officers. Often, the custom officers, who are posted at the end of the exportation chain, refuse to consider the specific bulletins dressed by the forest officers. Also, they used to refuse that the forest officers check the final container and co-signs the transport document "connaissance in french". In this condition, some products are exported without the visa of the forest officers.

The second problem in export is at the level of the chief of post N°1. Normally, the chief of forest and wildlife post n°1 who is settled at the entrance of the port must transmitted all specific bulletins to the Trade products database (COMCAM). This is not always the case, since some specific bulletins do not exist or disappear. Such behaviour is detrimental to the monitoring, and checking of statistical data on the trade wood.

The third problem is that of the non existence of COMCAM database in other ports. Only COMCAM Doula has functioned till date. COMCAM Limbé, Kribi, Tiko have not been functioning in fair manner. COMCAM Kribi has just started working in 2007.

The fourth problem is that of lack of such a system for monitoring domestic trade in wood and special products. Till date, the forest administration has never developed a fair system for controlling and monitoring domestic trade, which cannot help to get a global trade volume of forest products in the country.

The fifth problem observed in the control of timber products is that of the proliferation of the "criques". "Criques" are informal points of export, found in many localities settled along the frontier Cameroon – Nigeria. These are unsafe sites, where forest officers cannot undertake any control mission (Betti 2008,b). A total of 1265/1281 tons of special products were exported from five "criques" based in the Akwaya subdivision (South west province) to Nigeria between March and July 2002. Those products were sold for 413.1 millions of FCFA (Ojong Ayuk 2002).

The sixth problem is related to confusion made between the domestic and wild products. The actual forest legislation does not clarify management issues concerning each group of products. The Government continues to perceive tax for *Prunus* coming from some plantations settled in the North west region.

The seventh problem is related to the activities of the National Brigade of Control and the independent observer, Global Witness. These two structures focus their activities on forest logging, and not on special products.

CONCLUSIONS

Since July 2010, the National Forestry Development Agency (ANAFOR) launched a specific project with the support of ITTO and CITES to sustain *Prunus africana* in Cameroon. Preliminary results obtained shows that the North west region is one of the most important region hosting *Prunus africana* in Cameroon. Aside the wild *Prunus* found in community and non community forests, there exists many plantations of *Prunus* in the seventh divisions of the North west region.

Inventories were carried out on wild and domesticated *Prunus* in the mount Oku region.

A total of 180.7 tons of dried barks of *Prunus africana* can be granted every year to trade companies in the North west region.

In spite of the effort made by the Cameroon Government to alleviate poaching in the exploitation of *Prunus* in the North west region, many problems still remain in the monitoring of the exploitation and exportation of *Prunus africana*. Problems are observed at all levels of the control, from the forest till the points of exports, and from the central administration to the external services.

to ensure the conservation of *Prunus africana* in the region, following actions should be conducted:

- enforce capacities of all forest structures found in the area of mount Oku in terms of human resources, logistics, and financial incentives as to allow them to better control and monitor the exploitation, processing, and transport of *Prunus* products;
- filter the number of trade companies who are working in the field of *Prunus Africana* as to keep those who are interested in sustainable management of the resource;
- analyse the problem of equity in the trade exchanges on *Prunus africana*. It should be ensured that local communities are well motivated to conserve *Prunus africana* in their forests;
- the procedure of issuing the special permits should be in accordance with the reality of the sector, aiming to maximise the exploitation of the *Prunus* barks during the dried months which include: January, April, May, June, and December;
- propose a better system of taxation of *Prunus* products or the fiscality on *Prunus africana*. Till now, the Cameroon Government received only 10 FCFA per kilogram of *Prunus* barks. This tax is called the "regeneration tax". It is clear that, this amount cannot ensure the management of the resource by the Government. Inventories conducted in 330 ha of forest in the North west required more than 45 000 USD;
- forbid or ban the exploitation of *Prunus africana* in the six community forests indicated above;
- authorize the exploitation of community forest after the realization of the systematic inventories in the first plots on the basis of a rotation of 5.5 years;
- assist local communities in de realization of their systematic inventories as to avoid problems observed in past years in the same region within the BirdLife International project;
- develop and implement a fair tracking system to trace *Prunus* products from the forest till the exit points assist local people in developing fair farming system that do not harm *Prunus* habitat, especially in the area out of the community forests..

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