



## **SETTING EXPORT QUOTAS OF *PRUNUS AFRICANA*: GUIDELINES FOR A NDF PLAN**

### **AUTHORS**

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### **BACKGROUND**

At its 16th meeting (PC16, Lima, July 2006), the Plants Committee categorized *Prunus africana* from Burundi, Cameroon, the Democratic Republic of the Congo, Equatorial Guinea, Kenya, Madagascar and the United Republic of Tanzania as 'of urgent concern'. In consultation with the Secretariat, it formulated recommendations with deadlines for their implementation. These were transmitted to the range States concerned by the Secretariat in August 2006.

At that same meeting, the Plants Committee established an intersessional working group on *Prunus africana* with the task of providing guidance to relevant range States on the implementation of the Plants Committee's recommendations for this species. The Terms of Reference of the working group are described in the PC16 summary record. A workshop involving the Scientific Authority and Management Authority from the relevant range States is planned for September 2008 to assist with implementation of the recommendations. The workshop is being held thanks to financial support from France, Germany, Italy and Spain.

Based on the responses received, and in consultation with the PC Chairman, the Secretariat has made a determination regarding compliance with the PC recommendations by the range States concerned. This determination is summarized as follows and includes recommendations to the Standing Committee.

## *Prunus africana*

### **Burundi (BI)**

Within 3 months (November 2006)

- a) In consultation with the CITES Secretariat and the Chairman of the Plants Committee, establish a conservative quota for export of *P. africana* bark and other parts and derivatives exported.
- b) Clarify reported exports of extract which are likely to be powder, and inform the Secretariat of any facilities to produce extract within the country.

Within 1 year (August 2007)

- c) Carry out a preliminary inventory of standing stock, establish estimates of sustainable off-take, taking into account the need to conserve large seed-producing trees, and establish a scientific monitoring system of the harvested and unharvested *P. africana* populations.
- d) Establish a revised conservative export quota based on the inventory of standing stock and the estimates of sustainable off-take.
- e) Provide a timetable to carry out peer-reviewed ecological studies and appropriate population modelling of *P. africana* in order to establish a long-term management plan for the sustainable use of this species.

Within 2 years (August 2008)

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

The MA of BI reported to the Secretariat on 20 November 2006 that only one company exports *P. africana* bark but that investigations had found that the bark had been illegally entering the country from the Democratic Republic of the Congo. Consequently, the MA of BI has advised that they have temporarily stopped all exports and that a zero export quota has been imposed. The quota is to remain in place until inventories of *P. africana* are completed within BI.

### **Conclusion**

Some action towards the full implementation of these recommendations has been undertaken but further updates on progress are required. The zero quota is as an interim measure pending a preliminary inventory, but the remaining recommendations are to be implemented.

### **Recommended action**

If BI seeks to recommence exports of products of this species, it should first provide information to the Secretariat on how the Plants Committee recommendations have been implemented.

## Cameroon (CM)

Within 3 months (November 2006)

- a) In consultation with the CITES Secretariat and the Chairman of the Plants Committee, review their current export quota and establish a conservative reduced quota for export of *P. africana* parts and derivatives.
- b) Clarify whether they have a working facility to process and export extract, in addition to bark and powder and inform the Secretariat of what parts and derivatives they plan to export (bark, powder, extract).

Within 1 year (August 2007)

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

Within 2 years (August 2008)

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

The MA of CM reported to the Secretariat on 17 November 2006, 11 September 2007 and 3 January 2008.

Export quotas of 2,000 tonnes established for 2005, 2006 and 2007 were conservative in their view and were in the event far from fully utilized. The export quota for 2008 was reduced to 1,000 tons pending the results of inventories, which still require funding. The MA notes that, in addition to this 1,000 ton quota, there are accumulated stocks that will have to be taken into account. The current harvest and export quotas of *P. africana* are based on only two production sites.

Regarding recommendation b), the MA explained that CM does not have facilities to produce extract from the bark of *P. africana*. CM only exports bark or powder.

Inventories have been carried out at two sites: Mount Cameroon and in one part of Adamaoua province. Lack of funding has prevented inventories being undertaken in other areas. The MA recognized the need to undertake inventories at other sites and explained that available data from these do not differ much from the established export quota and that the export quota would certainly increase if inventories were done at all production sites.

The MA explained that currently it was not in a position to establish a rigorous harvest and export quota but it called for international cooperation in this regard.

No information has been received concerning collaboration with Nigeria.

CM submitted a package of information which was reported on orally at the meeting.

## Conclusion

Some action towards the implementation of these recommendations has been undertaken but further progress is required. Efforts have been made to set a conservative quota based on two production areas only and, more recently, a 50 %

reduction in the past quota has been applied as per recommendation a). However, preliminary inventories are required for all production sites for the quota to be more reliably set as per recommendations c) and d). At the time of preparing this document, no information on recommendations e), f) or g) had been provided.

#### **Recommended action**

The deadline for full implementation of all the Plants Committee's recommendations should be extended until 31 December 2008. If these are not implemented to the satisfaction of the Secretariat and Chairman of the Plants Committee, the Standing Committee should recommend that all Parties suspend trade in all specimens of *Prunus africana* from CM until that country demonstrates compliance with Article IV, paragraphs 2 (a) and 3, for this species, and provides full and detailed information to the Secretariat regarding the compliance with the recommendations of the Plants Committee.

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### **Democratic Republic of the Congo (CD)**

Within 3 months (November 2006)

- a) In consultation with the CITES Secretariat and the Chairman of the Plants Committee, review their current export quota and establish a conservative reduced export quota for export of *P. africana* parts and derivatives exported.
- b) Clarify reported exports of extract which are likely to be powder, and inform the Secretariat of any facilities to produce extract within the country.

Within 1 year (August 2007)

- c) Carry out a preliminary inventory of standing stock, establish estimates of sustainable off-take, taking into account the need to conserve large seed produ-

The MA of CD reported to the Secretariat on 24 September 2007 that *P. africana* was a rather common species in five of the 11 provinces of CD. Nevertheless, no inventories have been done by the SA because there are no funds to do so and the area of distribution of the species is located in war zones. The SA set the export quota on *P. africana* based on information provided by users and confirmed by the environmental services in the provinces. Considering the recommendations by the Plants Committee and the exports of the last three years, the SA recommended the reduction of the export quota to 600 tons per year, but the export quota notified to the Secretariat and published on the CITES website remains at 1,000 tons. The MA reported that exports were of bark since there were

cing trees, and establish a scientific monitoring system of the harvested and unharvested *P. africana* populations.

- d) Establish a revised conservative export quota based on the inventory of standing stock and the estimates of sustainable off-take.
- e) Provide a timetable to carry out peer-reviewed ecological studies and appropriate population modelling of *P. africana* in order to establish a long-term management plan for the sustainable use of this species.

Within 2 years (August 2008)

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

no facilities to produce powder specimens. The MA had some data provided by users of the species who reported on their inventory of exploitation. These data were to be verified by both the SA and the MA before being communicated to the CITES Secretariat.

#### **Conclusion**

Little progress has been made in complying with the recommendations.

#### **Recommended action**

The deadline for full implementation of all the Plants Committee's recommendations should be extended until 31 December 2008. If these are not implemented to the satisfaction of the Secretariat and Chairman of the Plants Committee, the Standing Committee should recommend that all Parties suspend trade in all specimens of *Prunus africana* from DRC until that country demonstrates compliance with Article IV, paragraphs 2 (a) and 3, for this species, and provides full and detailed information to the Secretariat regarding compliance with the recommendations of the Plants Committee.

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### **Equatorial Guinea (Bioko Island) [GQ]**

Within 3 months (November 2006)

- a) In consultation with the CITES Secretariat and the Chairman of the Plants Committee, establish a conservative quota for export of *P. africana* bark and other parts and derivatives exported. This quota should be based on results of studies conducted in the new harvesting areas.
- b) Clarify reported exports of extract which are likely to be powder, and inform the Secretariat of any facilities to produce extract within the country.

The MA of GQ reported to the Secretariat on 30 August 2006 that once other production areas were opened and a non-detriment finding had been completed, they proposed to establish an annual export quota of 197 tons of bark and derivatives.

#### **Conclusion**

Little progress has been made in complying with the recommendations.

#### **Recommended action**

The deadline for full implementation of all the Plants Committee's recommendations should be extended until 31 December 2008. If these are not implemented to the

Within 1 year (August 2007)

- c) Carry out a preliminary inventory of standing stock, establish estimates of sustainable off-take, taking into account the need to conserve large seed-producing trees, and establish a scientific monitoring system of the harvested and unharvested *P. africana* populations.
- d) Establish a revised conservative export quota based on the inventory of standing stock and the estimates of sustainable off-take.
- e) Provide a timetable to carry out peer-reviewed ecological studies and appropriate population modelling of *P. africana* in order to establish a long-term management plan for the sustainable use of this species.

Within 2 years (August 2008)

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

satisfaction of the Secretariat and Chairman of the Plants Committee, the Standing Committee should recommend that all Parties suspend trade in all specimens of *Prunus africana* from GQ until that country demonstrates compliance with Article IV, paragraphs 2 (a) and 3, for this species, and provides full and detailed information to the Secretariat regarding compliance with the recommendations of the Plants Committee.

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## Kenya (KE)

Within 3 months (November 2006)

- a) The MA should report to the Secretariat the result of its actions to implement the provisions of Article IV, and how the SA determines that levels of export are not detrimental to the populations concerned.
- b) Clarify reported exports of extract which are likely to be powder, and inform the Secretariat of any facilities to produce extract within the country.
- c) Clarify whether wood or plywood of *P. africana* is or is likely to be exported from Kenya.
- d) In consultation with the CITES Secretariat and the Chairman of the Plants Committee, establish a conservative quota for export of *P. africana* bark and other parts and derivatives exported.

On 18 November 2006, KE advised the Secretariat that concerns about increased exports of *Prunus* bark without scientific undertaking resulted in the MA declaring a moratorium on the issuance of export permits in 2002. However, permits to export two shipments of *Prunus* bark were issued in 2003.

All exports of *P. africana* authorized by KE have been of bark. The MA strongly feels that the data in the CITES trade database showing exports of extracts from KE is erroneous.

KE is in the process of undertaking non-detriment finding studies on *P. africana* and establishing sustainable harvesting levels. The Scientific authorities will be supporting a PhD student to undertake detailed studies on the species. The findings will guide the MA and the Scientific Authorities in

Within 1 year (August 2007)

- e) Carry out an inventory of standing stock, establish estimates of sustainable off-take, taking into account the need to conserve large seed-producing trees, and establish a scientific monitoring system of the harvested and unharvested *P. africana* populations.
- f) Establish a revised conservative export quota based on the inventory of standing stock and the estimates of sustainable off-take.
- g) Provide a timetable to carry out peer-reviewed ecological studies and appropriate population modelling of *P. africana* in order to establish a long-term management plan for the sustainable use of this species.
- h) The Management and Scientific Authorities should report to the Secretariat the final version of the long-term management plan and progress made against that plan.

making scientifically informed decisions regarding setting of harvesting and export quotas on the species. The moratorium on harvesting from the wild for export purposes will continue to be in force until the non-detriment finding studies are completed and recommendations made.

#### **Conclusion**

Some action towards the full implementation of these recommendations has been undertaken but further progress is required if exports are to recommence.

#### **Recommended action**

If KE seeks to recommence exports of products of this species, it should first provide information to the Secretariat on how the Plants Committee recommendations have been implemented.

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### **Madagascar (MG)**

Within 3 months (November 2006)

- a) Report to the Secretariat on the implementation of the National Action Plan for sustainable production of *P. africana* and how this contributes to its SA's determination that levels of export are not detrimental to the populations concerned.
- b) In consultation with the CITES Secretariat and the Chairman of the Plants Committee, establish a conservative quota for export of *P. africana* bark and other parts and derivatives exported.

Within 1 year (August 2007)

- c) Update their inventory of standing stock, establish estimates of sustainable off-take, taking into account the need to conserve large seed-producing trees, and establish a scientific monitoring

The MA of MG reported to the Secretariat on 16 November 2006 and 19 March 2008. The MA explained that there was a moratorium currently in place until inventories were completed and an export quota could be set. It reported work done in recent years, including the establishment by Ministerial decree of a coordination committee chaired by the Director General at the National Forestry Commission; a National Plan of Action for the Sustainable Management of *P. africana*; the creation of communication products; and regulations for *P. africana*. After a public tender process, two inventoried lots in the Sofia region had been allocated to a company for exploitation. The company completed an Environmental Impact Assessment, which was approved, and an environmental licence was granted subject to conditions. The process for issuing an exploitation licence under the new regulations is

system of the harvested and unharvested *P. africana* populations.

- d) Establish a revised conservative export quota based on the inventory of standing stock and the estimates of sustainable off-take.
- e) The MA should report to the Secretariat the result of its actions to implement the provisions of Article IV, and the current means by which the SA determines that levels of export are not detrimental to the populations concerned.
- f) Provide a timetable to carry out peer-reviewed ecological studies and appropriate population modelling of *P. africana* in order to establish a long-term management plan for the sustainable use of this species.

Within 2 years (August 2008)

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

being finalized. The new licence will also be the subject of a test for tracing the origin of products within the system. Research activities underway include acquisition of knowledge of the biology and ecology of *P. africana* and also a study on the genetic and chemical diversity of the species. A small scale experiment on vegetative propagation of *P. africana* is underway with early positive results.

#### **Conclusion**

Action towards the implementation of these recommendations has been undertaken, but further progress is required before a revised conservative export quota based on the inventory of standing stock and the estimates of sustainable off-take can be established.

#### **Recommended action**

If MG seeks to recommence exports of products of this species, it should first provide information to the Secretariat on how the Plants Committee recommendations have been implemented.

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#### **United Republic of Tanzania (TZ)**

Within 3 months (November 2006)

- a) In consultation with the CITES Secretariat and the Chairman of the Plants Committee, establish a conservative quota for export of *P. africana* bark and other parts and derivatives exported.
- b) Clarify reported exports of extract which are likely to be powder, and inform the Secretariat of any facilities to produce extract within the country.

Within 1 year (August 2007)

- c) Carry out a preliminary inventory of standing stock, establish estimates of sustainable off-take, taking into account the need to conserve large seed-producing trees, and establish a scientific

TZ responded to the recommendations in a letter of 24 April 2008. The letter indicates that some steps have been taken to implement the recommendations, including that only part of the bark of trees over 40 years old are harvested and no trees are felled in the process of collecting bark. The letter reports that the United Republic of Tanzania is looking forward to implementing the Plants Committee recommendations. The letter indicated that a stock assessment would be undertaken over the next 2 months.

#### **Conclusion**

It appears that little progress has been made in implementing the recommendations of the Plants Committee.

- monitoring system of the harvested and unharvested *P. africana* populations.
- d) Establish a revised conservative export quota based on the inventory of standing stock and the estimates of sustainable off-take.
  - e) Provide a timetable to carry out peer-reviewed ecological studies and appropriate population modelling of *P. africana* in order to establish a long-term management plan for the sustainable use of this species.

Within 2 years (August 2008)

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

#### **Recommended action**

The deadline for full implementation of all the Plants Committee's recommendations should be extended until 31 December 2008. If these are not implemented to the satisfaction of the Secretariat and Chairman of the Plants Committee, the Standing Committee should recommend that all Parties suspend trade in all specimens of *Prunus africana* from TZ until that country demonstrates compliance with Article IV, paragraphs 2 (a) and 3, for this species, and provides full and detailed information to the Secretariat regarding compliance with the recommendations of the Plants Committee.

The recommendations were supported by the Standing Committee (July, 2008).

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### **OBJECTIVE: ESTABLISHMENT OF THE LONG TERM NON-DETRIMENT FINDINGS PLAN**

A management model for Non-Timber Forestry Resources (NTFR) formed the basis for the proposed methodology, which was designed to prepare the necessary guidelines for implementation of a Non-detriment Findings Plan for the species on Bioko (Equatorial Guinea).

The guidelines provided are the culmination of a series of stages in work oriented towards evaluating the forest resource: *Prunus africana* specimens and their current status following bark-harvesting activities.

In recent years, great effort has gone into proposals of management plans for sustainable use of *Prunus africana* in several Range States. However, integral methodology must be established to evaluate the current situation, to know whether bark harvest is suitable or whether it is affecting the conservation status of the species, and propose corrective measures as needed to achieve sustainable use. The study was devised as a pilot project, covering a pre-selected area under 150,000 ha in Equatorial Guinea; it could give rise to a survey model and be applicable to other countries.

The general goal of the project was to determine the potential and current range of *Prunus africana* on Bioko. Based on this range data, stocks could be assessed, bark harvest evaluated, and proposals made with necessary recommendations to consider in drawing up a management plan for sustainable use of the species. The following specific objectives were established to achieve the general goal (Figure 1):

- 1 Survey of the distribution of dominant types of vegetation by means of remote sensing
- 2 Characterisation of the forests where *Prunus africana* occurs in current and potential harvest areas, in terms of their structure, species composition and diversity of tree species
- 3 Estimate of bark yield, and
- 4 Establishment of silvicultural criteria for sustainable use of *Prunus africana* forests

Figure 1 and 2 summarises a framework to establish national quota of *P. africana*. This outline is synoptic of the main results and conclusions of Equatorial Guinea project to guide possible improvements and final recommendations for consideration in designing a National Management Plan.

This practical case has been organized as a questionnaire following a methodology proposed by ISSC-MAP:

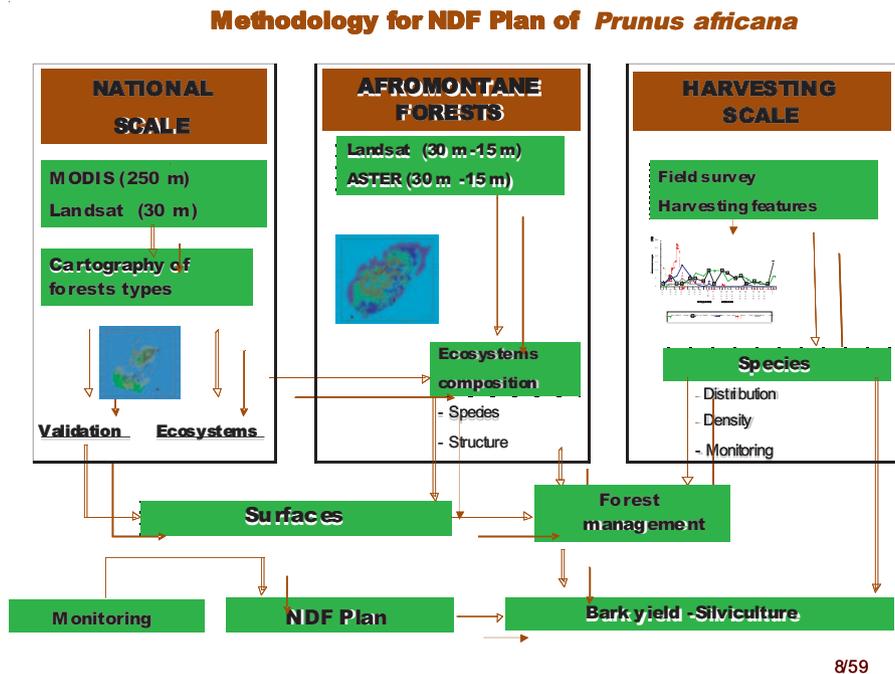


Figure 1. Framework to establish national quota of *P. africana*

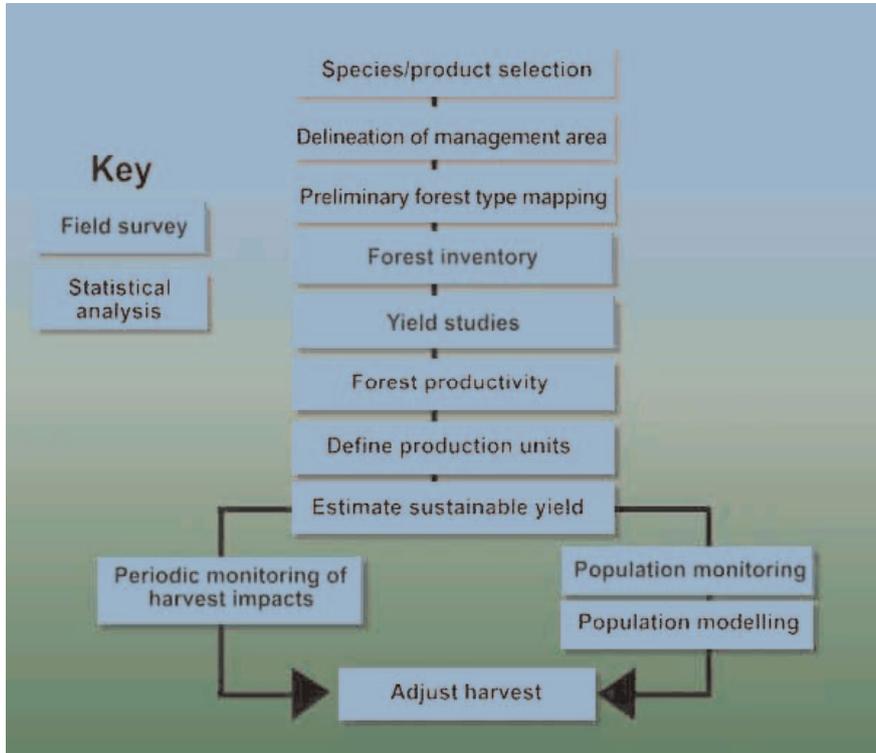
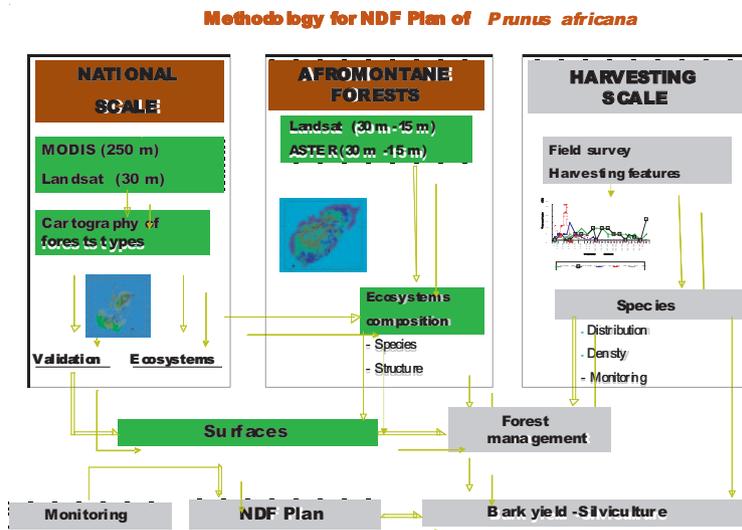


Figure 2. Stages of a modular management strategy for sustainable harvest of non-timber forest products (adapted from Wong, 2000)

WONG, J L G, THORNBUR, K and N Baker. 2001. Resource assessment of non-wood forest products: experience and biometric principles. FAO, Rome

### STEP 1: DEFINITION AND PRELIMINARY MAPPING OF DISTRIBUTION AREAS



## 1.1 NATIONAL DISTRIBUTION OF THE SPECIE

### Objective 1. National forest cartography

Survey of the distribution of the dominant vegetation types at National level by means of remote sensing and additional sources.

Evaluation of national distribution of dominant types of forests

- Is there a Governmental Department in charge of Natural Resources Evaluation and cartography (Geographic Information System and Remote Sensing Laboratory)?
- Is there a forest national cartography available? If yes, which is the map scale? Which is the data format (paper map, digital, etc.) ?[Example, Figure 3]
- Is this information accessible?
- Is this cartography based on field surveys? is it possible to access to a vegetation description of the forest types?

### Sources of information:

Spatial data infrastructure ([www.gsdi.org](http://www.gsdi.org))  
African cartography [www.kew.org/giswww/website/mad/madveg](http://www.kew.org/giswww/website/mad/madveg)African cartography ([www.africover.org/webmap](http://www.africover.org/webmap))

CITES (2001). Development of a methodological framework, and practical guidelines for the estimation, implementation and monitoring of sustainable harvesting quotas for *Prunus africana* at a national scale. PC11 Inf. 10

Dawson, I K and R Rabevohitra. 1996. Status of *Prunus africana* in Madagascar. Unpublished report (10pp). Cited in Schippmann (2001).

DGEF. 2003. Plan d'action national pour la gestion durable du *Prunus africana*. Ministère de l'Environnement, des Eaux et Forêts. Direction Générale des Eaux et Forêts. Comité National *Prunus africana*. Décembre, 2003.

Green, G M and R W Sussmann. 1990. Deforestation history of the eastern rain forests of Madagascar from satellite imagery. *Science* 248:212-215.

Hall, J. B., O'Brien, E. M. and Munjuga, M. (2000). Ecology and Biology, Chapter 2: 3-25 In *Prunus africana: a Monograph*. Hall, J. B., O'Brien, E. M. and Sinclair, F. L., Eds. (2000). School of Agricultural and Forest Sciences

Publication Number 18. University of Wales, Bangor. 104 pp.

Letouzey, R. 1985. Notice de la carte phytogéographique du Cameroun. Toulouse: Institute de la Carte Internationale de la Vegetation.

Midgley, J, R M Cowling, AHW Seydack and G F van wyk. 1997. Forest. Chapter 12 (pp. 278-299) in: R M Cowling, D M Richardson and S Pierce (eds) *Vegetation of southern Africa* (Cambridge University Press).

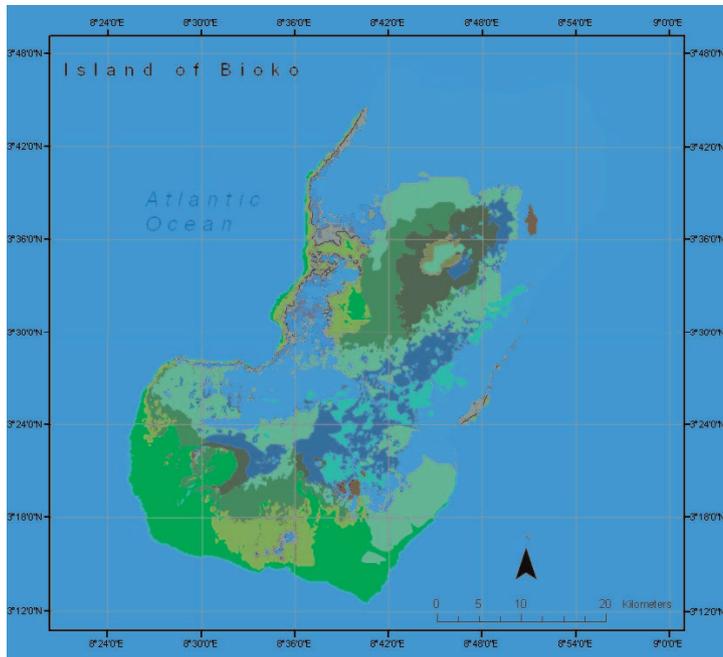
Neba, S A. 1982. *Modern Geography of the United Republic of Cameroon*. New York, Hamilton Printing Company.

ONADEF (1997) Rapport d'Inventaire d'Aménagement du Massif Forestier du Mont Cameroun (Government of Cameroon).

Quansah, N. 1999. *Prunus africana: harvest and resource management in Madagascar*. Medicinal Plant Conservation 5:18.

Walter, S and J.R. Rakotonirina. 1995. L'exploitation de *Prunus africanum* à Madagascar. PCDI Zahamena et la Direction des Eaux et Forêts, Antananarivo, Madagascar.

White, F. (1983). *The Vegetation of Africa*. UNESCO Natural Resources Research, 20: 1-356.



Altitude range	Ocaña, 1960	White, 1983	Summary review of potential vegetation types
(600) 800 (1000) / 1400-1500 m	Montane rainforest; monsoon forest	Afromontane forest	Lowland afromontane forest: monsoon forest
1400 / 1500-2500 m	Araliaceus forest		Highland afromontane forest (Araliaceae)
2500-2700 m	Ericaceous area	Afromontane shrub area	Afromontane heath forest (Ericaceae)
2700-3000 m	Highland herbaceous prairies	Afromontane herbaceous area	Afromontane herbaceous area

Figure 3. - Vegetation Map of the Bioko Island (Equatorial Guinea)

## Results of National distribution of the specie

Task 1 Range States of *Prunus africana*, summarizing the available cartography. Source of information must be included as well as data format (paper, report, scientific paper, computer format).

### 1.2 REGIONAL DISTRIBUTION OF THE SPECIE

#### Objective 2. National forest cartography

Survey of the distribution of forest types where *Prunus africana* exists by means of remote sensing and additional sources.

- Is there detail cartography of forests with current (or potential) distribution of *Prunus africana* forests?
- If yes, what is the scale? How recent is this assessment?) [Example, Figure 4]
- Have the cartography been based on field populations assessments? (Field survey, botanical collection data, etc.)?

#### Sources of information:

Acworth, J, B N Ewusi and N Donalt. 1998. Sustainable exploitation of *Prunus africana* on Mt. Cameroon. Paper delivered at the Symposium on the Conservation of

Medicinal Plants in Trade in Europe. Royal Botanic Gardens, Kew. 22-23 June 1998.

Besong, J B, P Abeng Abe Meka and S Ebamane-Nkoumba. 1991. Etude sur l'exploitation du Pygeum: rapport de mission effectuée dans les provinces du Sud-Ouest, de l'Ouest et du

Nord-Ouest. 25 Janvier 1991. Direction des Forêts, Ministère de l'Agriculture.

Green, G M and R W Sussmann. 1990. Deforestation history of the eastern rain forests of Madagascar from satellite imagery. *Science* 248:212-215.

Hall, J.B. 1973. Vegetational zones on the southern slopes of Mount Cameroon. *Vegetatio* 27: 49-69.

Midgley, J, R M Cowling, AHW Seydack and G F van wyk. 1997. Forest. Chapter 12 (pp. 278-299) in: R M Cowling, D M Richardson and S Pierce (eds) *Vegetation of southern Africa* (Cambridge University Press).

ONADAF (2000) Rapport sur la détermination

de dire de répartition du *Prunus africana*. (Pygeum) dans les province de l'Ouest, Littoral et du Nord-Ouest Cameroun.

Sunderland, T.C., Tako, C.T., 1999. The Exploitation of *Prunus africana* on the Island of Bioko, Equatorial Guinea. Report Prepared for the People and Plants Initiative, WWF Germany, and the IUCN.SSC Medicinal Plant Specialist Group.

Thenkabail, P. S., Enclona, E. A., Ashton, M. S., Legg, C. and Jean De Dieu, M. (2004). Hyperion, IKONOS, ALI, and ETM+ Sensors in the Study of African Rainforests. *Remote Sensing of Environment* 90: 23-43.

### Results of Forest type's distribution with presence of *Prunus africana*

Task 2.- Forest types where *Prunus africana* exists, summarizing the available cartography. Source of information must be included as well as data format (paper, report, scientific paper, computer format).

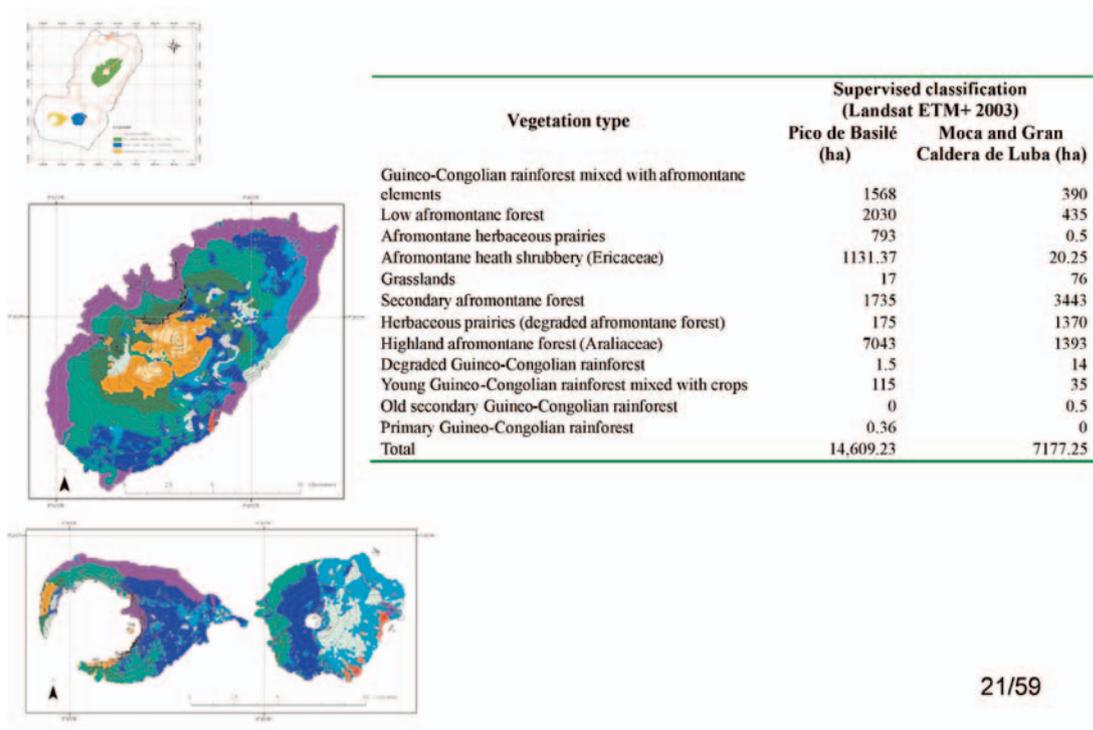
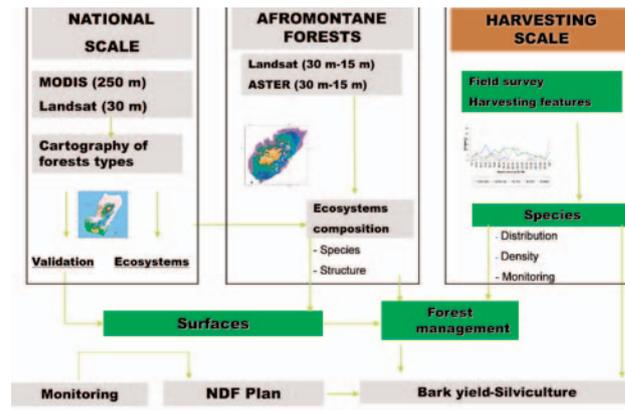


Figure 4 .- Distribution of vegetation types in Pico Basilé at altitudes above 1400 m according to supervised classification (WGS 84; Zone 32 N) (Bioko-Equatorial Guinea) and surfaces for vegetation type by using a Landsat 7 ETM+ image (Clemente et al., 2006).

## STEP 2: VEGETATION AND STRUCTURAL FEATURES OF *PRUNUS AFRICANA* FORESTS



### 2.1 SURVEY DESIGN AND ASSESSMENT

#### Objective 3. Inventory of the *Prunus africana* forest

Survey of the species and structural features of the *Prunus africana* in the distribution area by means of field inventory and assessment.

- Have any inventories or assessments of this species been conducted in the distribution area? What is the survey design? [Example, Figure 5]
- Have any ecological approach of this species been conducted in the distribution area?
- Describe the resource inventory the density and silvicultural features for this species?

#### Sources of information

Acworth, J., Ndam, N., Tchouto, P., Edwards, I. and Proctor, J. (1996). Review of Past Inventories and Prospects for Long Term Monitoring for Forest Management and Biodiversity Conservation on Mt. Cameroon. Report on the Conference and Training Workshop on Growth Studies in Tropical Moist Forest in Africa. Centre for International Forestry Research (CIFOR). Kumasi. Ghana.

Ndam, N., Ewusi, B.; Asanga, C.; Hall, J.B. (2000). The management context, Chapter 3: 27-37 In *Prunus africana*: a Monograph. Hall, J. B., O'Brien, E. M. and Sinclair, F. L., Eds. (2000).

School of Agricultural and Forest Sciences Publication Number 18. University of Wales, Bangor. 104 pp.

Thompson S.K. and G.A.F. Seber (1996) Adaptive Sampling, Wiley, New York.

Underwood F.M. and R.W. Burn (2000) Biometric aspects of sampling for the Cameroon inventory of *Prunus africana*. Mount Cameroon pilot phase. Interim report. Statistical Services Centre, Department of Applied Statistics, University of Reading. Unpublished.

Wong J.L.G. (2000) The biometrics of non-timber forest produce resource assessment: A review of current methodology. <http://www.etfrn.org/etfrn/workshop/ntfp/> (June 2001)

#### Results of forest inventory of *Prunus africana*

Task 3 Ecological studies conducted in the areas where *Prunus africana* exists. Source of information must be included.

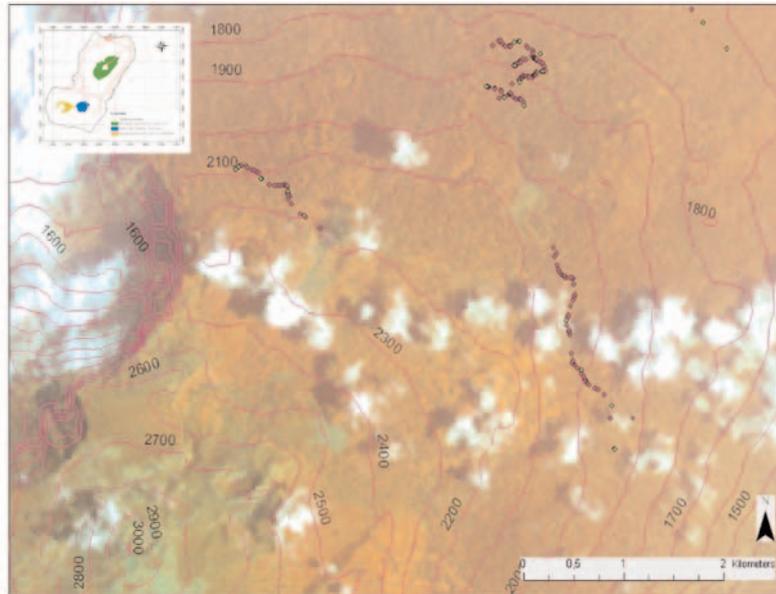


Figure 5 – Location of transects on Pico de Basilé and Moca-Lake Biaó: *P. africana* trees are marked with red dots and the systematic inventories are marked with yellow dots. (WGS 84; Zone 32 N).

## 2.2. KEY STRUCTURAL FEATURE: NUMBER OF TREES PER HECTARE AND DIAMETRIC DISTRIBUTION

### Objective 4. Population statistics

Determination of stocking levels and tree features of *Prunus africana* trees in the distribution area by means of field inventory.

- Is the population statistics of distribution areas known (e.g. density, tree size)? [Example, Figure 6]
- Have any species regeneration assessments been conducted?
- Have any long-term ecological monitoring assessments been conducted?

### Sources of information

- Geldenhuis, C. J. 1981. *Prunus africana* in the Bloukrans River Gorge, southern Cape. South African Forestry Journal, 118, 61-66.
- Hall, J.B. 1973. Vegetational zones on the southern slopes of Mount Cameroon. Vegetatio 27: 49-69.
- Hedberg, O. 1964. Features of Afroalpine plant ecology. Acta Phytogeographica Sueca 49:1-144.
- Ndam, N., Ewusi, B.; Asanga, C.; Hall, J.B. (2000). The management context, Chapter 3: 27-37 In *Prunus africana: a Monograph*. Hall, J. B., O'Brien, E. M. and Sinclair, F. L., Eds. (2000). School of Agricultural and Forest Sciences Publication Number 18. University of Wales, Bangor. 104 pp.
- Newbery, D.M., and J.S. Gartlan. 1996. A structural analysis of rain forest at Korup and Douala-Edea, Cameroon. Proceedings of the Royal Society of Edinburgh Section B Biological Sciences 104: 177-224.
- Sunderland, T.C., Tako, C.T., 1999. The Exploitation of *Prunus africana* on the Island of Bioko, Equatorial Guinea. Report

Prepared for the People and Plants Initiative, WWF Germany, and the IUCN.SSC Medicinal Plant Specialist Group.

Terry C.H. Sunderland, James A. Comiskey, Simon Besong, Hyacinth Mboh, John

Fonwebon and Mercy Abwe Dione  
Vegetation Assessment of Takamanda Forest Reserve, Cameroon SI/MAB Series #8, 2003, Pages 19 to 53

## Results of forest inventory of *Prunus africana*

Task 4 *Prunus africana* population: density, tree size. Source of information must be included.

Taxa	Place	Density (trees/ha)	BA (m <sup>2</sup> /ha)
<i>Bersama abyssinica</i>	Moca	4.46	1.43
<i>Crassocephalum mannii</i>	Basilé and Moca	0.39	0.31
<i>Ficus chlamydocarpa</i> var. <i>chlamydocarpa</i>	Moca	1.55	0.46
<i>Ficus</i> sp.	Basilé and Moca	2.72	1.04
<i>Ficus</i> sp.	Basilé	0.39	0.31
<i>Homalium</i> sp.	Moca	0.58	0.26
<i>Hypericum lanceolatum</i>	Basilé and Moca	0.39	0.31
<i>Macaranga spinosa</i>	Basilé	0.58	0.26
<i>Maesa lanceolata</i>	Moca	4.08	1.21
<i>Neboutonia macrocalix</i>	Basilé	6.60	1.91
<i>Nuxia congesta</i>	Basilé and Moca	4.27	1.29
<i>Oxyanthus</i> spp.	Moca	3.49	1.94
<i>Polyscias fulva</i>	Basilé and Moca	2.33	0.51
<i>Prunus africana</i>	Basilé and Moca	7.18	0.94
<i>Psychotria peduncularis</i>	Moca	0.78	0.37
<i>Psychotria</i> sp.	Moca	0.19	0.16
<i>Schefflera</i> spp. ( <i>S. barteri</i> , <i>S. mamii</i> )	Basilé and Moca	8.93	1.65
<i>Trema orientalis</i> .	Basilé and Moca	0.97	0.40
<i>Trichilia prieureana</i>	Basilé	5.05	1.62
<i>Uragoga</i> sp.	Basilé and Moca	0.39	0.22
<i>Xymalos monospora</i>	Moca	2.33	0.87
<i>Zanthoxylum</i> sp.	Moca	0.39	0.22
Other unidentified species (Bubi names)	Basilé and Moca	11.05	5.64
<b>Total Figures</b>		<b>69.29</b>	<b>23.51</b>

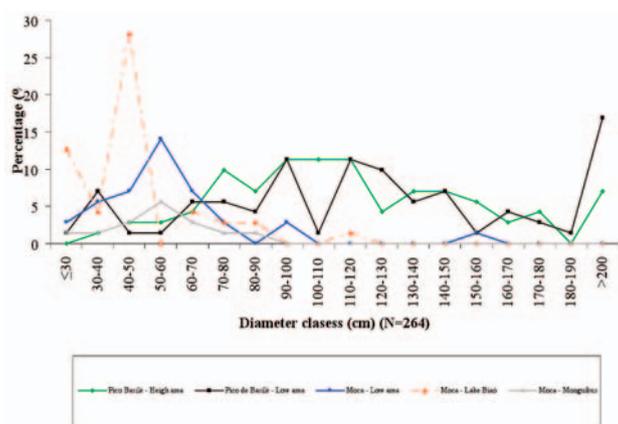
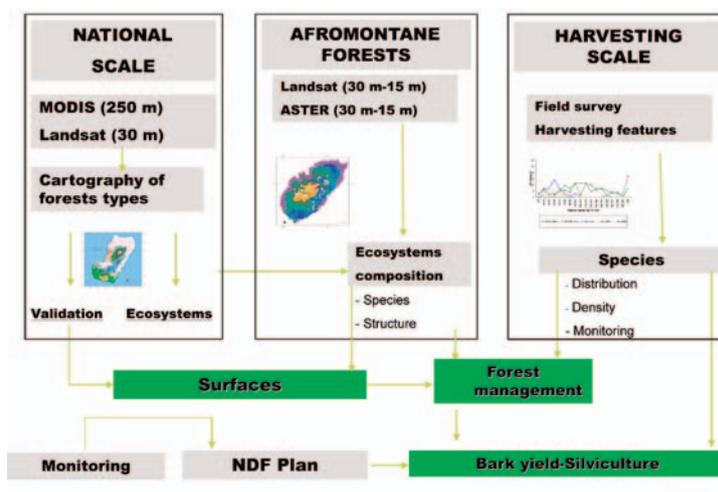


Figure 6 – Density and percentage distribution of *Prunus africana* individuals by diameter class in each of the harvest areas studied on Bioko

## STEP 3: SILVICULTURAL KNOWLEDGE OF *PRUNUS AFRICANA* FORESTS



### 3.1. BARK YIELD

#### Objective 5. Average bark yield and harvesting

Calculation of tree features related to yield bark production: diameter, harvesting height, and bark thickness

- Are current collection based on quantitative bark estimation? [Example, Figure 7]
- Is there any estimation of fresh bark weight/dry bark weight?
- Are there debarking methods in place?
- Has bark thickness been estimated in natural trees?, has bark regeneration period been studied? [Example, Figure 8]

#### Sources of information

Acworth J.M., B.J. Ewusi and D. Ngatoum (1998) Sustainable Exploitation of *Prunus africana* on Mt. Cameroon. Paper distributed at the Symposium on the Conservation of Medicinal Plants in Trade in Europe. Royal Botanic Gardens Kew, London. 22 - 23 June 1998.

Cunningham A.B. & F.T. Mbenkum (1993) Sustainability of harvesting of *Prunus africana* bark in Cameroon. People and Plants working paper number 2. UNESCO.

Eben Ebai, S.; Ewusi, B. N.; Asanga, C. A.; Nkongo, J. B. N. 1992. An evaluation of the quantity and distribution of *Pygeum africanum* on the slopes of Mount Cameroon. Limbe, Cameroon. Divisional Service of Forestry. Fako Divisional Service of Forestry, United Republic of Cameroon. 1988. Annual Report 1987/88. Limbe, Divisional

Delegation of Agriculture, Ministry of Agriculture.

Ewusi, B.N., Tanyi Charles, T., Nyambi, J. and Acworth, J. 1996. Bark extraction : current situation and sustainable cropping of *Prunus Africana* on Mount Cameroon. Unpublished paper, Mount Cameroon Project, Limbe, Cameroon.

Ndam N. and Tonye, M.M. 2004. *Prunus africana* on Mount Cameroon: A case study of the production-to consumption systems. In: Sunderland T. and Ndoye O. (Eds). Forest Products, Livelihoods and Conservation. Case studies of Non-Timber Forest Product Systems. Vol. 2 -Africa. Pp 37-52.

Walter, S and J.R. Rakotonirina. 1995. L'exploitation de *Prunus africanum* à Madagascar. PCDI Zahamena et la Direction des Eaux et Forets, Antananarivo, Madagascar.

#### Results of forest inventory of *Prunus africana*

Task 5 Bark yield parameters: density, diameter, harvesting height, and bark thickness. Source of information must be included.

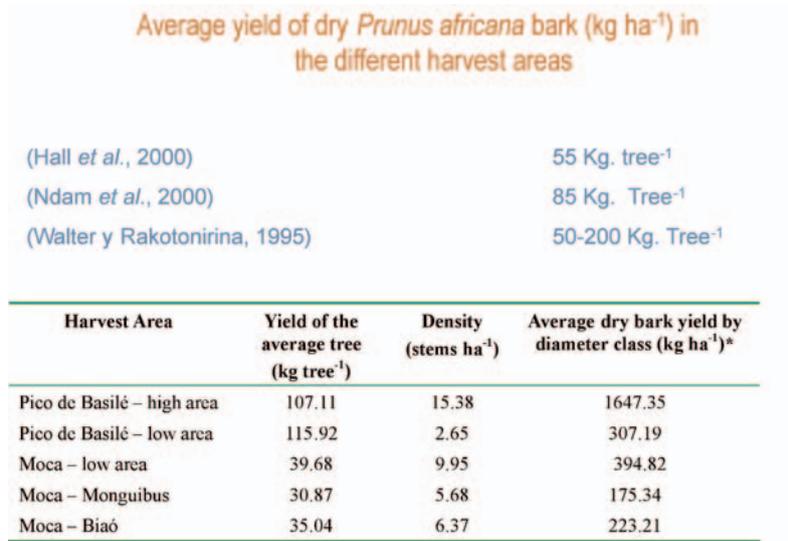


Figure 7 – Bark yield related to density, diameter and harvesting height on Bioko (Equatorial Guinea) (Clemente *et al.*, 2006).

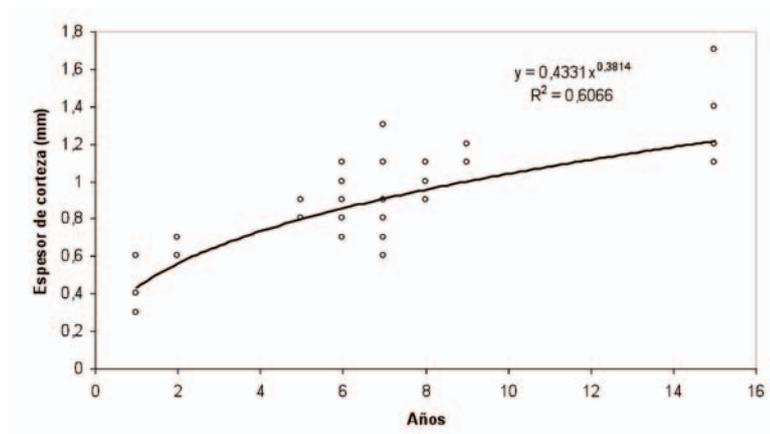


Figure 8 – Bark thickness by number of years since harvest on Pico de Basilé (Clemente *et al.*, 2006).

### 3.2. Regeneration models

#### Objective 6. Regeneration models

Although regeneration models are not part of the quotas assessment, several studies have demonstrated the impacts of bark harvest on *Prunus africana* populations in natural regeneration. Therefore, research on model population must be promoted following previous works (Stewart, 2001, 2003) to predict population decline.

## Sources of information

Fashing, P J. 2004. Mortality trends in the African cherry (*Prunus africana*) and the implications for colobus monkeys (*Colobus guereza*) in Kakamega Forest, Kenya. *Biological Conservation* 120:449-459

Hall, J. B., O'Brien, E. M. and Munjuga, M. 2000. Ecology and Biology, Chapter 2: 3-25 In *Prunus africana: a Monograph*. Hall, J. B., O'Brien, E. M. and Sinclair, F. L., Eds. (2000). School of Agricultural and Forest Sciences Publication Number 18. University of Wales, Bangor. 104 pp.

Stewart, K.M. 2001. The commercial bark harvest of the African cherry (*Prunus africana*) on Mount Oku, Cameroon: effects on traditional uses and population dynamics. PhD dissertation. Florida International University.

Stewart, KM. 2003a. The African cherry (*Prunus africana*): can lessons be learned from an over-exploited medicinal tree? *J Ethnopharmacol* 89:3-13

Stewart, K.M. 2003b. The African cherry (*Prunus africana*): From hoe-handles to the international herb market. *Economic Botany* 57(4): 559-569.

## STEP 4: ASSESMENT OF EXPORT QUOTAS OF *PRUNUS AFRICANA*

### 4.1. Maximal potential bark quotas

#### Objective 7. Calculation of potential *Prunus africana* bark yield in harvest areas

A potential harvest quota should be determined for the accessible sites using Ondigui's proposed equation (2001), assuming an unharvested stand [Example, Figure 9]:

$$Q = [A \times P \times RME \times Y \times V] F^{-1}$$

where: Q = annual quota per management unit (kg of dry material) A = harvest area (ha) P = proportion of area exploited (%) RME = minimum estimated density of *Prunus africana* in the harvest unit (trees ha<sup>-1</sup>) Y = estimated yield per tree per harvest (kg of dry material per tree) V = proportion of exploitable trees (%) (alive and not over-exploited) F = return times (years)

- Is potential bark yield calculated by the use of population and bark yield data? [Example, Table 5]
- Is the current bark extraction quota known in harvest areas?

## Sources of information

Acworth J.M., B.J. Ewusi and D. Ngatoum (1998) Sustainable Exploitation of *Prunus africana* on Mt. Cameroon. Paper distributed at the Symposium on the Conservation of Medicinal Plants in Trade in Europe. Royal Botanic Gardens Kew, London. 22 - 23 June 1998.

Cunningham A.B. & F.T. Mbenkum (1993) Sustainability of harvesting of *Prunus africana* bark in Cameroon. People and Plants working paper number 2. UNESCO.

Eben Ebai, S.; Ewusi, B. N.; Asanga, C. A.; Nkongo, J. B. N. 1992. An evaluation of the

quantity and distribution of *Pygeum africanum* on the slopes of Mount Cameroon. Limbe, Cameroon. Divisional Service of Forestry. Fako Divisional Service of Forestry, United Republic of Cameroon. 1988. Annual Report 1987/88. Limbe, Divisional Delegation of Agriculture, Ministry of Agriculture.

Ewusi, B N, T Tanyi Charles, J Nyambi and J Acworth. 1996. Bark extraction: current situation and sustainable cropping of *Prunus africana* on Mount Cameroon. Mount Cameroon Project, Limbe, Cameroon.

Ndam N. and Tonye, M.M. 2004. *Prunus africana* on Mount Cameroon: A case study of the production-to consumption systems. In: Sunderland T. and Ndoye O. (Eds). Forest Products, Livelihoods and Conservation. Case studies of Non-Timber Forest Product Systems. Vol. 2 -Africa. Pp 37-52.

Ndam, N., Ewusi, B., Asanga, G. and Hall, J. B. (2000). The Management Context, Chapter 3: 27-37 In *Prunus africana*: a Monograph. Hall, J. B., O'Brien, E. M. and Sinclair, F. L., Eds. (2000). School of Agricultural and

Forest Sciences Publication Number 18. University of Wales, Bangor. 104 pp.

Ondigui, B. R. P. (2001). Sustainable Management of a Wild Plant Species for the Conservation of Montane Forest Ecosystems and the Welfare of Local Communities: A Case Study of *Prunus africana* in the Mount Cameroon Area. 9 pp. In Sustainable Management of a Wild Plant Species. Proceedings of the World Mountain Symposium. Interlaken, Switzerland.

### Results of forest inventory of *Prunus africana*

Task 6 Identify a numeric approach to calculate bark yield quota at the National and local level.

Figure 9 – Estimated potential annual dry bark yield for an unharvested stand, by surface area to be harvested, proportion of area exploited, *Prunus africana* density, estimated dry bark yield in current and new proposed harvest areas, proportion of trees exploited, and return times (F = 10 years and F = 8 years). Values for the new proposed harvest areas are shown in boldface type.

Working area	A Surface area harvested (ha)	P Proportion of area exploited (%)	RME <i>Prunus africana</i> density (stems ha <sup>-1</sup> )	Y Estimated yield per tree (kg tree <sup>-1</sup> )	RME x Y Estimated dry bark yield <sup>1</sup> (kg ha <sup>-1</sup> )	V Proportion of exploitable trees (%)	Estimated potential bark yield <sup>2</sup> (t year <sup>-1</sup> ) in unharvested condition, depending on F (N° of years between harvests)	
							F = 10 years	F = 8 years
							Current areas	Current areas
Current areas								
Pico de Basilé – high area	1622	80	15.38	107.11	1647.35	90	192.38	240.48
Pico de Basilé – low area	1119	80	2.65	115.92	307.19	90	24.74	30.93
Moca – low area	282	80	9.95	39.68	394.82	90	8.16	10.02
Moca – Monguibus	103	80	5.68	30.87	175.34	90	1.30	1.62
Moca – Lake Biaó	72	80	6.37	35.04	223.21	90	1.15	1.44
Total current areas <sup>3</sup>							227.73	284.49
New areas							New areas	New areas
Pico de Basilé – south area (estimated)	1500	80	7.56 (estimated)	111.5 (estimated)	842.94 (estimated)	90	<b>91.03 (estimated)</b>	<b>113.79 (estimated)</b>
Pico de Basilé – east area (estimated)	1000	80	7.56 (estimated)	111.5 (estimated)	842.94 (estimated)	90	<b>60.69 (estimated)</b>	<b>75.86 (estimated)</b>
Total with new areas <sup>4</sup>							<b>379.45</b>	<b>474.14</b>

## 4.2. Current available quotas

### Objective 8. Calculation of current quotas of *Prunus africana* in harvest areas

The potential quota must be compared to the current extraction in harvest areas [Example, Figure 10].

- Are current bark yield calculated by the use of population and bark yield data? [Example, Figure 10]
- Is there any estimation of fresh bark weight/dry bark weight?

### Sources of information

- Acworth J.M., B.J. Ewusi and D. Ngatoum (1998) Sustainable Exploitation of *Prunus africana* on Mt. Cameroon. Paper distributed at the Symposium on the Conservation of Medicinal Plants in Trade in Europe. Royal Botanic Gardens Kew, London. 22 - 23 June 1998.
- Cunningham A.B. & F.T. Mbenkum (1993) Sustainability of harvesting of *Prunus africana* bark in Cameroon. People and Plants working paper number 2. UNESCO.
- Eben Ebai, S.; Ewusi, B. N.; Asanga, C. A.; Nkongo, J. B. N. 1992. An evaluation of the quantity and distribution of *Pygeum africanum* on the slopes of Mount Cameroon. Limbe, Cameroon. Divisional Service of Forestry. Fako Divisional Service of Forestry, United Republic of Cameroon. 1988. Annual Report 1987/88. Limbe, Divisional Delegation of Agriculture, Ministry of Agriculture.
- Ewusi, B N, T Tanyi Charles, J Nyambi and J Acworth. 1996. Bark extraction: current situation and sustainable cropping of *Prunus africana* on Mount Cameroon. Mount Cameroon Project, Limbe, Cameroon.
- Ndam N. and Tonye, M.M. 2004. *Prunus africana* on Mount Cameroon: A case study of the production-to consumption systems. In: Sunderland T. and Ndoye O. (Eds). Forest Products, Livelihoods and Conservation. Case studies of Non-Timber Forest Product Systems. Vol. 2 -Africa. Pp 37-52.
- Ndam, N., Ewusi, B., Asanga, G. and Hall, J. B. (2000). The Management Context, Chapter 3: 27-37 In *Prunus africana*: a Monograph. Hall, J. B., O'Brien, E. M. and Sinclair, F. L., Eds. (2000). School of Agricultural and Forest Sciences Publication Number 18. University of Wales, Bangor. 104 pp.
- Ondigui, B. R. P. (2001). Sustainable Management of a Wild Plant Species for the Conservation of Montane Forest Ecosystems and the Welfare of Local Communities: A Case Study of *Prunus africana* in the Mount Cameroon Area. 9 pp. In Sustainable Management of a Wild Plant Species. Proceedings of the World Mountain Symposium. Interlaken, Switzerland.

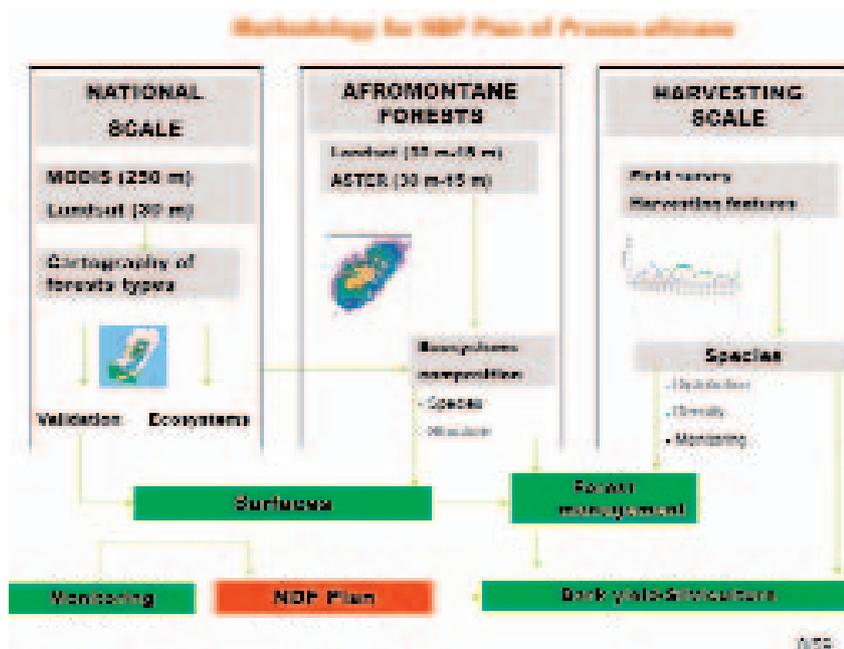
### Results of forest inventory of *Prunus africana*

Task 7 To discuss the current national quotas with the estimated quotas using the Ondigui's equation.

Figure 10.– Current annual dry bark yield for an unharvested stand, by surface area to be harvested, proportion of area exploited, *Prunus africana* density, estimated dry bark yield in current and new proposed harvest areas, proportion of trees exploited, and return times (F = 10 years and F = 8 years). Values for the new proposed harvest areas are shown in boldface type

Harvest area	Estimated potential bark yield (t year <sup>-1</sup> ) in unharvested condition, depending on F (n° of years between harvests)		Recommended quota (t year <sup>-1</sup> ) for 2006 following analysis of status in current and new harvest areas	
	F = 10 yrs	F = 8 yrs	F = 10 yrs	F = 8 yrs
Current areas	Current areas	Current areas	Current areas	Current areas
Pico de Basilé highlands	192.38	240.48	0 (bark regeneration period)	0 (bark regeneration period)
Pico de Basilé lowlands	24.4	30.93	0 (bark regeneration period)	0 (bark regeneration period)
Moca lowlands	8.16	10.2	4.8 (2 <sup>nd</sup> harvest)	5.1 (2 <sup>nd</sup> harvest)
Moca Monguibus	1.30	1.62	1.30 (unharvested)	1.62 (unharvested)
Moca Lake Biaó	1.15	1.44	0.58 (2 <sup>nd</sup> harvest)	0.72 (2 <sup>nd</sup> harvest)
<b>Total current areas</b>	<b>227.73</b>	<b>284.49</b>	<b>5.96</b>	<b>7.35</b>
New areas	New areas	New areas	New areas	New areas
Pico de Basilé (south)	91.03 (estimated)	113.79 (estimated)	91.03 (estimated)	113.79 (estimated)
Pico de Basilé (cast)	60.69 (estimated)	75.86 (estimated)	60.69 (estimated)	75.86 (estimated)
<b>Total with new areas</b>	<b>379.45</b>	<b>474.14</b>	<b>157.68</b>	<b>197</b>

### 4.3. Monitoring system



## Objective 9. NDF Plan and Monitoring System

Once the national current quota has been established, the NDF Plan should describe aspects related to operational harvesting and monitoring:

- Are the Management plans adapted depending of the situation observed through monitoring?
- How do stakeholders participate in the day-to-day implementation of the management plan (need to find out specifically how affected communities, collectors, middlemen are involved)?
- How is processing carried out by the harvesters before the material is sold?
- Are the main stages in the commodity chain from harvesting to export or sale known and documented (e.g. harvesters in the communal areas sell to intermediate buyers, or sell to exporters directly)?
- Are the main actors in the commodity chain identified?
- Can the processed product in the market place be traced back to its point of collection?
- Resource managers and collectors have adequate skills (training, supervision, experience) to implement the provisions of the management plan, and to comply with the requirements of this standard.
- Resource assessment and monitoring?
- Adaptive management process?
- Participatory processes (working with collectors to assess and monitor harvest impacts)?

## References

- Acworth, J., Ndam, N., Tchouto, P., Edwards, I. and Proctor, J. (1996). Review of Past Inventories and Prospects for Long Term Monitoring for Forest Management and Biodiversity Conservation on Mt. Cameroon. Report on the Conference and Training Workshop on Growth Studies in Tropical Moist Forest in Africa. Centre for International Forestry Research (CIFOR). Kumasi. Ghana.
- CITES (2001). Development of a Methodological Framework, and Practical Guidelines for the Estimation, Implementation and Monitoring of Sustainable Harvesting Quotas for *Prunus africana* at a National Scale. Project Proposal. Eleventh meeting of the Plants Committee, Langkawi (Malaysia), 3-7 September 2001.
- Ndam, N., Ewusi, B.; Tonye, M.; Laird, S., O'Brien, E. (2000). Policy and Regulatory Frameworks, Chapter 8: 67-71 In *Prunus africana: a Monograph*. Hall, J. B., O'Brien, E. M. and Sinclair, F. L., Eds. (2000). School of Agricultural and Forest Sciences Publication Number 18. University of Wales, Bangor. 104 pp.
- Hall, J., Sinclair, F. (2000). Securing the *Prunus* resource, Chapter 9: 73-79 In *Prunus africana: a Monograph*. Hall, J. B., O'Brien, E. M. and Sinclair, F. L., Eds. (2000). School of Agricultural and Forest Sciences Publication Number 18. University of Wales, Bangor. 104 pp.