A PROTOCOL FOR PARTICIPARTORY INVENTORIES OF TIMBER AND NON-TIMBER FOREST PRODUCTS IN CAMEROON II: REFINING THE METHODOLOGY

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The objective of this report is to streamline and refine the inventory methodology used to conduct village-level surveys of timber and non-timber forest resources in the IR1 component of the Central African Regional Program for the Environment (CARPE). The analysis builds on the previous report by Peters (1999) and is supplemented by the inventory results and experiences outlined in Sunderland and Tchouto (1999). The work was undertaken as part of a short-term consultancy with World Learning, Inc. of Washington, DC.

Peters, C.M. 1999. *A Protocol for Participatory Inventories of Timber and Non-timber forest products in Cameroon*. Report to IR1/CARPE.

Sunderland, T.C.H. and P. Tchouto. 1999. *A Participatory Survey and Inventory of Timber and Non-timber Forest Products of the Mokoko River Forest Reserve, SW Province, Cameroon*. Report to IR1/CARPE

BACKGROUND

An effective procedure for conducting participatory forest inventory work embodies several characteristics. Perhaps the first and most important of these is that the inventory design actually collects the data required to fulfill the stated objective. In statistical terms, the inventory should allow us to sample certain parameters of interest (e.g. floristic composition, species density and abundance, size distribution) in a small, selected area of forest with sufficient precision that the results can later be expanded to characterize the entire forest. The inventory should also be cost effective and time efficient and should mesh easily with the schedules and lifestyles of the community participants that will be doing the work. Finally, the inventory procedures should be simple and straightforward enough that everyone understands *how* the work is to be done, *why* each step is important, and *what* is to be done with the data once it is collected. To have any lasting impact or utility, the inventory methodology must be fully understood by the community.

The development of such a methodology invariably involves several iterations. In most cases, the best way to go about this is to start with a basic set of procedures that have proven effective in similar circumstances, field test them in several localities, and then adjust and refine things until a workable and easily transferable protocol results. This is essentially the strategy that is being followed in Cameroon. An initial design for participatory inventories of timber and non-timber resources was first developed in March of 1999 (Peters, 1999). This protocol[1] was then tested in April of 1999 at the villages of Dikome and Bonjare near the Mokoko River Forest Reserve. The results from this fieldwork are summarized in Sunderland and Tchouto (1999).

In general, the work at Mokoko verified that the basic components of the original inventory methodology are sound. However, close reading of the final report and subsequent conversations with Terry Sunderland suggest that there are several aspect of the protocol used at Mokoko that need to be changed or expanded before

[1] A slightly modified version of the protocol outlined by Peters (1999) was employed in the surveys at Dikome and Bonjare. The author, however, was in close contact with the Sunderland/Tchouto team during this period, and most of the procedural modifications were discussed prior to their implementation in the field.

additional work is started at Djoum and the Tikar Plain. These changes apply to three main areas of the inventory: 1) species selection, 2) sample intensity, and 3) field procedures. Each of these are discussed in detail below.

SPECIES SELECTION

The list of species to be included in the inventory clearly must be defined before fieldwork commences at each site. As much as we might like to use one standard list of timber and non-timber resources in all localities, the truth of the matter is that all of the valuable plant resources in Cameroon don't occur in all of the forests. Densities of different species vary greatly from one forest to the next, as does the subsistence or commercial importance of different species to local communities. Each village will undoubtedly have its own unique list of locally important and/or abundant plant resources. Preliminary ethnobotanical surveys must be conducted in each village prior to the inventory to compile such a list of plant resources (Martin, 1995; Alexiades, 1996).

Martin, G.J. 1995. *Ethnobotany: A Methods Manual*. Chapman and Hall, NY.

Alexiades, M.N. 1996. *Selected Guidelines for Ethnobotanical Research: A Field Manual*. Advances in Economic Botany 10.

Based on interviews with Limbe Botanical Garden staff and community members from Bonjare and Dikome, Sunderland and Tchouto (1999) compiled a list of fifteen important non-timber forest products and fourteen timber species in the Mokoko Forest Reserve. Unfortunately, no distinction is made between those species reported in Dikome and those reported in Bonjare, and so it is unclear whether there was variability in the relative importance of different resources between these two communities**. Future ethnobotanical surveys should segregate the results from each sample village and strive to compile a unique list of useful species for each inventory locale[2].**

It would be useful to record the results from the ethnobotanical interviews in each village on a standardized tally sheet which shows the name of the plant species, its life form (e.g. tree, shrub, vine, herbaceous plant), the specific plant part that is used (e.g. stems, fruits/seeds, leaves, bark, exudates), what it is used for (e.g. timber, construction, cordage, food, medicine, oil, etc.) and whether the resource is of commercial or subsistence importance. An example of such a tally sheet is shown in Annex I. The species recorded during this process will serve as the total pool of resources from which a final list of species will be selected. During the course of the inventory, replicate herbarium specimens should be collected of every species on the list that is encountered with flowers or fruit.

SAMPLE SIZE AND INTENSITY

In spite of the volume of data collected, the fieldwork at Mokoko can perhaps best be viewed as a methodology testing exercise rather than a systematic inventory whose aim was to describe the distribution and abundance of important forest resources at the Mokoko River Forest Reserve. The reserve extends over approximately 9,100 hectares. The total sample area at Dikome and Bonjare combined was only eight hectares and none of the transects were more than one kilometer long[3]. **It is**

[2] The are several good reasons for keeping the data from each village separate. Even assuming that the floristic composition of the forests surrounding two villages is virtually identical, it would be extremely rare for both villages to generate an identical ranking of important forest resources. History, culture, and preference exert a powerful influence on the overall importance afforded a plant resource, and noting how these perceptions vary from village to village are key data.

[3] This comment is not intended to reflect negatively on the fieldwork done at Mokoko. Given the time constraints and prevailing conditions, Terry Sunderland, Peguy Tchouto,

important to understand that the amount of inventory work at Tikar Plain and Djoum must be significantly increased if the overall objectives of the project are to be obtained . This will require more days in the field, more field crews, and longer transects.

Individual transects should be at least two to five kilometers in length to ensure that each survey line bisects as many different habitat types as possible. The longer the transect, the greater the amount of "edge" or perimeter the sample unit contains and the greater the probability that all of the inherent variability on the site will be accounted for. A larger number of transects should also be surveyed at each site. At the very least, the entire area routinely foraged over by the members of a particular community, i.e. the home range, should be completely bisected by a network of transects.

To guarantee that the transects extend over a larger total area, and, therefore, sample a larger number of the representative forest types, it is recommended that the sample intensity of the inventory be reduced from 10% to 5%. Operationally, what this means is that the parallel transects will be separated by 200 m rather than 100 m. This should enable the field crews to cover more ground in a shorter period of time, and, given the small standard errors exhibited by the Mokoko data, the smaller sample intensity should not greatly reduce the precision of the final inventory results (e.g. Avery and Burkhart, 1983; Köhl, 1993). For example, the eight 1-km transects recorded at Mokoko were spread out over a total area of 80 hectares (i.e. a 10% sample). Using a 5% sample the same transects would have covered 160 hectares.

Avery, T.E. and H.E. Burkhart. 1983. *Forest Measurements*. McGraw-Hill.

Köhl, M. 1993. Forest Inventory, pp. 244-326 *in* L. Pancel (ed.), *Tropical Forestry Handbook*

FIELD PROCEDURES

Several aspects of the field procedures used in the inventory can be streamlined to speed up operations. The most important of these concern the plants that are to be counted, the way that slope collections are made, and the method used to tally the data along the transects.

Sample Trees

During the field work at Mokoko, all trees greater than 4.0 cm DBH found in the transects were measured for diameter and tallied. Treelets, shrubs, and rattans taller than 50 cm were measured for height and tallied. **To reduce the number of individuals that have to be counted and measured, it is recommended that the minimum diameter limit for trees be raised to 5 cm DBH and the minimum height limit for shrubs and rattans be raised to 1.0 m in subsequent inventories.**

It was original suggested that 5 x 5 m regeneration plots be established every 100 m along the transects (Peters, 1999), and this sampling scheme was carried out at Mikoko. Due to the extra time required to sample these plots, the large quantity of data that must be collected and processed (T. Sunderland, *personal communication*), and apparent problems with the analysis and application of the data[4], **the regeneration**

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and the villagers from Dikome and Bonjare are to be commended for the quantity and quality of the data collected.

[4] In spite of the large quantity of regeneration data that were collected at Mokoko, these results were not presented or specifically addressed in the final report. This was undoubtedly a reflection either of the excessive amount of time required to analyze the data, or the excessive amount of variation in the plot results.

plots should be discontinued in future inventories. This recommendation is not based on the lack of utility of these data. Clearly, information on seedling numbers are extremely important for predicting change and for assessing the impact of harvesting[5]. The real issue here concerns what can be reasonably expected from local communities. The villagers at Dikome and Bonjare have had considerable interaction with researchers and floristic surveys through the Mount Cameroon Project. The communities at Tikar Plain and Djoum, however, have not, and it would seem advisable to simplify the inventory methodology and subsequent analysis as much as possible to ensure that key concepts truly are transferred and remain in the village after the foresters and botanists have left.

Tagging

Sample trees in the Mokoko survey were permanently labeled with a numbered, aluminum tag. The tags were nailed to larger trees and affixed to shrubs and treelets using wire. This time consuming practice should not be implemented in future inventories. Past experience has shown that tagging a witness tree at the start of each line and providing detailed descriptions of the exact location and bearing of the transect is usually sufficient to relocate all the trees on the plot tally sheets.

Slope Correction

In spite of the relatively steep and craggy terrain in many areas where the inventories will be conducted, the use of electronic range finders should be discouraged. Making a transect rope with knots at the appropriate position to correct for different slopes as described in Peters (1999) is the most simple, inexpensive, and transferable technology for dealing with the statistical pre-requisite of measuring everything along the horizontal.

Recording the Data

It is very important that each transect be divided into contiguous 10 x 20 m plots, and that the data for each plot be recorded separately. This was not done in the Mokoko survey. By tallying the data in this fashion, we can not only generate totals for the entire transect, but we can also examine *a posteriori* how the composition of the plots changes along the transect. For example, we might want to know how the density of a particular resource changes in response to increasing distance from the village. Or, we might want to select and group all of the individual plots that occur in secondary forest and analyze them to see how the abundance of rattan varies from primary to secondary forest. In contrast to a simple running tally, this procedure allows us much more flexibility in the analysis of the data. A sample tally sheet set up to record the data in this fashion is shown in Annex I.

A final consideration about the transect data is that the results from each village survey should be kept separate. We can later group the data from several villages to get some idea about the overall condition of the forest in the area, but of immediate interest is "what is in the forest near village *x* , and how can this information be used by the residents of village *x* to promote the sustainable exploitation of the forest resources within their reach?". Each village forest can best be viewed as a separate management unit that will be inventoried, managed, and exploited by the members of that community.

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[5] Data from the smaller diameter classes (e.g. 5-10 cm, and 10-15 cm) can also provide very useful information about the regeneration status of different plant populations and the demographic effects of exploitation.

Final Considerations

The upcoming inventory work at Tikar Plain and Djoum will be a good test of the refined inventory design. Relative to Mount Cameroon, there has been much less floristic work done in these areas, the species are not as well known, the villagers are not as accustomed to dealing with researchers, and the logistics are probably more tricky. The initial approach to each of the villages in these two areas will be extremely important. The objectives of the project should be clearly spelled out and the ultimate benefits to the village resulting from their collaboration should be realistically portrayed. The initial ethnobotanical surveys would be a useful pretext for getting different groups of people together to talk about plants, plant use, and the forest. This exercise is clearly not something that should be rushed through.

The same applies for the pre-inventory training sessions. Although the basic components of this training program were briefly outlined in Peters (1999), the actual implementation of the training workshops should be tailored to the responses of the participants. If more time is needed in the village to instill the basic concepts of resource stock and yield, spend more time on these. If everyone is bored and more engaged by going to the forest, move to the forest and continue the conceptual training while walking the transects. The important thing here is that the participants truly understand the plan and their role in it. If the training is correctly imparted, the villagers should be able to lay out the transects, count and tally the plants, and deal with the inevitable issues of steep slopes and funny compass readings by themselves.

It is strongly recommended that sufficient time be allocated in each village to do the ethnobotanical surveys and pre-inventory training right. These are not extraneous activities that take time away from the inventory work. In fact, these interactions lay the foundation for the inventory and ultimately determine the quality of future collaborations with the community. Invest the time.

ANNEX 1: TALLY SHEETS

Ethnobotanical Survey:

		[1]			[2]			

[1]the species is classified as tree (T), shrub (S), vine (V), or herb (H).
[2]the tissue code (TC) lists the part of the plant that is used, where stems=0, fruits/seeds=1, leaves=2, bark=3, and exudates=4.
[3]the use code (UC) describes how the plant tissue is used, where timber=0, construction=1, cordage/weaving=2, food=3, medicine=4, oil=5, industrial compound=6, other=7
[4]the value code (VC) describes whether the product is currently used for subsistence purposes, sold commercially, or both, where subsistence=0, commercial=1, both=2, past commercial=3.
[5]additional descriptive details about uses listed as "other" or information about market prices, fruiting seasons, or cultivation practices could also be noted

Transect Data:

[1] general locality descriptor; name of community or general area
[2]where the transect starts, sufficiently precise to facilitate relocation with GPS reading
[3]names of field crew members
[4]notes on tree vigor, reproductive status, evidence of harvesting, attack by pathogens, etc.