Exploratory Trip to Democratic Republic of the Congo, August 20 – September 15, 2004

Trip Report for International Programs Office,
USDA Forest Service, Washington, D.C.

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1 SUMMARY

This report summarizes results of an exploratory trip to western Democratic Republic of the Congo in equatorial Africa during August-September 2004 by Bruce G. Marcot and Rick Alexander of USDA Forest Service (FS). Purposes of the trip were to observe ongoing activities in community forest planning under the aegis of USAID's Central African Regional Program for the Environment (CARPE) Program and Innovative Resources Management's (IRM) Community Options and Investment Tools (COAIT) planning process, to determine feasibility of community forest management and sustainable timber harvesting, and to identify opportunities for further FS involvement. Our field expedition took us from Mbandaka south to Bikoro and across Lac Tumba and up the Ubangi, Congo, and other rivers to many remote villages, covering over 464 km (290 mi) by four-wheel drive, pirogue (dugout canoe), and trekking.

We concluded that IRM is doing a commendable job engaging local communities in forest resource planning. Under their COAIT process, the first stages of community participatory mapping have gone well and are providing a basis for communities to next inventory and develop more quantitative objectives and evaluations of options.

We also concluded that timber harvesting could become one of the several sustainable economic activities for local communities, but should be integrated into broader management of all forest resources including nontimber forest products, fishing, hunting, gathering, agriculture, and other uses. Most villages, however, would likely not be able to develop a long-term, sustainable timber management program in the near future. Major impediments to community forest planning in the area include lack of quantitative information on forest resources, lack of transportation infrastructure, degraded or unreliable market conditions, and lack of tools, such as chain and rail saws, and training in their use. Overall goals for sustainable community forest planning should focus on simultaneously maintaining community welfare and biodiversity conservation in an ecological context.

Populations of much of the wildlife of the region have been severely depleted. Pockets and elements of old forests should be sustained as source habitats, and efforts made to control the rampant bushmeat market.

FS can provide valuable technical assistance to communities at several steps in the COAIT process, by working with such organizations as USAID and IRM. FS could provide technical capacity-building in areas of silviculture, timber management, forest ecosystem management, resource inventory, and forest ecology. FS could also assist in further drafting and review of implementation decree guidelines under the national 2002 Forestry Code, particularly for guidelines on sustainable timber management, application of community forestry procedures, forest biodiversity conservation, and wildlife conservation. We offer additional recommendations for IRM and USAID in continuing their community forest planning work, and suggestions for developing implementation decrees for community forestry and for wildlife and forest biodiversity conservation.

2 INTRODUCTION AND SETTING

During August 20 to September 15, 2004, Bruce Marcot and Rick Alexander of USDA Forest Service (FS) visited Democratic Republic of the Congo (DR Congo) on an exploratory trip for the International Programs office of FS, Washington, D.C. The overall purpose of the trip was to learn about community forestry planning in western DR Congo, to determine potential future involvement by FS as technical advisors.

We met with United States Agency for International Development (USAID) personnel in Kinshasa and representatives of numerous non-government organizations (NGOs) and government offices on the Central African Regional Program for the Environment or CARPE (http://carpe.umd.edu/overview2004/cbfp_2004.asp). We traveled with members of the NGO Innovative Resources Management (IRM) (http://www.irmgt.com/html/home.htm) and others to a portion of CARPE's "Landscape #7" (Lac Tele – Lac Tumba Swamp Forest Landscape), more specifically to remote Bantu and Pygmy villages south of Mbandaka to Lac Tumba and then north along the Congo and Ubangi Rivers within DR Congo. We observed IRM's progress on community forest planning, particularly IRM's Community Participatory Mapping process under their COAIT (Community Options and Investment Tool), CBFP (Congo Basin Forest Partnership), and CLIFS (Congo Livelihood Improvement and Food Security Project) methodologies.

We provided recommendations back to FS on potential future involvement. This report summarizes our project Terms of Reference, specific travel itinerary, contacts, observations, and suggestions and recommendations to FS.

3 TERMS OF REFERENCE

The complete Terms of Reference for FS-IRM contact are provided in Appendix 1. The following two major headings of terms are those that pertain to our participation for this particular trip. See Appendix 1 for specific questions posed under these headings, and Section 6 below for specific answers to these questions.

> 1) To assess how IRM's COAIT Tool & IRM's Community Forest Resource Inventory Tool (designed for inventorying non-timber forest products) may support a sustainable timber harvesting set of activities at the community level, based on IRM's experience with these tools in Cameroon and plans for using these tools in the Lake [Lac] Tumba region.
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> 2) To assess whether or not it would be feasible and desirable for the particular community(ies) visited in Lac Tumba to engage in sustainable timber harvesting.

4 TEAM MEMBERS AND CONTACTS

The trip was coordinated out of the FS Washington D.C. office by Kathleen Lawlor and Oliver Pierson of the Africa Program, International Programs.

The core team of the field expedition in DR Congo included the following: Rick Alexander and Bruce Marcot of FS, and four people from IRM: George Akwah, Deputy Coordinator for IRM Activities in Africa; Laurent Nsenga, IRM Coordinator for CBFP; Alfred Yoko, IRM Assistant Coordinator, CBFP; Alpha Nzongo, in charge of security and logistics. The core team also included François Bokondokondo, representative of Provincial Ministry of Environment, Mbandaka; and Justin Elabela Eso, advisor to the Governor, Equateur Province, Mbandaka. Guy Bongo Mbembe, Territorial Administrator, Bikoroand his security and logistics personnel traveled with the team from Bikoro to Botuali and Ituta. IRM President Michael Brown joined us in Bobangi for the remainder of the trip.

Contacts made in DR Congo are listed in Appendix 2. They included additional members of Innovative Resources Management; personnel of USAID and CARPE project; and representatives of World Wildlife Fund, Bonobo Conservation Initiative, Wildlife Conservation Society, Rainforest Foundation Norway, Centre de Cooperation Internationale en Recherché Agronomique pour le Developpement (CIRAD), University of Maryland, African Wildlife Foundation, and World Resources Institute.

5 TEAM SCHEDULE AND ITINERARY

Our itinerary entailed travel from our respective work locations (Portland, Oregon for Marcot, and Vallejo, California, for Alexander) to Kinshasa, DR Congo; meetings in Kinshasa with USAID, IRM, and other contacts; internal flight from Kinshasa to Mbandaka DR Congo; use of four-wheel drive, pirogue (dugout canoe), and trekking to stay in 7 villages in the vicinities of Lac Tumba, Ubange River, and Congo River; and return to Mbandaka via pirogue and then to Kinshasa via airplane for closeout meetings with USAID, IRM, and other groups. Maps of our travel locations and a listing of our daily itinerary are listed in Appendix 3.

6 CHALLENGES TO COMMUNITY FORESTRY

6.1 Use of Community Options and Investment Tools (COAIT)

The 2002 Forestry Code of the Democratic Republic of Congo attempts to harmonize customary land use with modern land and forestry law. While the code underscores that the forests are the property of the state (national government), local communities are allowed user rights for domestic needs, certain property rights to trees, and the right of consultation through national and provincial consultative committees on topics such as forestry rules, forest land classification, and forest projects (Ngoy Isikimo 2003). The Forestry Code describes "local community" as a people traditionally organized based on custom and united by ties of clan solidarity or family, which are the basis of its internal cohesion. A local community is characterized otherwise by its attachment to a specific territory (DRC 2002).

The terms of reference for this FS IP mission (see Section 3 and Appendix 1) called for an assessment of the usefulness of Community Options and Investment Tools (COAIT) in community forest planning and management. COAIT is designed to enable communities in developing countries to collect and analyze economic, environmental, and social data. These data, in turn, are intended to help communities make well-informed decisions and take actions that promote self-sufficiency through ecologically and economically sustainable development (Bonis-Charancle et al. 2003).

Innovative Resources Management (IRM) developed COAIT to link participatory mapping with several essential next steps. COAIT builds community capacity for gathering and analyzing the information on forest resources depicted in the participatory community mapping process.

COAIT includes three phases: information gathering, option analysis and decision-making, and implementation. At present, the communities we visited have completed participatory community mapping as a first step in their information gathering. Participatory community mapping has been employed in developing countries to record community perceptions of how forest resources are being used and to increase community understanding of the value and relationship of forest resources to the livelihood and well being of community members (Brown 1999).

We witnessed the IRM team working with communities to review maps that displayed data gathered through participatory community mapping exercising. We were extremely impressed by how well the participatory mapping exercise resulted in high rapport among IRM project leaders, local IRM facilitators, community leaders, and community members. In each village we visited, IRM was obviously highly regarded and had an effective network of local facilitators who provided entrée to community leaders, right holders, and community members engaged in subsistence agricultural activities and very small scale commercial timber harvesting activities.

IRM's participatory mapping is extremely useful in two areas: gathering relevant information, and nurturing working relationships among community members, facilitators, and outside experts. In both areas, these mapping tools laid an essential and valuable foundation for community decision-making based on appropriate ecological and socio-economic information. Although the participatory maps nicely depict the approximate locations and sequences of roads, trails, rivers, villages, vegetation conditions, wildlife, and resources, we concurred with IRM that the maps should not be used to estimate absolute areas or analyze spatial patterns of forest vegetation conditions and resources. We mention this here not because it was suggested to do so, but the maps, being formalized in a GIS system, could otherwise easily lend to such analyses by others, which is simply not an appropriate use.

Figure 1. Elabelea Eso, Yoko, Akwah, and Bokondokondo discussing participatory map. (Photo by Rick Alexander)

Participatory community mapping provides information on the general location and distribution of particular natural resources and how they are used by community members. (See the list of map categories in Appendix 4.) During our expedition, we observed community members reviewing the GIS (geographic information system) maps that IRM had created by digitizing data provided by community members. In each of the seven villages we visited, it was obvious that community members had tremendous pride and ownership in their contribution to the maps and were carefully reviewing and offering additions and corrections to ensure that the maps more accurately reflected their perceptions of where their forest resources are located and how they are being used.

An essential next step in the COAIT process is a systematic natural resource inventory including timber and non-timber resources. Such an inventory process could be adapted from those developed by Peters (1999, no date), Zapfack and Ngobo Nkongo (1999), and Sunderdland and Tchouto (1999) for Cameroon. In developing the inventory techniques, particular consideration must be given to the ecological functions of the various forest conditions and types (see Vegetation categories in Appendix 4). This expedition helped to identify such functions. One example was in Mobenzeno village where seasonally inundated forest was found to provide a critical zone for fishing during the rainy season. When inundated, this forest attracts catfish and other fish from the nearby Ubangi River. Villagers reported that fishing is actually better within the inundated forest during that

time than in the river itself. Some of the fish themselves consume and rely on fruits produced by mature overstory trees (the stilt-rooted boondjo or *Allanblackia floribunda*) in the forest; during the rainy season when the forest floods, fish migrate into the forest from the river and consume the tree's fallen fruits (a similar situation to seasonally inundated forests in part of the Amazon River Basin). Thus, to maintain the fish, the overstory trees should be maintained.

Additional steps to include in the COAIT process of information gathering are: an analysis of markets to identify their locations, an assessment of which raw materials or processed forest products are in demand, and an evaluation of the relative prices of forest products among markets. Communities will need data on transportation costs to get products to market. They will also require data on costs for equipment, maintenance, training, and production rates of long saw and mechanized mobile saw operations.

This additional information, yet to be gathered, will form the basis for the second COAIT phase of participatory cost-benefit and risk analysis. The cost/benefit analysis and decision making must not focus on just timber harvesting alone. Such a narrow approach would not suffice as a basis for sustainable, economically viable resource management. Many of the villages simply do not have enough commercially viable trees within a reasonable distance to harvest, nor the equipment to fell, buck, saw, and transport the lumber. Many of the villages, especially those distant from the lake or rivers, lack transportation routes and infrastructure to transport timber products in any quantity, to reliable markets.

Figure 2. Palm oil processing operation; palm nuts boiling in drum on right, then pressed and stored in the 25-liter yellow jugs. (Photo by Rick Alexander)

Consideration of timber harvesting as one component of a broader, sustainable community-based forest resource plan should be developed and evaluated in the context of the entire ecosystem. The context should include all other forest and associated resources, the economic conditions of market access and product values, and the social and cultural expectations and needs of all resources including foods and medicines grown or taken from the forests. Such contexts could be expanded within the COAIT process itself. In fact, much of the community participatory mapping has provided initial, qualitative information on both timber and non-timber forest resources used and valued by local people. This is one major step toward such a broader ecosystem approach.

The third phase of COAIT will entail implementing decisions by developing prospectuses, building partnerships, negotiating agreements, monitoring, and adapting to

new information and changing conditions. It is in these areas where the success of building community capacity will really be put to the test. We feel the awareness of the community connection to its natural resources and the networks that IRM has helped communities build will serve communities well if the communities carefully conduct each phase of the COAIT process. We believe the Forest Service can provide valuable technical assistance to communities at several steps in the COAIT process, by working with such organizations as USAID and IRM.

In summary, the complete suite of COAIT is appropriate for building community capacity to make land management decisions. The initial success of the participatory community mapping step of COAIT is a testament to this

6.2 Feasibility and Desirability of Lac Tumba Communities Engaging in Sustainable Timber Harvesting

In general, most of the communities in Lac Tumba (also spelled Lac Ntomba) area appear to have sufficient timber resources to include timber harvesting as one of several economic activities. They certainly have enough resources to warrant the next step of inventorying the timber and non-timber resources, but the overwhelming observation is that the villages currently lack infrastructure and equipment to support community forestry. The transportation system is insufficient and unreliable. In remote areas, the only means of transporting forest products is human labor. We saw a few bicycles and very few push carts, presumably because the foot paths are rough and people lack the capital to invest in even basic equipment.

Demand for or ability to purchase forest products in villages is low or non-existent. Village economies barely approach subsistence levels so there is not much cash to support a local market for basic necessities, let alone forest products. At the same time, forest products are readily available to most villagers able to exert the labor to gather them for themselves..

Most building materials in the villages we visited consisted of mud brick, sticks, and poles for building structures, and palm thatch for roofing. However, timber could be promoted and used directly as a building material as communities grow and develop, and can be a valuable commercial commodity that helps fund community infrastructure and social services. At present, there is very little market in the villages for sawn planks as building materials.

Figure 3. Using palm thatch to patch a hut roof. (Photo by Rick Alexander)

As the village societies and economies evolve under a variety of external and internal influences, there will be increased demand for sawn planks (lumber) to be used for local construction as well as for selling in larger towns and cities. At the same time, increased population, and diversified agriculture for both subsistence and commerce, will increase the pressure to clear more forest land. As part of COAIT, a market analysis will provide better information about markets for community forest products, but, at present we see the best opportunity for commercial community timber operations to be targeting markets in towns and cities within Equateur Province.

Community forest plans must be developed in the context of provincial and national forest plans. Plans at each level must consider appropriate spatial and temporal scales for social and ecological processes. Plans will require careful inventories and information about growth and production of natural resources, size and location of important wildlife home ranges, and future human demand for forest resources, agricultural lands, land for habitation, and other structures and infrastructure. Plans at each level must address equitable enforcement and monitoring of important ecological components and transparent accounting of economic benefits deriving from forestry activities.

Figure 4. Rough cut log is marked and notched to guide sawing into planks. (Photo by Rick Alexander)

We have concerns about how quickly and smoothly communities can organize to pool rights to sufficient area to operate an economically ecologically sustainable forest management program. We understand from discussions in DRC that implementation decrees will detail how the Forestry Code is put into practice. We recommend that implementation decrees be developed that directly address community forestry. Agencies such as USAID, World Bank, and others should coordinate with on-the-ground NGOs experienced with capacity building to help communities participate in the development of implementation decrees. Decrees should outline a process for communities to identify and request a concession for community forestry lands on a scale and level of priority comparable to industrial concessions. There are two points to underscore here. One is that communities participate in a meaningful way (with help from NGOs such as IRM), and the other is that communities secure rights to sufficient area on which to base long-term sustainable community forest management.

Social and economic pressures are prompting some right holders to harvest trees now, before planning is completed and long-term guidelines for sustainable management are established. Anticipating that gathering the needed additional information and the development of relevant implementation decrees will take some time, short-term interim

guidelines for community harvest may be developed (e.g., see Section 7.2 below on Recommendations). An interim management plan including simple guidelines could be developed for the selection of trees to harvest—minimum diameters, tree form and quality, species, frequency or spacing of trees to harvest, and so forth, to enable communities to build experience with decision making, pooling resources, and related capacity-building activities while the information needed for long-term planning is being gathered.

Eventually, after completion of the entire three phases of COAIT, a more detailed community forest management plan model would be developed. Such a plan would be extremely useful to national and provincial government officials and to community administrators, chiefs, and community forestry commissions. Forest Service work in Madagascar (Gaulke et al. 2001) identified a simplified approach to forest management planning similar to that used in the western U.S. This model could be adapted to use in DRC.

We were told that current rules require harvested trees to be at least 80 cm in diameter. This was presumably a reference to rules established under the 1949 Forestry Code. The 2002 Forestry Code does not mention diameter limits, and such limits may be a subject of an implementation decree. In any case, we feel that a simple diameter limit by itself is insufficient to ensure that essential ecosystem elements are maintained. Some additional rules are needed to address concerns such as protection of water, soil, wildlife habitat, and benefits of residual stand elements (e.g., "legacy" elements of large old trees and large down wood); species to be harvested; distance between harvested trees; and proximity to transportation and markets. These can be accommodated in a set of well thought-out, relatively simple guidelines and rules (for example, see our initial recommendations in section 7.2.5 below). Such guidelines would be useful in both interim and longer-term community forest management plans.

Whether harvest is done by community members or by contractors, there are several training programs that should be undertaken. Again, the USFS working through USAID and NGOs can offer technical assistance. Some immediate training needs we identified are discussed in the following text.

Crews harvesting trees would greatly benefit from training in felling, including directional felling for improved safety and reduced environmental impact, and sawing, including introducing simple concepts and tools to improve utilization of raw materials.

It would also be useful and feasible to train community members in additional inventory and planning skills. Training in timber cruising, felling, bucking, and sawing would be of service. In more mechanized industrial operations in Gabon and Cameroon (Dykstra and Toupin 2001), training in some of these techniques is already paying off in safer operations, better utilization of harvested trees, and less adverse impact on soils and the residual stand.

Training community members would enable communities to make informed decisions that could improve the likelihood of longer-term economic and ecosystem sustainability. Training programs should include follow-up or refresher sessions and monitoring to assess additional needs and the feasibility of training in advanced techniques as skills increase and different tools become available.

During our visit to the Lac Tumba villages, we considered if it would it be feasible for communities to contract out all or portions of the timber planning and harvesting operations to professional foresters, logging companies, government technicians, and international or local consultants. The answer again is dependent on community capacity, which is addressed in the third phase of COAIT which identifies skills relevant to developing and administering contracts. Contracting out may be feasible if communities are trained and organized to negotiate fair contracts for services and if such contracts include guidelines for environmental protection. During our visit we did not have occasion to learn if there are sufficient social and legal measures in place to support compliance and enforcement for such contracts. Considerable training and follow-up coaching and consulting would be needed over a period of months and years to ensure that contracting is an equitable and viable option for communities.

Contracting could open considerable opportunity for corruption. Part of IRM's work in the Congo Basin is also a program called *Relance Economique,* to decrease petty corruption in DRC. People in some of the communities we visited cited corruption as a barrier or drain on commercial activities. Another concern is that contracting out the harvest operations might quickly lead to a large-scale, mechanized operation for which sufficient environmental practices and safeguards are not yet in place. Quickly introducing highly mechanized operations could easily encourage pressure to harvest at unsustainable rates at a pace greater than the communities could devise and adopt proper environmental protection guidelines. As a cautious approach, and one more geared to the current situation in these communities, we feel it would be better to first develop and increase the community capacity in decision making and contract administration with the "low-tech" locally operated projects, before jumping to mechanized systems that could put more people and forest at risk of irreparable damage.

Financial capital is obviously short, but there is sufficient local labor such that economic sustainability is likely best served by training local people to harvest and saw the lumber. Depending on the total area, standing inventory, regeneration, and growth rates, one possibility would be for 2 or 3 teams of sawyers to organize to serve a "groupement" of villages, so harvest area could be expanded and distance between trees harvested in any given decade would be large (for ecosystem sustainability). Having too many saw crews, or highly mechanized sawing operations, could lead to more intensive (spatially and temporally) harvest that could be unsustainable economically or ecologically.

At present, communities really do not have the capital and other resources necessary to engage in a highly mechanized harvest operation. No beasts of burden were observed in the area, and interviews suggest there are none commonly used in this area. Human labor is used almost exclusively, and very little mechanization is currently used or available.

Labor appears plentiful and the reliance on human labor presents a much lower risk to sensitive ecosystem elements than would highly mechanized operations. Communities can take advantage of this situation by learning as they engage in forest management with the low-tech approach. This also provides time in which to complete gathering of additional information, make decisions about resource management and develop plans and guidelines for management activities. The down side of relying heavily on human labor, particularly in felling and moving immense trees and heavy timber, may be concern for human safety. Access to hand tools such as lever winches, chain hoists and peaveys (hook affixed to handle or lever, for moving logs by hand) would increase safety and productivity. Additional training and guidelines to help ensure safe operations would likely be welcome.

Before long, as investment capital comes into the country, and as communities pool resources and capital, mechanization (e.g., power saws, motorized vehicles) will increase and the pressures to increase harvest of timber and other forest resources will increase potential for higher impact operations. By that time, communities will have gained valuable experience from their early years of forest management with less intensive techniques causing far lower adverse environmental impacts.

For communities that decide to contract out operations, community members and leaders would need training in relevant forest codes, implementation decrees, basics of silviculture, mensuration and measuring, accounting, contract law, and techniques for contract administration. Most of these skills also would be needed for communities that decide to undertake their own harvest operations. The FS is well positioned and qualified to work with NGOs who work in building community capacity (decision making), contract administration, forest planning and so forth. (This would be a modified form of the assistance FS personnel provide in the U.S. to state forestry departments, and state/federal extension agents at land grant universities to train small landowners in how to manage their woodlots and how to deal with professional services for harvest planning and logging.) IRM has demonstrated its ability to work with local community members to plan and deliver workshops with its successful participatory community mapping effort. While we were in Mbandaka, we observed another example of these techniques being used by the Rainforest Foundation which was conducting a well attended workshop and field tour to help people learn about the 2002 Forestry Code.

While we did not explore the topic in great depth, it was unclear from our conversations with people in Lac Tumba communities how a given community would distribute the proceeds equitably to right holders and to others in the community. Proceeds could be distributed through wages and investment of some portion of proceeds into the development, improvement, and maintenance of infrastructures and social services to benefit the community. However, specific mechanisms to accomplish this dispersement of proceeds seem to be lacking. Ultimately, communities must decide this for themselves. The experience that communities gain with transparent and equitable decision making that is fostered through the COAIT process should prove very valuable in such decisions.

7 CONCLUSIONS, RECOMMENDATIONS, AND OPPORTUNITIES

7.1 Overall Conclusions

Following is a list of our overall conclusions. These were drawn from our personal observations, interactions with villagers and other contacts, and our discussions in closeout sessions particularly with IRM, WWF (World Wildlife Fund), and USAID. Potential solutions to limitations (item 2 below) are discussed in section 7.2 Recommendations. Our conclusions and recommendations pertain specifically to the area we visited in the general region of Lac Tumba and Equateur Province (that part of CARPE Landscape #7 in DR Congo).

(1) **IRM is doing a highly commendable job in their COAIT process of helping local villages develop information, goals, and objectives for community-based timber management and forest resource planning.**

(2) **It is unlikely that most villages would be able to develop a long-term, sustainable timber management program in the near future.** The main constraints are lack of: equipment, training, silvicultural knowledge and experience for regenerating key timber trees, and availability and density of marketable timber trees in many locations. Other key limitations are poor access to potential markets, poor conditions of road systems for transporting products, and lack of consistent and reliable valuation methods.

In many areas, the desirable trees have been cut but some remain, particularly in swamp forests and seasonally inundated forests with trees too large to cut with hand tools (especially those trees with very wide buttresses).

Specifically regarding timber, information is needed on the replacement rate of the large commercial trees that are cut and sawn for planks (boards). We found that the "redwood" and "blackwood" trees are sought and cut for their lumber approximately at age 40-60 years or older. Such trees are 60+ cm (24+ inches) in diameter. Their relatively low density and scattered distribution may not be sufficient to permit sustainable harvesting at any economically viable level to support entire communities. It may help if a market were developed or available for smaller diameter trees, provided a sufficient number of trees are left to mature, produce seed, and become reproductively viable. .

(3) **The objectives for sustainable community forest planning should not focus solely on timber harvesting but should broadly address all forest-based resources including timber and non-timber forest products, in all forest and vegetation conditions** including *terre firme* (upland) forests, seasonally inundated forests, swamp forests, riparian gallery forests, and secondary forests. To develop a resilient economy, communities need to look beyond just timber. The aim would be to encourage a more diverse and resilient economic base for local communities.

Each forest and other vegetation condition provides complementary and different sets of resources. For example, the seasonally inundated forests that we explored in detail in Mobenzeno village along the Ubangi River provide a key source of consumable

fish – including catfish or "mudfish" (*Claris lazera* or "walking catfish"), freshwater eels (*Propterorus* sp.), and other species -- during the rainy season, which are far more accessible than in the adjacent Ubangi River itself at that time of year. Harvesting the few commercial timber trees in seasonally inundated forests could damage this ecological balance, rendering greater harm to the sustainable fishery than the benefits that would be accrued from the few commercial trees. Thus, there is a need to evaluate community forestry holistically across all conditions and resources.

Figure 5. Catfish (*Claris lazera*) caught and being sold by villager in the Ubangi River. (Photo by Bruce G. Marcot)

(4) **The overall goal for sustainable community forest planning should not be natural resource exploitation and utilization per se, but rather the focus should be on simultaneously maintaining or supporting (a) community welfare and (b) biodiversity conservation.** These goals, when met, will in turn guide the types and amounts of renewable forest resources and means of sustainable extraction.

(5) **Missing from the community forest planning efforts thus far is a more explicit ecological basis for determining which forest resources (timber and non-timber) could be extracted, at specified rates, in a sustainable manner.** An example is a need to better integrate considerations for how specific resources such as timber trees and populations of consumable fish and bush meat can be regenerated and maintained in a sustainable manner, and what ecological conditions need to be maintained or restored to ensure regeneration of those resources.

(6) **Needed is a quantitative procedure to inventory timber and non-timber forest resources, and the capability to carry out and evaluate such inventories in each community area, and to integrate results into local community forest planning.**

(7) **A more explicit definition of "sustainability" can help guide which resources each community chooses to focus on for their sustainable forest resource plans.** "Sustainability" can be simply defined as rates of utilization (plus natural loss) not exceeding rates of production. Once seen in this light, it is clearer that what is needed to develop sustainable community forest plans would be a list of the desired resources, an inventory of the locations and amounts of each resource, and estimates of the current and expected rates of utilization, natural loss, and production of each resource.

(8) **Also needed to be considered in community forestry plans are means and products of agriculture, particularly rates of shifting (slash and burn) cultivation**

and its influence on reducing forest cover over time, and types of foods produced to provide better nutrition. We observed many villages that persist largely on manioc and maize which by themselves likely lack essential vitamins and protein. Encouraging a more diverse and permanent-plot agriculture would go far to reduce malnutrition and reduce the continued clearing of older forests for short-lived shifting cultivation use. However, we recognize that such changes in agricultural practices may entail substantial investments in capital and labor.

Figure 6. Landscape of slash-and-burn (shifting) cultivation patches. (Photo by Bruce G. Marcot)

(9) **Much of the wildlife of the region has been severely reduced in distribution and density, and some species such as most monkeys have likely have been locally extirpated around village influence zones.** Much of this has been the direct result of increased illegal bushmeat trafficking and of direct exploitation during the past decade's war, adding to the local villagers' traditional trapping and collection of animals and plants for sustenance, medicinal, and other uses. Most animals (and medicinal plants as well) are found now only in swamp forests that are very difficult to access.

The "good news," however, is that, to the best of our knowledge, few if any plant or animal species have likely gone regionally or globally extinct because of human activities, although this needs study. Core populations of scarce species likely occur in more remote, less-disturbed forests and other environments. These could be used to renew overall biodiversity of the region (see next point).

What is needed urgently are regulations or guidelines for controlling bushmeat exploitation. This could be accomplished as a set of "implementation decree" guidelines under the country's 2002 Forestry Code (see Recommendations below).

Special consideration should be given to ensuring protection of the bonobo (pygmy chimpanzee) population at Botuali village south of Lac Tumba. Bonobos are highly endangered throughout the entire range of the species, which is only in DR Congo, and the Botuali population likely is isolated from the next nearest population further north and east. The Botuali population is likely to be very small and its isolation suggests great vulnerability to local extinction.

(10) **Much of the "natural" or "primary" forest of the region has been influenced or altered by human activities, including clearing for shifting agriculture and village areas and high-grading for the best timber.** The few stands of truly primary forest we observed in locations such as Bobangi along the Ubangi River, particularly in swamp forests where great buttressing of the large trees render the trees noncommercially viable, could be conserved as pockets of older forests in which wildlife can find refuge and regenerate. Trapping of animals within and adjacent to such areas should be discouraged. Such stands, however, could still be used for other selected non-timber forest products such as medicinal plants, fish, fruits, mushrooms, caterpillars, and many other resources. Fully excluding humans from such protected natural areas to achieve forest ecosystem conservation goals may not be possible or even necessary, but local communities would need to see it to their own advantage to retain such conditions and help police its correct resource usage.

Overall, restoring and conserving biodiversity of the region may take the concerted and simultaneous effort along several fronts and along several administrative levels:

- *control of the illegal bushmeat market and trade* (although we were told that even local environmental officers are sometimes involved in the take and trade activities)
- *standards for concession forestry* to avoid rampant deforestation or excessive loss of major, large overstory trees *in toto* (although the commercially viable trees in areas we visited seemed quite scattered, perhaps 1-3/ha or quite less frequent depending on the forest type or condition)
- *standards for local community forestry* so as to not unduly eliminate all large, overstory primary trees that serve as critical habitat and food sources for so many wildlife species
- *standards to retain representative areas and habitat conditions* including seasonally inundated forest, swamp forest, dry upland (terre firme) forest, savanna, and riparian gallery forest
- *standards to provide for some older forest structures and components*, such as big old trees, and fruit- and seed-bearing trees, in agricultural plantations, fallow areas and shifting cultivation farm plots

Also needed will be inventories of selected forest resources, forest structures, and wildlife species and their habitat associations, such as bonobo.

7.2 Recommendations

In the conclusions section above, we offered some general suggestions. Following are more specific recommendations, near and long term, for further involvement by FS, aiding village communities, IRM's community forest management program, USAID and its CARPE program, and considerations for implementation decrees under DR Congo's 2002 Forestry Code.

7.2.1 Recommendations for potential further involvement by FS.— Following are recommendations for how FS might further aid community forestry planning in western DR Congo. We derived these recommendations after discussions with IRM, USAID, and our other contacts and work partners there.

(1) Provide technical capacity-building in areas of silviculture, timber management, forest ecosystem management, and forest ecology.

It was strongly suggested by IRM, USAID, and others that FS is well respected for their international programs and has the type of technical expertise in timber and forest ecosystem management that is sorely needed in DR Congo. It was said that FS would be viewed as injecting an "objectivity" into the sometimes political and contentious forest planning efforts there.

Specifically, FS could provide specialists in these areas to work with government officials, NGOs, and even local communities and villages on the ground, to help develop professionally- and scientifically-based guidelines and procedures for timber and forest ecosystem management. FS could also aid in developing inventory procedures and resource-tracking databases, particularly for timber but also for non-timber forest resources.

FS could also help at various levels in technical areas of:

- species identification of plants and animals
- use of timber inventory and management equipment
- providing technical reviews of participatory resource inventory procedures
- reviewing and improving iterations of field application of the COAIT community forest planning process
- geographic information systems (GIS)
- use of computers to store data
- use of field data gear such as GPS units and data recorders
- training in sivicultural practices at the community level
- training to strengthen the capacity of cartographers at the community level
- reviewing the economic and ecological risk assessment steps of the COAIT process
- provincial resource planning
- national level forest and resource management planning

(2) Further assist in drafting and review of implementation decree guidelines under DR Congo's national 2002 Forestry Plan, particularly for guidelines on sustainable timber management, application of community forestry (vs commercial industrial forestry)

procedures, forest biodiversity conservation, and wildlife conservation including the bushmeat issue. The overall goal would be to assist DR Congo in achieving economic, social, environmental, and ecological sustainability.

It should be emphasized that there is currently a window of opportunity to provide such requested assistance, but timing is critical. If FS provides such a set of ideas for decree guidelines for community forestry (see recommendations below in section 7.2.5 for initial ideas in this area), it should do so by early 2005. This may be one of the most important and far-reaching tasks in which FS could engage in the short term, to aid community forest management in DR Congo.

(3) FS could advise and assist DR Congo on developing a program akin to the sensitive species program of USDA Forest Service for plant, wildlife, and fish management. This could tie into meeting the guidelines for plant and animal conservation under CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), and could address issues of bushmeat, the need for de facto wildlife population reserves, the need for a "T&E" (threatened and endangered) species national legislation and management program, protection of globally- and regionally-threatened species such as bonobo, and provision of plants and animals to help meet local sustenance needs.

(4) FS could help advise on ways to increase the efficiency of local use of forest products, including more efficient means of timber felling, bucking, and sawing of planks (boards).

7.2.2 Recommendations for aiding village communities under the IRM COAIT process.- Continue the COAIT process. Ultimately, the goal is for communities to develop their own plan for sustainable management of community forests. This will require identifying where the forest is and how it will be used or otherwise managed. In each of the following recommendations, FS, other agencies, universities and organizations can assist IRM in working with personnel from Equateur Ministry of Environment to train community members in the following areas:

- Gathering natural resource data—basic mapping techniques, measurements and field observations. This would include species identification, training in conventions such as consistent naming, consistent techniques of measurement, importance of objective observations, use of basic tools of measurement and techniques for note taking. When and where appropriate, incorporate use of data recorders, GPS, and similar tools.
- Gathering additional social data about right holders, concessions, agricultural, cultural (e.g., ceremonial areas and cemeteries) and other uses that may affect community forests.
- Gathering information about existing transportation systems, and about potential systems. Include footpaths, abandoned and currently used vehicle roads, waterways.
- Gathering information about other existing or potential infrastructure that may affect forest management. In some situations, this may include existing or

potential water or wastewater systems, or other utility systems such electricity or microwave and transmission sites for communication.

- Gathering information about markets for agricultural and forest (timber and non-timber) products. Include survey of current commercial agricultural and forest products. Include current and foreseeable future market locations, including Mobenzeno, Irebu, Lukolela, Bikoro, Mbandaka and Kinshasa.
- To extent possible identify potential additional products such as diverse agricultural crops, value added forest products (e.g., mats made from palm leaves or other plant fibers, furniture, household or farming tools and implements, cultural or leisure items such as musical instruments, toys, decorations that may have a market in towns and cities to citizens there or to tourist trade.) Such products may be found in markets, but are not currently produced in particular villages in Lac Tumba study area.
- Storage of field data in systems useful for analysis and decision making. Computer systems are desirable, if these are not available or feasible, there are paper systems that could be used now, and converted later to electronic databases and GIS.

When helping provide the training listed above, continue to incorporate IRM's philosophy of capacity building. That is, keep multiple objectives in mind: getting the immediate task done and capacity building. The immediate task is information gathering. The longer-term objective is to develop and implement sustainable natural resource management plans. Along the way individuals acquire skills through job training that allow them to contribute to and benefit from accomplishment of the immediate and long-term objectives. Similarly, communities acquire analysis and decision-making skills that enhance their collective capacity to implement the natural resource management plans that protect resources and benefit communities.

In designing the inventory data, plot data should record forest types using the definitions used in participatory community mapping, so that inventory plot data may be compared with the participatory community mapping. In addition, consider using more specific classifications of forest type, such as described by Bwangoy-Bankanza (2004.) FS could offer assistance of statisticians and measurement specialists from its agency and can make available reports from FS inventory work other countires with tropical forests. As mentioned earlier in this report, the work of Peters (1999), Sunderdland and Tchouto (1999), and Zapfack and Ngobo Nkongo (1999) is also useful.

We recommend that IRM work with donor organizations and communities to develop grants and provide assistance to communities in obtaining the necessary training, tools and supplies. Grants and assistance could also help compensate community members engaged in data gathering for meals, travel and other expenses, and perhaps provide a stipend. We understand that the participatory community mapping exercise was voluntary (unpaid) on the part of local facilitators and community members. We recognize the value of that approach both from the fiscal standpoint of keeping project costs under control, and from the standpoint of developing community ownership in the project and its potential outcomes. So, the appropriateness of a stipend would deserve

careful consideration by IRM and donor organizations that have experience in capacity building.

Also, in the immediate future, timber harvesting methods for community operations should employ the basic hand tools already in use. In most cases these are "long saws." Additional tools to help move logs and measure and lay out saw cuts to transform logs to planks on site are logical immediate additions to the current tools and techniques. Over time, as communities organize and pool resources and revenue from harvesting, sawing, transporting, and marketing hand sawn planks they could upgrade to chain saws and mechanized portable mills. A prerequisite for more mechanized harvest is a community forest management plan to identify the appropriate rate and scale of harvest to ensure economic and ecological sustainability.

Figure 7. Planks cut by mobile power saw, 7x7cm x 5.2m. (Photo by Rick Alexander)

IRM is well positioned to coordinate and integrate its work in community forestry and CBFP with its work in the CLIFS (Congo Livelihood Improvement and Food Security) Project (www.irmgt.com/html/CLIFS.htm.) Agricultural use of the land is a significant competitor with forestry uses. Community forestry plans will necessarily address land allocations and must take into account current and projected future use of land for agriculture. Both forestry and agricultural management should explore the use of cover crops and appropriate native tree and shrub species that could increase fertility during fallow cycles.

CLIFS and CBFP projects could jointly explore several possibilities for reducing a community's future reliance on timber as the primary cash crop. Experiment with more diverse and marketable food crops. Explore possibilities for revitalizing existing plantations of palm, cocoa, and coffee. Examine the potential for agro-forestry in existing agricultural lands where food crops are grown on same site with some native trees to enhance fertility, provide wildlife habitat or produce timber and non-timber forest products.

IRM is also well positioned to coordinate and integrate its work in community forestry with its Relance Economique project (http://www.irmgt.com/html/Relance.htm.) The obvious immediate interest of community members in community forestry is to bring income into the village. Unfair, inappropriate or illegal fees, fines or taxes during the process of transporting and selling forest products could defeat the commercial objective of community forestry. Involving a project like Relance Economique early in the development of community forestry projects could help deter some illegal activity.

7.2.3 Recommendations for IRM's community forest management progam.--
Communities need specific forestry skills in order to pursue community forestry. FS, other agencies, universities and organizations can assist IRM in providing training in the following activities:

- forest inventory and measurement, including identifying, sampling, measuring and grading trees for potential harvest, and equally important, what trees to leave standing to meet non-timber objectives. Use and maintenance of appropriate tools for these tasks. These skills and tools are necessary for planning and monitoring of forest management. IRM has inventory experience in Cameroon they plan to adapt to their COAIT work in DRC.

- tree felling, cutting into desired lengths sawing into planks or lumber with basic tools such as axes, saws peaveys, cant hooks, chain hoists and lever hoists. Include training in directional felling that protect the forest and reduce breakage or unsafe situations for the workers. Train in layout and measurement for sawing that maximizes utilization (conversion to usable products.) Include training in safe use and maintenance of this equipment. The need for such training is increasing rapidly as more villagers are looking to timber as a source of income. Training in these tools and techniques must be accompanied by short-term guidelines to ensure protection of key ecological components of the forest ecosystem.

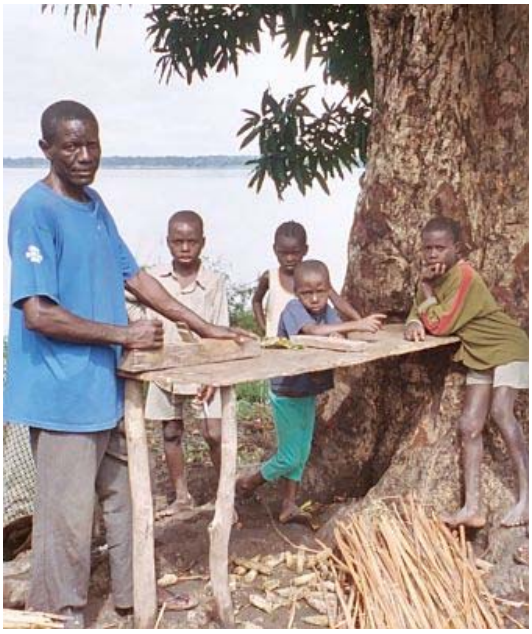

Figure 8. Villager constructing doors and window shutters with simple hand tools, Bobangi Village. (Photo by Rick Alexander)

- value-added manufacture of timber and non-timber forest products. Help develop "cottage industries" that produce goods for urban markets. Introduce and train in use of carpentry, craft and other hand tools appropriate for value-added processing. Market analysis would help identify types of products and market locations. Interest and basic skills in this type of work were evident in several villages where we saw locally made furniture, door and window frames. The limitation seems to be lack of affordable hand tools.

IRM has successfully trained and developed networks of local facilitators. Rainforest Foundation was using a similar approach to training local representatives of NGOs on the Forest Code. While functioning schools with qualified teachers have been nearly

wiped out during recent wars by the disintegration of the civil service system, there was an obvious hunger for training and education in every village we visited. There is an apparent willingness and ability to learn, but there is an obvious lack of tools.

Figure 9. Two villagers making furniture with knife and hammer, Eden-Mobenzeno village. (Photo by Rick Alexander)

Making basic handtools available with appropriate training would be an effective next step in helping rebuild a more fully functioning economy. Training techniques currently used by NGOs in Equateur Province, combined with FS or university extension experience with training could be used to develop training in the areas identified above. In addition, community members would benefit from training in project administration, supervision, payroll and accounting, and related business skills necessary for forest management projects.

IRM should complete the Sub-Sector Analysis of Wood Products, referenced in Task 3 of the Terms of Reference for this mission. As noted in Section 7.2.2, IRM could coordinate with Equateur Ministry of Environment to enlist and train community members to assist with the market analysis. Develop a data base for storage and analysis of this information. Equateur Province Ministry of Environment would eventually assume responsibility for periodic updates and long term maintenance of this data base. This is an area where FS, universities and industry consultants and associations have much experience to offer.

IRM should include French and Lingala or other appropriate local language on the legend of its participatory community maps. French and appropriate local language should be incorporated in IRM's printed training materials for COAIT. In addition, a dictionary, glossary or other listing of definitions and criteria for identifying items in the map legend should be provided in appropriate languages.

IRM should work with Equateur Ministry of Environment to develop a training program to publicize, distribute and explain the 2002 Forestry Code. Sessions should be offered

and training materials printed in French and Lingala or other appropriate local language. The training should highlight opportunities for community forestry and be designed to foster effective community participation in the development of implementation decrees relevant to community forestry.

FS and IRM should work with Equateur Ministry of Environment to develop an outline or model for a community forest plan. Work with communities to develop specific community forestry plans. USFS has helped develop community forest plans in other areas that could be provided and described if appropriate for DRC. Elements of such plans are offered below, adapted from our own professional experience and work done by USFS IP (Gaulke, et al 2001, Iverson et al 2004.)

- **Identify and describe the area.** Include physical, biological and social features.
  - Physical features include soil and topography, water features (such as lakes, streams, springs, ponds), boundaries.
  - Biological features include trees shrubs, herbs and grasses; animals including birds, fish and insects found using the area.
  - Human uses includes foot paths, roads, hunting and fishing areas, gathering sites for NTFPs, minerals and soil (e.g., for brick making), drawing domestic water, agriculture (crops and animal rearing), permanent and seasonal or temporary habitation.

- **Objectives.** Describe what the community expects from management of the forest, including resource protection, description of what the area should look like after management activity, expected type and amount of materials extracted. Identify benefits that will go to individuals and to community from activites in the community forest.

- **Guidelines.** List rules or constraints that will permit or constrain activities in order to meet objectives. List who will ensure guidelines are met. For example, will agriculture or fishing activities be allowed or protected in forest management areas? Consider need to zone sub-sets of the forest for particular objectives, activities or limits to activities.

- **Action Plan.** List specific activities that will occur to meet objectives, include methods, intensity, frequency, duration and location of activities. List who is responsible for performing activity or ensuring they are performed. List resources needed to accomplish activities, amount of labor, type of equipment, funding, supplies, and so forth. Describe how revenues and benefits will be distributed, how costs will be borne, how risks will be shared

- **Monitoring Plan.** What activities and quantifiable data will be measured and analyzed to evaluate how well objectives are met and ensure guidelines are met. List who is responsible for monitoring, equipment, supplies and funding needed.

- **Adaptive management.** Feedback and adjustment of future activities. List who and how will monitoring results be evaluated and used to adjust future activities and inform future decisions.

7.2.4 Recommendations for CARPE.— Following are recommendations derived from our observations that may be helpful to USAID and the CARPE program.

(1) Help focus or coordinate efforts to develop "implementation decrees" under the 2002 Forestry Code.

We became aware of several very disjunct efforts to develop such decree guidelines by different entities. There seems to be a need to coordinate these efforts.

(2) Clarify the potential role of industrial forestry within DR Congo, especially the western portion with Landscape #7.

Maps showing past, existing, and potential industrial timber concession areas were scant, hard to locate, and ambiguous in meaning. Part of this is due to DR Congo's overall uncertain governmental control and planning of its forest resources, but USAID (and FS) could use this as an opportunity to work with the DR Congo government to develop and help implement a defensible forest resource inventory and planning procedure. This effort, in part, would help DR Congo to clarify the goals and roles of industrial forestry, the need for and relevance of community forestry, and relationships between the two.

(3) Span both Congos in CARPE assessments and planning for Landscape #7.

CARPE'S Landscape #7 straddles both countries of Congo-Brazzaville and Congo-Kinshasa (DR Congo), and both sides should be reviewed as a single ecosystem that feeds into and affects that portion of the Congo-Ubangi Watershed. Thus far, it is apparent that work by WWF, IRM, and WCS within DR Congo has not at all included any information from, or considered conditions within, Congo-Brazzaville.

(4) CARPE partners should work with the DRC Ministry of Environment and appropriate provincial ministers and NGOs to publicize, distribute and explain the 2002 Forestry Code in French, and Lingala, Kikongo, Kiswahili, or Tshiluba as appropriate for local communities (Ngoy Isikimo 2003). This effort should inform and encourage communities to organize and participate in the development of implementation decrees relevant to community forestry.

(5) CARPE partners should consider working with DRC and provincial governments and local radio stations to publicize forestry information and issues. Communities need basic information in appropriate languages about the Forest Code and processes associated with community forestry, and they will have a long-term need for daily, weekly or other periodic information related to weather, markets, transportation and new technology for forestry and agriculture.

(6) CARPE, working through appropriate NGOs, should encourage communities to develop processes to organize traditional right holders and other community members to equitably share the benefits and risks associated with community forestry. This would help build community capacity for decision-making and local governance. The community processes for sharing benefits must be coordinated with and complement benefits and services provided by national and provincial government.

(7) Geographic information systems (GIS) and related skills and technology are necessary for modern, large scale land management planning. USAID, donor organizations and GIS specialists from FS and other agencies can help broker contacts and assistance from and contracts with commercial businesses and technical specialists with GIS software and expertise.

(8) USAID could coordinate the assistance of forest economists, tax experts and related skills to national and provincial governments to ensure that taxes and fees help maintain a "level playing field" for low-tech community forestry and large, mechanized industrial concession forestry. With appropriate tax and regulatory structure these two forestry operations will likely find market niches that support economic sustainability.

(9) USAID or its implementing partners could offer to assist DRC Ministry of Environment and appropriate provincial ministers in the development of national and provincial land registers described in the Article 28 of the Forest Code. The registers would ultimately be electronic data bases linked with GIS mapping. In the western US these systems are sometimes linked with on-site monuments such as section corner markers. We observed a form of local on-site boundary markers delineating farm plots or fishing areas. FS experience with cadastral and land status record systems could be relevant to this work as is the work University of Maryland is doing with GIS in Equateur. Having a registry of land allocations, right holders and concessions will be necessary for monitoring and enforcement of Forest Code provisions for ecological protection and transparent distribution of benefits from forestry operations. The map base for these registries should be linked to the inventory of resources recommended as a next step in COAIT process.

(10) USAID should offer to assist DRC Ministry of Environment and appropriate provincial ministers in the development of a transparent and equitable process for national and provincial forestry advisory councils described in the Forest Code Article 29. This work could eventually involve assistance with establishing operating principles, guidelines and process for the councils work as described in Forest Code Articles 30 and 31. FS, other agencies and NGOs could assist with this work. FS experience with federal advisory committees may be very useful in this work.

(11) USAID and donor organizations should offer grants and provide assistance to communities to obtain the necessary training, tools and supplies for inventory, analysis and planning for community forestry. Consider offering "seed money" for the early stages of implementation of community forest plans to help communities reach sustainable self-sufficient operations.

7.2.5 Recommendations for Implementation Decrees under the 2002 Forestry Code of DR Congo.— The 2002 Forestry Code of DR Congo provides the general goals for forest management in the country. The Code states "The present law is intended to be general. It limits itself to defining principles and general matters, which will be the object of regulatory texts allowing the government a dynamic adaptation to socio-economic conditions of the country. Such "regulatory text" or additional guidance, known as "implementation decrees," will and could provide specific guidelines for many facets of the Code including for industrial forestry, community forestry, international trade, and conservation of forest biodiversity. At present, no implementation decree has been finalized regarding community forestry. It seems to be an opportune time to help provide concepts and suggestions for specific guidelines for implementation decrees based on the Code.

The DR Congo national Forestry Code of 2002 lists the following three main categories of forests:

(1) Classified Forests:
- use and rights restricted
- ecological concerns
- under state public domain
- natural reserves
- national parks
- botanic and zoologic gardens
- fauna reserves and hunting domains
- biosphere reserves
- recreational forests
- urban forests
- safeguarded forests
- erosion-resistance forests

(2) Protected Forests:
- part of privately-owned forests by the states
- private plantations owned by the states
- concessions for timber exploitation
- local communities can apply to acquire forest concessions on their accustomed lands
- established by presidential decree
- tax free to local communities

(3) Permanent Production Forests:
- forest concessions
- forests declared "good for marketing"
- no rights applicable
- decreed by the Ministers of Agriculture and Forests

Implementation decrees could be suggested, through appropriate NGOs or government offices, to address the following topics and guidelines.

7.2.5.1 Recommendations for a Forestry Code Implementation Decree for Community Forestry

We recommend that implementation decrees be developed to outline and govern equitable processes for identification, delineation, and management of community forests. Implementation decrees should address how the national and provincial governments will recognize community forests and protect the rights of communities to those forests' resources, by addressing the following concerns.

- **Process for defining community**. The Forest Code generally defines community but does not specifically define the process by which specific boundaries of communities are delineated on the ground and in official records. Implementation decrees should address processes for communities to generally define themselves by taking into account traditional and existing patterns of local coordination and governance of families, clans, villages, and groups of villages.

- **Process for identifying traditional use lands**. Implementation decrees should address processes for identifying "accustomed" (traditional, historic) use of forest lands by individual right holders and processes for aggregating those traditional lands into community forests for sustenance and commercial production of timber and non-timber forest products to benefit the entire community.

- **Size and priority of community forests.** Implementation decrees should protect communities' rights to establish community forests on sufficient area to ensure their economic and ecological sustainability. To facilitate local use and management, community forest lands should be in close proximity to the community with which they are associated, without intervening commercial concessions. Criteria for determining size of community forests could include the community's projected need or demand for income or products from the forest based on a projected human population in four or five decades (current life expectancy in DRC), ecologically sustainable rotation length of timber species (generally 30 to 60 years to seed bearing age), and production rates of timber and other forest products. These considerations are similar to those for commercial concessions, and it is logical to expect communities might need areas of comparable size to commercial concessions. Therefore, community forests should be delineated in advance or concurrent with identifying commercial concessions, otherwise establishment of commercial concessions may preclude communities' having sufficient area for sustainable management.

- **Development of community forest management plan**. Certain required elements of sustainable community forest plans should be identified in implementation decrees along with general processes that lead to development and approval of the plan by community leaders and members. The process for

provincial or national government review and acceptance (recognition) of community forestry plans, following approval by the community, should be outlined by implementation decree.

- **Precedence of community forest management plans.** Implementation decrees should give community forestry plans precedence over subsequent interests in those specific forests and their resources, such as from commercial or industrial forest interests, unless the community determines such subsequent claims to be in its interest and formally included, in its community forest management plan. Ecological considerations such as subsequent information about habitat area requirements of wildlife may legitimately override a community's desire to use the forest for timber extraction or agricultural plots and implementation decrees and individual community forest plans should include mechanisms to make appropriate adjustments to community forest plans. (We understand that Cameroon has a "preemption rights" law that prevents others from overriding local community use of forests. In Cameroon, as in DR Congo, all forests are state owned and local communities use them by concession only. However, we are not aware of a similar preemption rights law in DR Congo.)

- **Equitable tax structure**. Implementation decrees should be developed to help enable products from community forests to be priced competitively in local, regional and national markets such that industrial concession operations do not undersell or otherwise force communities out of business in markets necessary for economic sustainability.

7.2.5.2 Recommendations for a Forestry Code Implementation Decree for Conservation of Wildlife and Forest Biodiversity

The purpose of an implementation decree for conservation of wildlife and forest biodiversity is to delineate specific objectives for sustained provision and use of such resources, and to identify associated permitted and non-permitted activities.

- The objective of this implementation decree is to help ensure, where appropriate, the conservation, restoration, and use of wildlife and forest biodiversity in all Classified, Protected, and Permanent Production Forests of DR Congo.

- No wildlife species shall be brought to local extinction (at the scales of districts, territories, or sectors, or greater area) through deliberate, reversible actions of hunting, snaring, collection, fishing, or gathering for local use or market trade.

- Illegal poaching of wildlife shall cease. A policing and monitoring system shall be established to eliminate illegal taking, transporting, trading, and otherwise marketing of wild native animals. This includes, but is not limited to, adhering to international policy and guidelines under CITES.

- Under an officially approved Community Forest Management Plan, local Communities (the “Right Holder”) may be permitted to take wildlife in accordance with procedures and principles of sustainable harvest and as consistent with traditional and customary use.

- An inventory of presence of wildlife species and biodiversity components shall be carried out in selected areas of the country, particularly those most vulnerable to past, ongoing, or proposed activities that may greatly disturb or reduce the extent or quality of native habitats and forest environments. The inventory shall identify wildlife species, habitats, and locations, and forest biodiversity elements and indicators, that are most in peril or in greatest decline. The inventory shall be published as a national report on “the state of wildlife and forest biodiversity.”

Figure 10. A common millipede of the forest and an important detritovore and part of the nutrient cycle. (Photo by Bruce G. Marcot)

- The inventory shall be repeated as a monitoring program for selected species, locations, and forest environments, selected as those most in peril or in greatest decline.

- Specific guidelines and training for animal husbandry of desired native and domesticated animals shall be provided to Communities that have identified such activities as part of their formally adopted Community Forest Management Plan.

- Activities in concessions of Protected Forests shall not cause local extirpations of native plant or animal species.

8 SPECIFIC OBSERVATIONS

In this section, we provide specific observations that underlie conclusions and recommendations presented above, as well as some observations that may be of further interest in a more general, scientific or management context.

8.1 Wildlife and Biodiversity

8.1.1 Endangered wildlife and the bushmeat trade.-- The Red List of the International Union for Conservation of Nature and Natural Resources (IUCN) includes 356 endangered plants and animals within DR Congo. Overall, we were surprised at how much of the primary forest area we visited has been heavily altered and converted to secondary forest, shifting (slash-and-burn) cultivation plots, and various plantations of agricultural products including cacao and coffee.

Recent years of conflict and overexploitation of wildlife for bushmeat and poaching have greatly reduced densities of most wildlife species. For example, after spending more than a week traveling among villages by pirogue (canoe) on Lac Tumba, Congo River, Ubangi River, and tributaries, we saw not one monkey in any of the riparian gallery forest canopies; nor did we see bonobo in remote forests of Botuali south of Lac Tumba, nor hippo, crocodile, or other larger water animals anywhere on our travels, although we were told that these larger aquatic animals do occur in some places we visited.

Figure 11. Slash-and-burn (shifting) cultivation agricultural field. (Photo by Bruce G. Marcot)

The region does contain a high diversity of amphibians, reptiles, birds, and mammals (see Appendix 5 for a listing of mammal species potentially present in the area). For example, among predator species, based on range map distributions (van Perlo 2002 for birds, Kingdon 1997 for mammals), the region of Lac Tumba and Landscape #7 in DR Congo likely contains 26 species of hawks, eagles, and falcons; 11 species of owls; and 16

species of mammalian carnivores (mustelids, mongooses, genets, civets, and cats). However, many of these predators likely are rather scarce to rare.

Also in the general area of Landscape #7 likely occur a rather amazing diversity of 13 species of primates (bonobo, 9 higher monkeys, and 3 prosimians) and 16 species of ungulates (hyrax, elephant, hippopotamus, 2 hogs, chevrotain, buffalo, 6 duikers, and 3 other antelopes). Most of these species are probably taken as bushmeat, along with many other animals. Many of these species likely are now found mostly in more remote and less disturbed environments away from villages.

Figure 12. Villager selling a De Brazza's monkey (l.) and Allen's swamp monkey (r.) as bushmeat. (Photo by Bruce G. Marcot)

Many villages traditionally snare or otherwise capture wild animals for food and sale. For example, along the Ubangi River, we observed a fellow selling an Allen's swamp monkey and a De Brazza's monkey which he had killed. At the Mobenzeno market also along the Ubangi River, we observed several live serrated hingeback tortoises (*Kinixys erosa*) for sale. At an outdoor market in Kinshasa we saw 3 leopard pelts for sale (we were told that leopards have been locally extirpated throughout the disturbed forest landscape just east of Lac Tumba). In Botuali village we were shown and then served a freshly-caught west African dwarf crocodile (*Osteolaemus tetraspis*). We also observed captures of several species of snake intended for the cooking pot.

Figure 13. Dwarf crocodile caught with snail bait. (Photo by Bruce G. Marcot)

Fish also provide important sources of food and protein for many villages, not surprisingly particularly along the main rivers and in seasonally inundated forests. The fish fauna of the region is particularly rich, with about 700 species found in the country. Inventories of fish of the Congo River region (Shumway et al. 2002, no date) suggest presence of about 20 families of fish, the most commonly caught being Mormyrides, and others often from Characides, Citharrinides, Claridae, Clupeides, Bagrides, and Mochocides.

8.1.2 Wildlife of young and old forests.-- During the field expedition, Marcot recorded observations of over a hundred bird species, sign or direct observations of 10 mammal species, several amphibians and reptiles, and many invertebrates including mollusks, millipedes, spiders, and many insects. He also explored forests at night for owls, coucals (large cuckoo-like birds), nocturnal primates, and frogs, and he tape-recorded sounds and photographed some of the species for later identification and analysis. He recorded plant and animal species associated with various conditions of village habitations, young or disturbed forests including fallow shifting cultivation patches and secondary forests selectively harvested, older or primary forests, savannas, and riverine environments.

Species *closely associated* with each set of these conditions may be useful as indicators or representatives of such conditions, as follows. This list is but a sample of species that happened to be observed or encountered during the brief duration of this expedition; doubtless, many other examples could be cited, especially of insects (not listed here). (See van Perlo 2002 for scientific names of birds mentioned here, and Appendix 5 for scientific names of mammal species.)

Species observed closely associated with village habitations.— These included most of the wildlife species recorded, as much of our time was spent in village situations. Bird species that Marcot observed to be closely associated with villages and human habitations included Village Weaver, Bronze Mannikin, Grey-headed Sparrow, West African Thrush, Red-tailed Palm Thrush, African Palm Swift, Velvet-mantled Drongo (sometimes combined with Fork-tailed Drongo), Common Bulbul, Pied Crow, Black-bellied Seedcracker, Rufous-crowned Eremomela, Pintailed Widow, Chestnut-winged Starling, a number of sunbird species including Congo Sunbird and Olive-bellied Sunbird, and others. Also found mostly or solely in village habitat environments were Giant African Land Snails although they would be expected in older forest environments as well. Several unidentified species of bats and African Dormouse (a small mammal) were found associated with buildings in villages. Marcot chased a lone Congo Serpent Eagle among several tall-tree roosts one night in Bogonde Drapeau village, although this species reportedly occurs more consistently in old forests where it feeds and nests.

Species observed closely associated with young secondary forest.-- Young secondary forests usually contained scattered overstory trees and other elements of older forests distributed adjacent to agricultural plantations and harvested forest areas. Examples of wildlife observed to be associated with these conditions include Shining Drongo, Splendid Sunbird, and Crested Guineafowl.

Species observed closely associated with older secondary forests.— Bird species detected in older secondary forests adjacent to villages included Red-chested Owlet, Gabon Coucal, Violet-tailed Sunbird, African Pied Hornbill, Piping Hornbill, and Black-and-White Casqued Hornbill; however, it is likely that these species find optimal habitat in primary forests. At least 7 African Wood Owls were detected in older secondary forests adjacent to villages. Also associated with older and mixed secondary forests adjacent to villages were Pottos, a nocturnal arboreal primate. None of these species was observed in young secondary forests and plantation environments.

Species observed closely associated with old or primary forests.—These included such birds as Great Blue Turaco, which Marcot observed in primary terre firme forest and seasonally inundated forests. Bicoloured Mannikin is a bird that was found once at night roosting in a small group of 4 or 5 at the top of an isolated oil palm tree in one of the villages, but mostly they occurred in large numbers in old swamp forests. African Paradise Flycatcher was observed only in primary forest although it is known to use secondary forests near human habitations as well. Red-tailed Monkey was observed only in the primary forests of Mabali Forest Reserve. A Lesser Anomalure, a small, rare flying squirrel, was observed only in uncut, primary, seasonally inundated forests of Mobenzeno village, and its cavity den was discovered in a 7-m tall snag. In the same forest was discovered sign of Pangolin (termite diggings at the base of a large tree) and Four-toed Elephant Shrew (runway along the base of a large down log).

Figure 14. Extensive old primary forest with diverse tree species and canopy structure. (Photo by Bruce G. Marcot)

Other primates closely associated with older forests include bonobo (not observed but reported in remote drier, older forests 10+ km from Botuali village) and two species of Colobus monkey.

Observed only in pools in swamp forest was the common swamp frog of the *Phrynobatrachus plicatus – P. auritus* group (of which taxonomy is currently being resolved), although it may also be expected to occur in older secondary forests with pools and ponds.

It should also be mentioned that the villagers noted on the Participatory Community Maps the presence of some wildlife species only within what seemed to be older or less disturbed forest conditions far from village centers; these species included Elephant, Leopard, Buffalo, Bush Pigs, Bongo, Python, and Parrots. We observed none of these species except African Grey Parrot, found in an older upland forest.

Species observed closely associated with savannas.— A small population of Red-billed Queleas was observed in a savanna at Mobenzeno village. This observation is significant because this bird species occurs in vast numbers further north and south in Africa outside the west African equatorial belt, but is not shown in the bird field guide (van Perlo 2002) to occur in this part of DR Congo. It was observed only in savanna habitat (with 0.5-1 m tall grasses). Whether it is a recent invader, or has escaped previous detection, is unknown.

Species observed closely associated with riverine and wetland environments.—These included the birds Hamerkop, Hartlaub's Duck, African Fish Eagle, Palmnut Vulture (Vulterine Fish Eagle), Kelp Gull (on Lac Tumba), Shining-blue Kingfisher, Pied Kingfisher, Winding Cisticola, Goliath Heron, Great Egret, African Jacana, Orange Weaver, Green Heron, Hadada Ibis, and Gray Pratincole and Rock Pratincole (at dusk on the Congo River).

In the village of Bobangi along the banks of the Ubangi River was the only site where the Central African Mud Turtle (*Pelusios chapini*) was observed, a specimen of which was given to us as a gift by the le groupement chief and his council. This was a significant find, as identification was later confirmed by 4 herpetology experts from photos taken of the specimen by Marcot (B. Marcot, *Two turtles from western Democratic Republic of the Congo: Pelusios chapini and Kinixys* erosa; in press). Apparently, these were the first photographs known for this species.

Figure 15. Central African mud turtle (*Pelusios chapini*), perhaps the first photograph of this species in the wild. (Photo by Bruce G. Marcot)

A number of wildlife species were found broadly distributed among these and other habitat types, such as Black Kite and Woodland Kingfisher. Such generalists may be less vulnerable to loss or reduction of any specific habitat conditions as listed above (although other ecological reasons can account for a species' endangerment, such as overharvesting and disease).

Marcot explored many of the forests near the villages at night for owls and other noctural wildlife, and through vocalizing and playing taped recordings of owl songs and calls was able to detect 11 total owls among 3 species: 1 Red-chested Owlet (*Glaucidium tephronotum*), 8 African Wood Owls (*Strix woodfordii*), and 2 probable Pel's Fishing Owls (*Scotopelia peli*). A separate report on the owl observations is in press (*Tyto*) and available on-line (Marcot, B. G. 2004. Observations of owls in western Democratic Republic of the Congo, with a note on African wood owl vocalizations. OwlPages.com http://owlpages.com/articles/Owls_Congo.html). Marcot also tape-recorded several nocturnal calls of pottos, and photographed bats and many insects including rhinoceros beetles and giant water-bugs (Belastomatidae).

8.1.3 Forest trees and their associations.- In Bobangi village along the Ubangi River, we explored various vegetation conditions and forest ages. Marcot catalogued the following associations of the more dominant trees of each type:

Lingala and local dialect common name	**Scientific name**	**Commercial name**
OLDER, UPLAND (*TERRE FIRME*) FORESTS		
Overstory trees		
bouma	*Maesopsis emimii*	musisi
Understory trees		
limbange	*Ceiba pentandra* \1	kapokier
bolanga	*Bridelia atroviridis* \1	(none)
PLANTATIONS AND SECONDARY FORESTS (*JACHÈRE*)		
Overstory trees		
lingoto	*Terminalia superba*	limba
Understory trees		
(none; single story only)		
"WET" (NOT SWAMP) FORESTS (includes seasonally inundated forests)		
Overstory trees		
bouma	*Maesopsis emimii*	musisi
boole, bolobolo	*Funtumia* sp. (prob. *F. elastica*)	mutondo
bokole, mokole	*Lophira elata*	azobe
Understory trees		
nsange, basange	*Xylopia aethiopica*	(none)
bokuka, mokuka	*Alstonia boonei* or *A. congensis*	emien
bokoli	*Mammea africana*	oboto, moboto

\1 Species identification uncertain.

8.1.4 Caterpillars and trees.—Several species of caterpillar are gathered by villagers as food (they are cooked over fire until rather roasted and crunchy). The caterpillars – "les chenilles" in French -- are found closely associated with at least 10 species of trees, mostly in older secondary or in primary forest conditions. These trees are:

Lingala local common name	**Scientific name**	**Commercial name**
lifake ("redwood")	*Entandrophragma angolensis*	tiama
?	*Entandrophragma utile*	sipo
bosenga	*Piptadeniastrum africanum*	dabeme
bolaka or botaka (boele in Mongo)	*Strombsiopsis tetranda*	afina
bokanga	*Amphimas pterocarpoides*	lati
lifake ekaala	*Meletia laurentii*	wenge
bolengu	*Deniellio pynaertii*	fara
bolle	*Funtumia elastica*	mutando
depake	?	?
dingodju	?	?

To maintain the caterpillar resource, the local villagers realize they must maintain mature specimens of these trees. Again, this seemed to be a lesson in needing to consider all forest resources to help determine the desirable timber resource.

Figure 16. *Les chenilles* caterpillars collected as a delicacy. (Photo by Bruce G. Marcot)

8.1.5 Islands and trees.—A long, unnamed island occurs in the Ubangi River off Bobangi village. The island was included by IRM in their participatory community mapping project. The island contains several villages and is heavily forested. The main trees present on this river island ("les arbres d'isle") constitute a unique set of species, and include the following:

Lingala local common name	**Scientific name**	**Commercial name**
mokese, bokenkese	*Cynometra sessiliflora*	?
waka, mobaka	*Copeifera milbraedii*	?
bouma	*Cleistopholis patens*	sobu
lingoto	*Terminalia superba*	limba
bokole, mokole	*Lophira elata*	azobe
bosambo	?	?

8.1.6 Army ants.—Prevalent in both secondary and primary forests alike were swarms of army ants, called "*les fourmis*." On nearly every forest trek, we encountered army ants in all forest conditions. During hikes, someone toward the front of the line would shout "*les fourmis*! *les fourmis*!" and everyone in line would start a rather comical high-step dance and sprint forward to avoid getting covered by the painfully-biting insects. On nearly every night-outing into the forests to track down owls and other nocturnal creatures, Marcot ran into *les fourmis* and several times was bitten head to boots, as you cannot see the ant swarms at night in the dark forests until they are all over you and send the pheromone signal to begin biting all at once. Thus, the ants were found to be both diurnal and nocturnal, and to occur in both dry and wet forest and young and old forest, and were prevalent even after heavy rain, despite our being told that rain drives them away.

Two kinds of army ants are recognized there: *fourmis magnants*, black ants with very painful bites, and *fourmis rouge*, red ants and the more common form. It was unknown if these are only two species, or several species. However, if ever there was a factor to dissuade lay-public ecotourism -- beyond the difficulties of travel, obtaining water, and the lack of infrastructures -- it will be *les fourmis*.

8.1.7 Nurse logs and oil palms.—In a seasonally inundated forest that Marcot explored in the Mobenzeno village area, was discovered an oil palm tree (*Elaeis guineensis*) growing from a down nurse log of waka or, in the local Bobangi dialect of Lingala, mbaka (*Copeifera milbraedii*, also called by its commercial name of etimoe). The nurse log was at least 40 cm diameter. This is mentioned because, as far as we can tell, so little silvicultural research seems to have been conducted on desirable commercial and crop tree species in the region, including this species of palm.

8.1.8 Names of trees.— Trees had 3, and often 4, different names: a general Lingala common name, often a local Lingala dialect common name, a general commercial name, and a Latin scientific name. It was a challenge to track all names to be certain which species we were observing or discussing. One member of our traveling team (François

Bokondokondo) brought along an indispensable booklet ("Liste des Essences Forestieres du Zaire [RDC]" by Government of Zaire, no date) that crosswalked these names.

Additionally, several tree species were combined into the generic term "redwood" and at least one species was referred to as "blackwood" due to the color of the heartwood. Redwood, the local term lifqué, includes the species *Ceiba pentandra, Entandrophragma candollei, E. angolensis, Chlorophora excelsa, Meletia laurentii*, and others.

8.1.9 Terminology in English, French, and Lingala.— To better understand the local villages' use of forest resources, Marcot compiled a crosswalk of key terms and concepts between English, French, and Lingala (see Appendix 6). From this crosswalk, it was discovered that the local people do not have a specific concept of "wilderness" or primary, undisturbed, uninhabited forest. The idea of wilderness is more of a western concept. In general, at least central Africans do not conceive of nature being unoccupied or apart from people; people, instead, are inherently part of nature. The local concept of "primary forest" too has more to do with forests not yet cut for agriculture or timber; it does not connote absence of people, as even stands of very old or large trees usually have some presence by people using some resources. These differences in concepts may have significance if parts of the forests are ever intended to be designated as reserves or *sancta sanctora* (core areas excluding human presence) in the biosphere reserve sense.

Likewise, the concept of "spirit grove" has no specific meaning with the local people. Instead, there may be specific locations with graves, and those locations might hold specific meaning or significance and are seen as being "occupied" or used by people. Elsewhere, such as in southern Asia, "spirit groves" can serve to denote patches of uncut or older forests that secondarily serve as *de facto* reserves and habitat for rare plants and animals. These conditions also exist in western DR Congo but are not conceived as such by the local people.

8.2 Forests and Forest Management Activities

Figure 17. Four-wheel drive vehicle stuck at stream crossing en route to Bikoro. (Photo by Rick Alexander)

The overwhelming observation is that the villages currently lack infrastructure and equipment to support community forestry. The transportation system is insufficient and unreliable. In remote areas, the only means of transporting forest products is human labor. We saw a few bicycles and very few push carts, presumably because the foot paths are rough and people lack the capital to invest in even basic equipment.

Demand for or ability to purchase forest products in villages is low or non-existent. Village economies barely approach subsistence levels so there is not much cash to support a local market for basic necessities, let alone forest products. At the same time, forest products are readily available to most villagers able to exert the labor to gather them for themselves.

Right holders or sawyers who have obtained permission to harvest trees in communities south of Mbandaka, along the poorly maintained road to Bikoro, sometimes sell planks at the roadside, Others arrange with truckers to transport planks to market in Mbandaka in exchange for planks or part of the revenue from selling the planks.

Figure 18. A pirogue or dugout canoe, typical transportation of goods along the rivers and lakes. (Photo by Rick Alexander)

Along Lac Tumba and the rivers, some villagers told us that they used to transport planks to market by pirogue or *baleinières* (motorized boats much larger than pirogues for hauling passengers and freight). At present, only a few *baleinières* are operating in the areas we visited. (One was being loaded on Lac Tumba at Bikoro and two were docked at Irebu.)

On the Congo River in Mbandaka, we saw a barge with pusher (tug) boat transporting very large diameter (2+ meters) logs, other goods, and people to Kinshasa. On the Ubangi River, we saw one barge with a pusher headed downstream; the barge was loaded with people and all manner of agricultural and forest products. Several people told us that river traffic had been reduced to a tiny fraction of what it had been before the civil war (approximately 1994 to 2002). In Kinshasa, there were hopeful signs of river transport beginning to revive. People were seen laboring on steel hulls and investing in materials for repair of boats and barges.

In villages, technology to convert raw forest materials to product is limited by lack of capital. For example, a long saw (2 m long, two handled handsaw) with the necessary handles, files, saw sets, and so forth costs US$100-200 in Kinshasa. Average annual per capita income in villages is said to be less than US$25. Individual community members will need to pool resources to make such capital investments in equipment.

Infrastructure and equipment for transporting raw materials or sawn planks to market is currently limited by extremely poor roads, few vehicles, and poorly organized public or commercial transportation enterprises. Raw logs, on average one meter in diameter by 4 to 5 meters long, are sawn in place because there is no way to move them. In fact, basic

tools for safely and efficiently moving the logs into position for sawing on site are lacking.

Community forestry markets are very limited. Most villages visited do not currently use planks (sawn timber) in construction and existing infrastructure limits ability to transport planks long distances. Mbandaka and Bikoro, once political/social stability improves, will be nearest markets in which there is demand for sawn timber.

Larger towns (e.g., Mbandaka, Bikoro) are more likely to see increased demand for planks if there is a sufficient period of political and social stability to encourage repair, maintenance and new construction. Once demand for sawn timber begins to increase, hand saw operations will need to improve so product dimensions are more uniform and consistent. At some point, communities can mechanize with chain saws and portable mills to improve utilization and quality of product. However, mechanization increases the threat of harvesting at unsustainable rates. This is one reason why area of forest available for community forestry must be large scale.

Industrial concessions in the vicinity of Lac Tumba are in the range of 175,000 ha to 250,000 ha. Some people interviewed suggested a minimum size of 360,000 ha is needed for an economically viable industrial operation that will support a mill. This estimate assumes the mill requires at least 3000 m^3 of raw logs per month, or 36,000 m^3/year. An average tree yields about 3 m^3 and approximately one tree per hectare is harvested, requiring 12,000 ha/year to supply the mill. Assuming an average harvest rotation cycle is about 30 years, 360,000 ha would be required for a sustainable rate of operations.

The status of forestry concessions is hard to determine. Many have been abandoned during the civil war. Others have been taken back by the state since the 2002 Forest Code because the fees and taxes were not paid on them. Some companies continue to lay claim to the old concessions. Along the road between Mbandaka and Bikoro much of the forestry activity is illegal, unregulated and untaxed in the view of the state. The provincial ministry of environment has no authority to arrest people illegally in possession of planks, only if in possession of illegal logs (round wood). The ministry has no funding for enforcement.

Figure 19. Fish trap in swamp forest stream near Botuali village. (Photo by Bruce G. Marcot)

Traditionally, rights to use the forest were held by the chief, who is descended from the earliest family to have settled in the area and began using the forest. Initially other families would settle nearby and establish patterns of using the forest

that was not used or "claimed" by the first family. These oldest family lines become the "right holders" in the village. The precise organization varies by community, but in general forest rights are associated with the chief and a few elders descended from other old family lines. Relatively more recent arrivals to the area are allowed permission to use the forest or fishing areas by permission of the early "right holders" (Akwah and Yoko 2004).

Recording of the rights to use of the forest is by oral tradition. Areas to which families hold traditional rights are known without the need of physical boundary markers. We observed carving on trees or posts, signs written in charcoal on a rough piece of wood, and symbols simply fashioned from palm fronds in the forest and along streams which identified whose farm or fishing area we were in. Such markings appeared to identify areas being used by newer arrivals with less permanent standing than the oldest families.

The 2002 Forestry Code suggests that the benefits from community forestry should be spread broadly through the community but offers no specific guidelines on how to do that. Traditional patterns of use and deriving benefits will have to be accommodated with desires and demands of the present day community as community forestry plan are developed. Such community plans will need to identify how benefit and risk is distributed between older families with traditional rights and "new comers".

Many people reported to us that since the civil war, civil servants have not been paid or are not paid on a regular basis. When they are paid it is only the equivalent of a few dollars per month. Many civil servants in the city have a second job or some enterprise on the side.

The provincial minister of environment told us DRC has no forestry school and that training and research is needed in silviculture and reforestation. In Mbandaka there is a botanical garden suffering from lack of maintenance and struggling to recover from neglect during the civil war. At Mabali Forest Reserve, near Bikoro, the Centre de Recherche en Ecologie Forestier is in a similar state of poor maintenance and no funding. While both the botanical gardens and the research center are sad to see in their current condition, there are encouraging signs of people working in spite of limited means to care for the facilities, and clinging to the hope that there will be enough political stability, economic incentive, and social will to resume the scientific work. There is still enough of the tradition of learning and scientific study at these facilities that they could become centers of study and leadership in the protection and management of the DRC forests and rivers.

We understand that some NGOs are operating in health care and in infrastructure such as roads and bridges. However, we are not aware of any organization looking ahead to the need for other community infrastructure and services. With the projected increase in human population and the continued pattern of people concentrating in villages near roads and rivers, we see a need for DRC government with the help of NGOs to begin now to address sanitation, waste water, solid waste, transportation, energy, and

communication infrastructures. Kinshasa and Mbandaka are examples where wood fueled cooking fires and burning of garbage or waste contributes to air pollution.

Another example of an increasing solid waste problem is non-biodegradable garbage. In villages most refuse is readily degraded in the warm moist climate. However, we observed discarded plastic bags and dry cell batteries that are very persistent in the environment. We are not aware of any provision for more environmentally sound disposal. As the use of motor vehicles increases, used motor oil and tires also will contribute to this problem. There is an opportunity and need for USAID to work with the DRC and provincial governments to restore or establish infrastructure in rural areas. Along with the establishment of systems to properly handle waste and recycle materials, there should be a program to raise the awareness of how certain wastes are particularly harmful to human health or the environment. In some cases, this could be done by modestly expanding health, environment, and lifestyle projects that the NGOs already have in place in rural areas.

8.3 Site-Specific Observations

Mbandaka

The provincial minister or coordinator of environment told us he has no budget and no equipment for field work or to maintain a proper office with records and accounting systems necessary to oversee forest protection and management. Indeed, his offices had no phones, faxes, computers, calculators, electricity, or plumbing. He is a sincere and dedicated person doing his best with a few old maps and ledgers, and a few file folders of yellowing papers. He said a portion of taxes from timber harvested from forestry concessions is supposed to support his ministry, but he sees little or none of it.

We interviewed two entrepreneurs working in forestry. Jean Noangi (a French speaker) tried operating with a mobile mill. Years ago he was working with a hand crew clearing farm plots. He recognized the value in the trees being cut but not utilized and decided to apply for assistance from European Community in the late 1980s to fund a mobile sawmill, a 45-horsepower tractor, and related equipment. The portable mill could saw 3 m^3/day. He paid the right holder a negotiated price, generally US$30 per tree. If the right holder was not also the village chief, the chief was also paid, usually in goods such as sugar, salt, or soap. One tree would generally yield about 3 m^3. Noangi usually received US$130-80 per cubic meter in Kinshasa for milled planks. However, long saw operators would sell for US$60, undercutting his prices in Kinshasa. Competition, transportation costs and the difficulty and expense of keeping equipment operating forced him out of business.

Fidel Boutela (a Lingala speaker) runs a crew of 14 people. It was not clear if his crew worked with powered or hand equipment. He sells planks in Mbandaka for US$130-140/$m^3$. Both Boutela and Noangi said transportation costs, and what Noangi called "globalization" or excessive (and probably illegal) fees, taxes, and forced rents, were a

drain on small entrepreneurs. They are concerned that the 2002 Forestry Code will increase such problems.

Bogonde-Drapeau

In Bogonde-Drapeau, villagers told us there are five crews using axes and hand saws called long saws. It requires one or two days to fell a tree with an ax. Four crews are working with power saws (chain saws) and a portable mill. One portable mill is owned by The Reverend Sisters (Catholic mission) and one by a former army general. It requires 30 to 60 minutes to fell a tree with a chain saw. Logs are sawn into planks at the stump because there is no means to move them very far. Both chain saw and ax crews move logs into position for sawing, by using ropes. Sawn planks are head carried to a road, sometimes a kilometer or more along dense forest trails. Most planks are transported to Mbandaka by truck, or to Kinshasa by pirogue, barge, or raft.

Figure 20. Porter head-carrying a 4-m plank to a "depot" in village approximately 1 km away. (Photo by Rick Alexander)

The preferred species for lumber are the redwoods, including lifake (*Entandrophragma* spp.), because they are very durable. Commercial names for these woods include sapeli, tiama, and kosipu. Traditionally, lifake was not cut because *binjyou* (caterpillars) lived in them and the caterpillars are gathered by villagers for food.

Figure 21. First cut on bokenge (*Hua gabonnii*) log, 70 cm diameter x 3.9 m long, felled with axe. (Photo by Rick Alexander)

Loggers typically pay a fee to the right holder for permission to reconnaissance for timber. The fee is modest, usually a few Congolese Francs (FC) and some sugar, or a few bottles of wine, or some soap. The right holder and logger agree on which trees will be harvested and then negotiate a price per tree harvested. Payment per tree may be as

much as US$30 and often a few of the planks that are sawn from it. Often the logger ends up buying back the planks from the right holder at a reduced rate, because the right holder has no way to transport the planks to market.

In Bogonde-Drapeau (and other villages we visited), Akwah and Yoko presented the participatory community maps, reviewing the process that went into developing them. About fifty people listened and participated in discussion, including three women and about 18 children of various ages. Most examined the maps after the presentation and asked questions or commented on them. The population of Bogonde was recorded as about 4700 people during the mapping.

Figure 22. Longsaw operation. Trees are felled with axe and sawn into planks using long saw. (Photo by Rick Alexander)

We visited a long saw crew (usually 3 to 5 people) cutting a bokoli tree (*Mammea africana*). The stump was about 3 m tall and the clear bole was about 18 m above the stump to the lowest branches. It will yield three 5-meter logs. The logs are pushed, pulled, and rolled up onto a scaffold so the saw can be used vertically with a sawyer on either end – one sawyer standing on top of the log and the other sawyer in a pit beneath the log, the latter being an apparently precarious position should the scaffolding collapse. This particular crew's saw was shorter and narrower than a new saw because it had been filed or sharpened so many times.

A new saw is about 2 m long and costs about US$200 in Kinshasa. They give the right holder two planks from each log. Planks are generally 2 cm to 4 cm thick and about 25 cm wide. They also cut planks 7 x 7 cm. They usually cut to 4 m lengths, and will cut to order 5 m logs. Plank thickness is not uniform because they do not use a guide. They mark all the cuts before sawing, but cannot control saw well enough to create uniformly thick planks. Planks sell in Mbandaka for FC600-800 each. They pay about FC200 to transport each plank by truck from Bogonde to Mbandaka. They pay porters FC50 to carry each plank about 1 km to village.

We also visited Reverend Sisters' Mobile Dimension Saw (Mobile Mfg. Co., model 128) sawing two bokesu (species scientific name unknown) trees in a fallow farm plot. The trees were felled toward each other to minimize moving the portable mill from log to log.

This had the secondary benefit of having the least disturbance of the existing forest canopy and lessening secondary breakage and damage of other non-target trees.

Figure 23. Mobile Dimension Saw operated by 5-person crew plus 5 people carrying planks to road 1 km away. (Photo by Rick Alexander

The crew included five people working with the mill, and five carrying planks to the road. They are paid monthly by the Reverend Sisters, each one earning FC5500 per month, about US$16. Log length is 5.2 m, planks are 7 x 7 cm and 3 x 7 cm. Each of these trees yielded four logs of 4 to 5 m long. It appears that the slabs and the waste below the saw guides total about 35-40% of the log volume. Modifying the set-up or guides for the saw rails could yield a few more planks from each log and greatly reduce wastage.

Bogonde-Drapeau: Trees observed or mentioned in interviews

Local name	Commercial name	Scientific name	Notes
		Elaeis guinensis	wild palm, said to be an indicator of swampy area
bofeko or mofeko	essessang	*Ricinodendron huedelotii*	light colored wood seen in locally crafted chair
bokoli		*Mammea africana*	long saw crew
bokesu		*?*	
bolanga		*Bridelia atroviridis*	
bolondo	iroko or kambala	*Chlorophora excelsa*	yellowish red wood seen in locally crafted chair
bosenga	ilomba	*Pycnanthus angolensis*	redwood
bosulu	padouk	*Pterocarpus castelsii*	red wood
lfake ngola	tiama	*Entandrophragma angolense*	red wood
lifake mpembe	sapelli	*Entandrophragma cylindricum*	red wood
lifake ya mabanga	kosipo	*Entandrophragma candollei*	red wood

Kalamba-Beambo

Yoko and Akwah presented the maps in this village to about 50 people including a dozen or so children. No women participated here. Kalamba has a population of about 2000. Community members expressed interest in community forestry in order to secure their lands. They do not harvest much timber now, because they lack the means (saws, mills, trucks) to do so. Some long saws are working in the area. Villagers say blackwood brings a better price than do the red- and whitewoods.

Much of the forests are called swampy, having numerous small streams and pools of brown, tannic water. We trekked through many farm plots and fallow land, a neglected cocoa plantation, and some secondary forest that had been cut years ago for farming and then allowed to go fallow. The average shifting cultivation plot is about one hectare to feed a family. The plots are cropped for about three years before being fallowed for several years, sometimes up to five to ten years. Corn and manioc are the most common crops.

Figure 24. Shifting cultivation site with manioc, maize, and oil palms. (Photo by Rick Alexander)

Villagers showed us boala (*Pentaclethra macrophylla*), bolula (*Omphalocarpum mortehanii*) and bonenge (*Annonidium manni*) trees and numerous medicinal plants and vines. One vine was described, in translation, as wild yam and had a knobby oblong tuberous root about 20 x 30 cm. Boala has a large (approximately 3 x 35 cm) pod from which seeds are collected and ground to make a cake or bread-like food. Bonenge has a large, pineapple sized fruit that was collected on our trek to be taken back to the village to ripen. *Gnetum afracanum* is a prized plant, the leaves of which are used in a popular (and deliciously spicy) dish called fumbwa. Ketsu vine (*Piper negrum*) is a common spice. In Kalamba and every other village we visited, community members make broad use of the forest for food and non-timber products.

We observed a crew hand sawing a bokenge (*Hua gabonnii*). The tree was felled with an ax, its stump height was about 130 cm and 89 cm in diameter. Two 4-m logs were cut; the fist log immediately above the stump was 70 cm in diameter at the stump. The tree was cut about one month earlier and had sprouts of about 20 cm. The slab or waste wood appears to be unnecessarily thick and not optimum utilization of the tree.

Iymebe Munene
Yoko and Akwah discussed the maps in this village with about 100 adults, including a dozen women. As many as 50 children clustered around the circle too. People reviewed the maps and asked questions about them. They asked if IRM was going to fix the road and talked about constraints to community forestry, namely lack of equipment. The village stretches for several kilometers along the dirt track between Mbandaka and Bikoro. Its population is nine to ten thousand people.

We trekked out of the village through a savanna and into the chief's primary forest. It is probably the least disturbed and oldest of the forest stands we visited, notable for its large trees, abundance and large diameter of lianas, closed over-story, and relatively sparse under-story. Beyond the primary forest stand, the chief showed us several of his farm plots which had the most diversity of crops we saw anywhere: corn, manioc, peppers, sugar cane, pineapple, squash, banana, a plant the chief called tobac, and another he called aubergine (but was not egg-plant).

On the way back into the village, we stopped to talk to a person tending his 5-ha coffee plantation. He says it yields about 3 ½ metric tons per year. He ships his coffee crop by truck to Mbandaka for about FC1500/100 kg. He says prices are about FC50/kg in the village, FS100/kg in Mbandaka, and FC250/kg in Kinshasa. He can pay another FC1500/100 kg to ship by pirogue from Mbandaka to Kinshasa. He believes his coffee must be open grown. He also has 2 ha of cocoa which grows in partial shade of oil palms.

We reviewed, on the participatory community map, the area we trekked through the previous day. The maps were obviously fairly general and not spatially accurate. They are a reasonably good schematic of where general forest types occur and what uses are made of various natural resources in the forests. The mapping process seems extremely useful to begin building awareness of the relationship between community and surrounding forests and to initiate community discussions about the possibilities for development to improve community and individual well-being. We visited another long saw operation where acajou (*Khya anotheca*) was being sawn into planks. This log was suspended over a pit in which the sawyer at the bottom end of the saw worked. The log was 90 cm in diameter and 4 m long. Three other logs (4 m lengths) were cut from this tree also.

Mabali Forest Reserve and Centre de Recherche en Ecologie Forestier
We traveled to the Mabali forest research center by pirogue from Bikoro. There is also a jeep track from Bikoro to Mabali. The reserve or research center was established about 1948. Since then, there has been relatively little disturbance of the primary forest trees, but prior to that there had been. The administrator suggested it was not really primary forest, but old secondary forest. He pointed out large specimens of dabema (*Piptadendiastrum africanum*), wenge (*Melitia laurentii*), and ilomba (*Pycnanthus angolensis)* among many others. The research center was one of the few places we saw live monkeys (Red-tailed Monkey), the other place being the old primary forest in

Iyembe Munene. Mabali Forest Reserve is about 1400 ha, including a small island in Lac Tumba.

The facilities were once quite elaborate with a power plant, library, laboratories, zoological collections, herbarium, green houses, nurseries, plant drying sheds for botanical samples, maintenance garage, employee housing, the administrators house, and the cottage in which Belgian King Leopold III took refuge during World War II. The cottage and library buildings have beautifully carved native woods incorporated in their architecture. The administration building has beautiful, dark hardwood panels, posts, doors, and window frames.

The library and herbarium are in a state of neglect and the administrators have no funding to maintain them. The small library may have rare scientific manuscripts worth retrieving, preserving, and cataloging. The center administrator, the director for fisheries studies, and the director for vegetation studies were all enthusiastic about our visit and hopeful that before long there would be sufficient political stability and funding for them to resume their ecological studies.

Bikoro

In this village, we interviewed eleven men organized into four saw teams using long saws owned by Mele Emunu. Emunu provides the saw and equipment. The saw team members are each paid FC500 per plank and provided food, mostly manioc, some corn, and occasionally fish. Emunu also gives them some clothes and sometimes gifts for their families. The sawyers only receive a little cash and not on a regular schedule. Most wages are paid in goods. It usually takes a day to fell a small tree (about 80 cm) with an ax, and about 2 days to fell a large tree (>100 cm) by ax, longer if they have to build a scaffold to get above the buttress. They said one log yields about 15 planks and they can saw about four logs per week. They learned their sawyer's trade from Mr. Cruz in Iyembe Munene years ago. They say they like their work and prefer it to fishing or hunting which other Batwa do, because they get at least a little bit of cash for this work. Planks sell for FC500 in Bikoro. In Kinshasa, a plank sells for FC2200 to FC3000 (US$6-8). To transport to Kinshasa by pirogue or *baleinier*, Emunu pays ¼ of the planks being transported.

Emunu bought the saws about five years ago and they cost US$200 each in Kinshasa. He makes his own saw sets, because they are hard to obtain commercially. He has worked in the area since 1995 and has made enough money to buy a used vehicle. Emunu says there are four other businessmen like him in the area. He believes there is enough forest to keep his crews busy for another 10 years. His 6 teams cut 5 or 6 trees a month. Emunu also serves on the CBFP commission in Bikoro.

Botuali

We traveled to Botuali with the territorial administrator and his entourage from Bikoro. It was the first time in 11 years that an administrator has visited Botuali. The administrator got a special welcome and honored treatment by the community. By association, so did we. Yoko and Akwah talked to about 60-80 community members

about IRM and why we are visiting the area. No participatory community forest mapping had been done in this area yet.

Botuali is a 10-km trek from a point along the Lobombo River that is another 10 km from its mouth at Lac Tumba. There are no usable vehicle roads into the area. There was a vehicle road years ago, but it fell into disrepair over the last decade. Consequently, the nearest market is Bikoro, a long way to go in a pirogue without a motor. With a motorized pirogue and the trek, it took us most of a day to reach Botuali from Bikoro, and this included an interlude on one of the lake's islands when swells nearly swamped our boat.

In Botuali, we trekked through an old cocoa plantation and many shifting cultivation plots to an area the villagers described as a primary forest. We saw no large diameter (>100 cm) trees in the area. The under-story was fairly dense and the over-story was relatively sparse. There were no saw operations in the vicinity of the village. We saw one 60-cm diameter bobondo (species scientific name unknown) tree cut down to collect honey from a cavity in the bole just below the branches. This tree had 16 m of clear, straight bole and another 6 m of bole exhibiting some twist and crook. Villagers told us none of the wood would be used for fuel wood or other purposes because it is too far from the village. They showed us trees they called boteli and bokumbo, but we were unable to determine the scientific name of these, or to learn of a commercial name or another common name. Bonobo chimpanzees and elephants are reportedly using the forest another 10+ km south of the village.

Bobangi

In Bobangi, Nsenga, Akwah, and Yoko presented the participatory community maps. The discussion in this community was more animated and engaged than in the others. The community has established commissions for forestry, fishing, farming, and animal rearing to explore management options in the COAIT process. Traditionally, fishing has been, and will continue to be very important for subsistence and commerce. They discussed individual ideas about how a community forest might be identified and organized to benefit the community. Community members expressed appreciation for the work IRM is doing to help them learn about possibilities for development. They said FS could help them with training in forestry operations, particularly inventory, harvest tree selection, felling and sawing operations, and marketing. They said they also need help obtaining the tools and equipment for forestry operations

In Bobangi, many non-timber forest products are harvested for local use. A small amount of timber is harvested for local use, mostly for pirogues or in stick and mud construction. The mud brick building IRM rents for its office in Bobangi has new doors and window frames made by a local craftsman using local lumber. This craftsman works on a small wooden bench propped against a tree, using an old wooden plane and a battered, worn chisel to do the millwork. The village does not sell wood because markets are far and accessible only by pirogue.

We trekked through shifting cultivation plots into secondary forests where the local IRM facilitator told us the trees are more than 30 years old. Beyond the secondary forest, we saw several bouma (*Maesopsis eminii*) in a seasonally inundated foresst with huge buttresses and diameters of an estimated 2 m above the buttress. Buttress heights were an estimated 10 or more meters above ground. Many of these trees are growing next to streams and in inundated areas. We were shown many lingoto trees (*Terminalia superba*). One of these was chopped down and about 13 m of the bole was used to dig-out two pirogues. The remaining 20-m bole was left in the forest unutilized and decaying. The taper was less than 15 cm from the stump (70 cm diameter) to the first limbs (55-60 cm diameter).

We also saw mosange, a tree with dramatic aerial roots arching away from the bole 5-8 m above the ground. Mosange (local dialect name) is called bosange elsewhere (*Xylopia aethiopica*). We looked at wind-thrown trees, observing the very shallow, broad root systems. From the crown of one fallen tree, villagers were gathering lianas of 3 to 5 cm in diameter and about 20 m long, to be used in stick and mud construction.

Figure 25. Massive buttress of bouma (*Maesopsis eminii*) in Bobangi seasonally inundated forest. (Photo by Bruce G. Marcot)

The large buttress, aerial roots, and oftentimes poor form of the trees, coupled with the sensitive wet sites on which they were growing, held little promise for an ecological or economically sustainable timber harvest operation. We discussed these problems with villagers and they offered to take us to a stand they felt had more commercial promise a kilometer or so north of the village. We next visited a stand of lingoto that the villagers are considering for community forestry. The trees are growing in an old cocoa plantation near the river. They are 60-70 cm diameter with an estimated 20-25 m of clear, straight bole above buttresses 1 ½ to 2 meters high. From under the cocoa it was difficult to estimate how many there were, but probably only a dozen or so. When we suggested this was not enough trees on which to base a sustainable plan, they assured us Bobangi village forests included a very large area between the Ubangi and Mpoko Rivers with stands of suitable trees.

Eden (near Mobenzeno)

Eden is a Christian missionary community several kilometers south of Mobenzeno. This entire area along the river was heavily impacted during the civil war. Animals were

hunted out and many trees cut for shelter and firewood by rebel armies. Traditionally, fishing has been the primary subsistence and commerce in this area. Nearby Mobenzeno (estimated population, 2000) has a large market once a week serving a wide area, including people from The Republic of Congo (Congo-Brazzaville) across the Ubangi River.

Nsenga, Yoko, and Akwah reviewed participatory maps with about 40 people, mostly men. Villagers were interested in community forestry and told us they have large molondo (called bolondo elsewhere, *Chlorophora excelsa*) and wenge (*Miletia laurentii*) about 2 to 4 hours walk from village. We split up and looked at two stands. Alexander visited one up the Mpoko river 10–12 km where villagers said there were large wenge. Marcot visited another stand east of the village, with very large bouma (*Maesopsis emini*).

Figure 26. Seasonally inundated forest near Mobenzeno. (Photo by Bruce G. Marcot)

The villagers said we would see wenge, mokoli (bokoli), mosange, and mbaka (waka) in the upriver stand. We traveled there by pirogue and walked inland from the river 1-2 km across a savanna and into a stand where we saw mostly mbaka (*Copaifera milbraedii*) and mokoli (*Mammea africana)* in a seasonally inundated forest. We were told the mbaka is a very durable "black wood" that will last as long as 20 years on the forest floor with only minimal decay.

The area was entirely dry at the time, but we saw holes into which eels or mud fish had burrowed into the mud to wait out the 8 to 10 week dry season Villagers told us this is an important fishing area during the rainy season. A small pirogue resting nearby was testament to this. One cluster of a dozen or so mbaka were 30–50 cm diameter, 30–35 m tall, and spaced 5-20 m apart. Nearby, another group of trees averaged 45 cm diameter and had an estimated 10-12 m clear bole. Another cluster of six mokoli and mbaka were 60–80 cm diameter and 45–50 m tall with an estimated 25 m of clear bole, spaced 10–30 m apart.. Villagers told us mokoli is too heavy to float to market easily; it sells for US$100–150 in Kinshasa.

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Appendix 1. Terms of reference between USDA Forest Service and Innovative Resources Management.

Innovative Resources Management/USDA Forest Service International Programs Collaboration to Develop a Model for Community Engagement in Sustainable Timber Harvesting in the Lac Tumba Landscape (#7), CBFP/DRC

1) Introduction

The need to develop a working model of sustainable forestry at the community level has been recognized and exhaustively discussed in international development circles over the past fifteen years. The challenge in realizing such a model lies primarily in balancing the need to create livelihood options for local communities with the demands of sustainable resource management. At a World Bank workshop in Abidjan in 1990, attended by Innovative Resources Management (IRM) President Michael Brown, for example, the necessity for sustainable approaches to timber extraction at the artisanal or community level were highlighted. Yet prevailing stereotypes that tend to depict community-based timber extraction as inherently unsustainable seem to have constrained the development of viable alternatives to industrial extraction. Despite an emerging consensus on the feasibility and practicality of sustainable timber management at the community level, little has been achieved in terms of workable alternative models for the Congo Basin region.

The collaboration proposed here represents an effort to address the imperatives of both sustainable forest management and community economic development. The goal of this work would be to identify the most appropriate methodology for communities to engage and benefit from production forestry using the DRC as a case study. The purpose in bringing together IRM and the USDA Forest Service is to combine the areas of essential expertise needed to assess the possibilities for producing such a model. IRM has extensive capabilities and experience in participatory/collaborative community development methods, while the USDA Forest Service has technical expertise in sustainable forest management and its International Programs has experience with reduced-impact logging projects. The respective capabilities of both organizations are needed to adequately assess community involvement methodologies in production forestry that will encourage community economic development.

Existing precedents for this model build on the possibilities opened up by legislation facilitating decentralized forest management in many African countries. Recent community-level timber harvesting projects carried out by international organizations in the Congo Basin have also illustrated the limitations that often characterize current models of locally managed or small-scale extraction. The extent to which these projects have linked the ecological basis of sustainable forestry to community management practices remains to be further clarified. Based on the limited available information, our assumption is that this vital dimension of sustainable forest use remains elementary at best.

The hypothesis shaping our plan for this IRM/USDA Forest Service collaboration as CARPE partners, is therefore roughly the following:
Community engagement in sustainable timber harvesting in 2004, continues to be a philosophical notion that most natural resource development professionals agree upon as a worthy objective. Yet current practice falls far short of an acceptable standard, and few viable precedents exist in African contexts for successfully realizing this urgent conservation and development objective in the Congo Basin.

2) Objectives

The current phase of CARPE provides a significant opening to move beyond the currently unsatisfactory state of affairs in community-level timber harvesting programs in the Congo Basin. The principal objective for the proposed IRM/USDA Forest Service collaboration is to use our combined expertise to address critical gaps in knowledge and practice regarding community engagement in sustainable timber harvesting in the Congo Basin.

At this early stage of the collaboration, USFS is able to commit to providing two technical experts and one representative from USFS International Programs (IP) to work on an initial assessment mission to Lac Tumba at the end of June-early July, for approximately three weeks, in order to work towards fulfilling the aforementioned objective. This USFS team's report will produce information that USFS IP may then use to make a decision about further engagement in the project and the specific details of this engagement.

The primary objectives of this first USFS assessment mission will be:

1) To assess how IRM's COAIT Tool & IRM's Community Forest Resource Inventory Tool (designed for inventorying non-timber forest products) may support a sustainable timber harvesting set of activities at the community level, based on IRM's experience with these tools in Cameroon and plans for using these tools in the Lake Tumba region. Questions to address:

- Do these tools allow for decision-making based not just on socio-economic information, but also based on ecological information?
- Are these appropriate tools for making land-use decisions? In particular, are they appropriate for making decisions about engaging in timber harvesting?
- Do these tools allow for the development of simplified management plans?
- How can these tools be used and built upon to facilitate the above aspects of community timber harvesting?

2) To assess whether or not it would be feasible and desirable for the particular community(ies) visited in Lac Tumba to engage in sustainable timber harvesting. [Since participatory planning should absolutely be a component of any community-level enterprise, the Lac Tumba communities that the IRM/USFS assessment missions will visit should be communities that have already decided, by going through IRM's Community Options and Investment Tool (COAIT) process, that they want to engage in a

community timber harvesting enterprise, and not another use of their communal forests. See Task #6]
Questions to address:

- Considering the target markets and corresponding species identified by IRM, and ecological sustainability of the forest, what would be possible harvesting methods for these species?
- Does a simplified management plan model need to be developed? If so, what could it look like?
- What skills would be needed by those harvesting these trees?
- Would it be feasible to train communities to acquire these harvesting and/or management planning skills?
- Would training community members be financially smart? Would it ensure long-term project sustainability? Would it ensure ecosystem sustainability?
- Would it be feasible for communities contracting out timber harvesting operations to professional foresters (logging companies, government technicians, international or local consultants)?
- Would contracting out operations be financially smart? Would it ensure long-term project sustainability? Would it ensure ecosystem sustainability?
- For communities that might decide to contract out operations, what skills would they need to act as rational owners, manage an enterprise, and monitor the contracts?
- Would the USFS be well-placed to help develop these models? (For example, for a community that decides to harvest the trees themselves, would an organization that does reduced-impact logging with horses be better placed? Additional technical expertise of foresters from region or other community timber harvesting projects needed?)

3) TASKS

Task #1: Mobilize a USFS assessment mission team.

a) Recruit a silviculturalist, with experience developing timber sale management plans for natural forests; experience in the tropics preferable. Primary assignment will be to assess management plan components, technical components, and financial components as outlined above.
b) Recruit a tropical forests ecologist. Primary assignment will be to assess rotational issues and sustainability components, and ecological components of decision tools, as outlined above.

Responsible party: USFS IP

Task #2: Compile and analyze examples for desk study entitled, "A Review of Community Engagement in Timber Harvesting Globally: Preparation for Work in DRC." All case studies will be compiled and synthesized in order to put together in time for USFS mission the week of June 21. At this time, USFS IP and IRM will reevaluate whether or not they want to further revise the desk study, so that it may be available on their organizations' websites. The desk study case studies will treat the following components:

- relevant legal framework in countries (enabling, not enabling)
- types of projects (community members trained, contract out to company, etc.)
- scale of projects (markets, value of wood, size of area, volume, finances, etc.)
- results of projects
- constraints of projects (cultural, social, political considerations)
- perceived opportunities of projects (works, doesn't work)

Areas to be examined:

1) Guatemala: IRM
2) Peru: IRM
3) Bolivia: IRM
4) Mexico: IRM
5) Cameroon: IRM
6) Papua New Guinea: IRM
7) DRC: IRM
8) Indonesia: USFS IP
9) Nepal: USFS IP
10) US: USFS IP
11) Guinea: USFS IP
12) South Africa: USFS IP
13) Madagascar: USFS IP

Responsible party: USFS IP & IRM

Task #3: Collect information from of IRM's ongoing "Sub-Sector Analysis of Wood Products" in time for USFS mission. Provide team with info about valuable species logging companies in area likely to be harvesting, species in area likely to be harvested for local furniture and construction needs, and info about access to markets in Mbandaka and Kinshasa and associated costs of getting wood to markets.
Responsible party: IRM

Task #4: Analyze DRC Forestry Code and assess to what degree it enables community-level timber harvesting projects. Include as part of desk study.
Responsible party: IRM

Task #5: Alert local DRC administration officials to USFS' team arrival and assessment mission's purpose well in advance of team's arrival. Discuss with local officials the purpose of the assessment mission and the idea of engaging communities in timber harvesting projects. Arrange for USFS team to meet with necessary local officials for protocol purposes. The message given to the government officials should emphasize that this is an exploratory/assessment mission at this point and that no concrete project plans have been made for engaging communities in Lac Tumba in timber harvesting.
Responsible party: IRM

Task #6: Species composition of forests near identified communities outlined.
Responsible party: IRM

Task #7: Contact CARPE Director, John Flynn, about project and inquire about relationship to Programmatic Environmental Assessment (PEA). Run by John Flynn the following: "We are assuming the steps are (1) start assessment activities, (2) meanwhile, PEA is completed, (3) once extraction begins, project will have to follow general guidelines from the PEA. Is this assumption correct?"
Responsible party: IRM

Task #8: Compile studies examining sustainable off-take systems in the Congo Basin in time for the USFS team's mission.
Responsible party: USFS IP

Task #9: Arrange travel and hotel logistics and itinerary for USFS team.
Responsible party: USFS IP

Task #10: Arrange for a translator to accompany the USFS team. If the IRM in-country partners hosting the team are unable to provide this service, then they will arrange for a translator to be hired for this mission. USFS and IRM will discuss how to pay for this service, should it be required.
Responsible party: IRM

Appendix 2. Team members and contacts made in Democratic Republic of the Congo (DR Congo), by USDA Forest Service travelers Rick Alexander and Bruce Marcot during August 20 to September 15, 2004.

Names marked with an asterisk (*) denote people who attended some or all of the field journey out of Mbandaka into Landscape #7 in DR Congo.

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also (met during Aug-Sep '04 trip):
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Philippe Ngwala Malemba, Charge de Suivi et Evaluation CLIFS
* Alfred Yoko
Jean Bernard Mibeko
* Alpha Nzongo

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Bonobo Conservation Initiative (BCI) - - - - - - - - -

Field Researchers met in Botuali Village:
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Yelo Mahambi
Koko Losala
Mputu-Bokoto
Bwango Mpembe

Jean Marie Benishay, Coodonnateur National
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African Wildlife Foundation (AWF) - - - - - - - - -

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World Resources Institute (WRI) - - - - - - - - -

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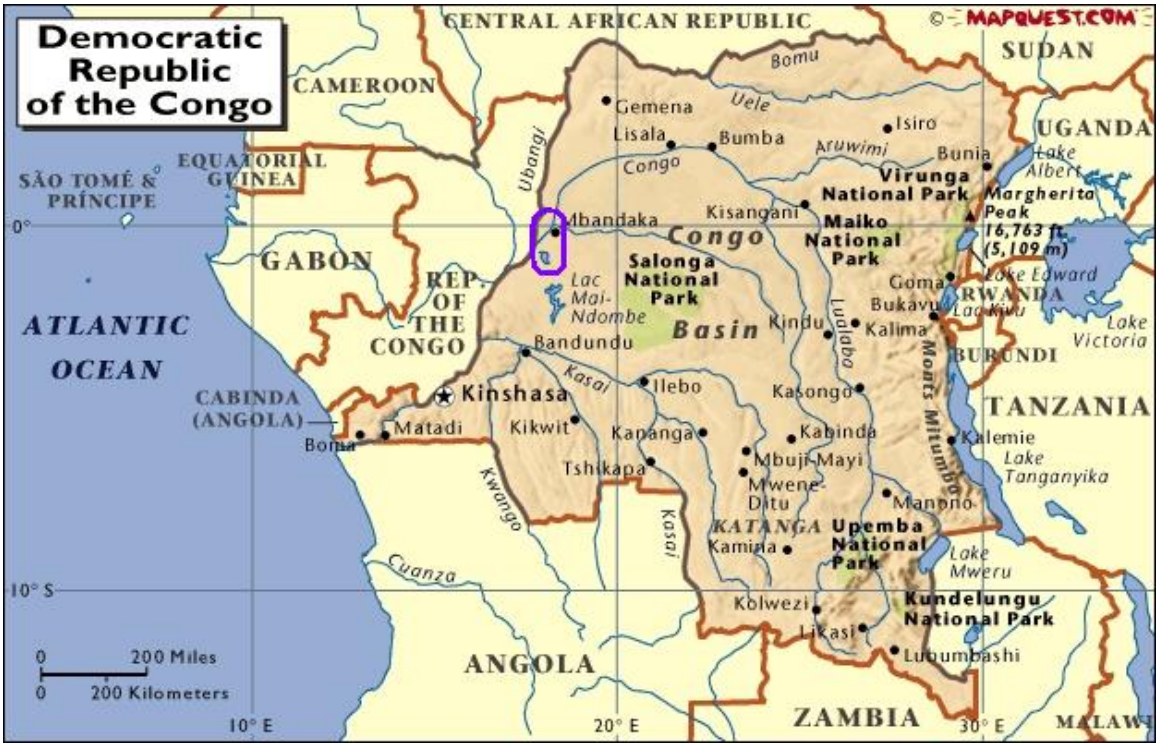
http://www.globalforestwatch.org
(met at Grand Hotel in Kinshasa, discussed forestry and World Bank situation)

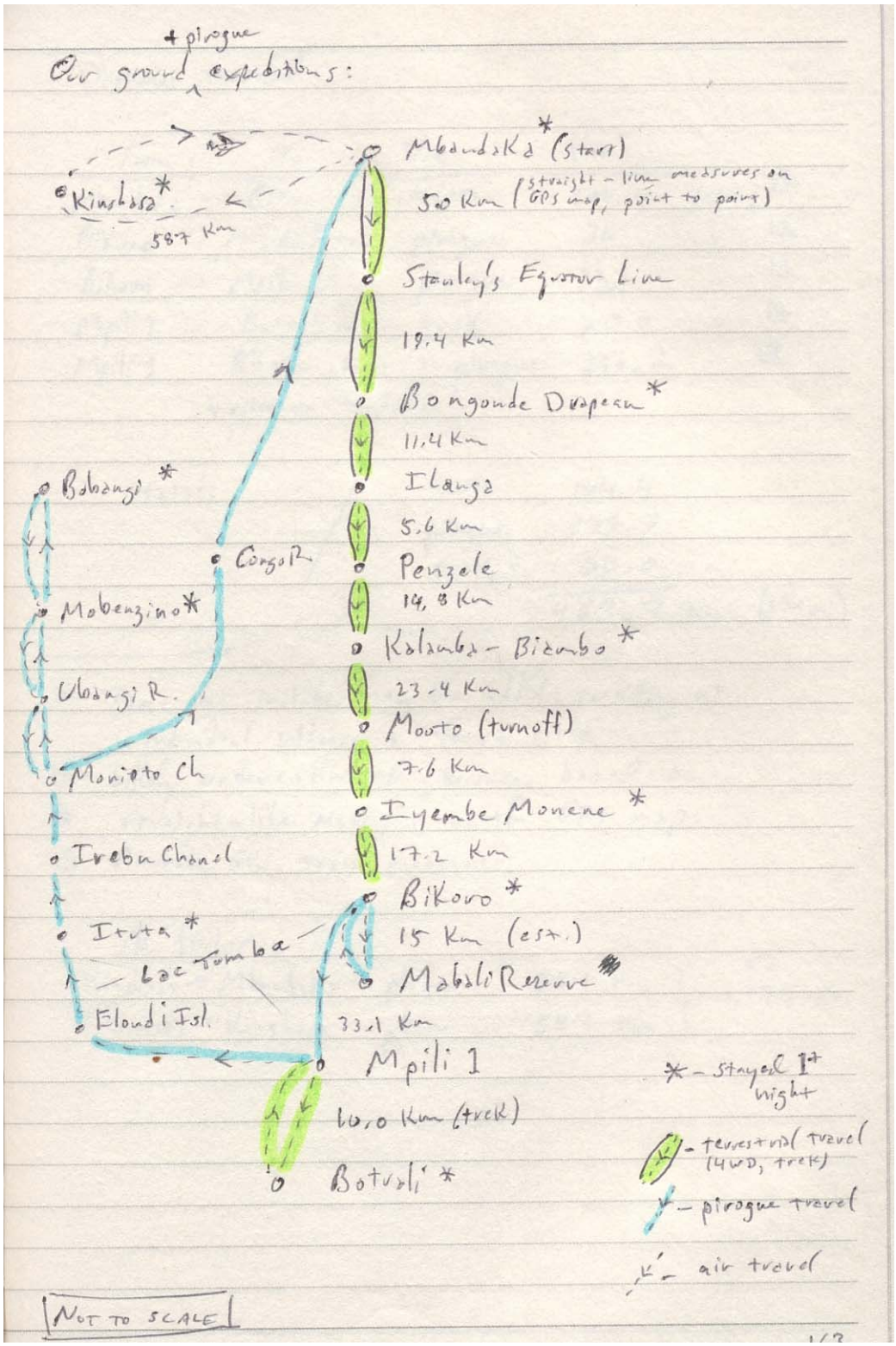
Appendix 3. Maps of travel locations and itinerary of Forest Service participants Bruce Marcot and Rick Alexander to Democratic Republic of the Congo during August 20 – September 15, 2004.



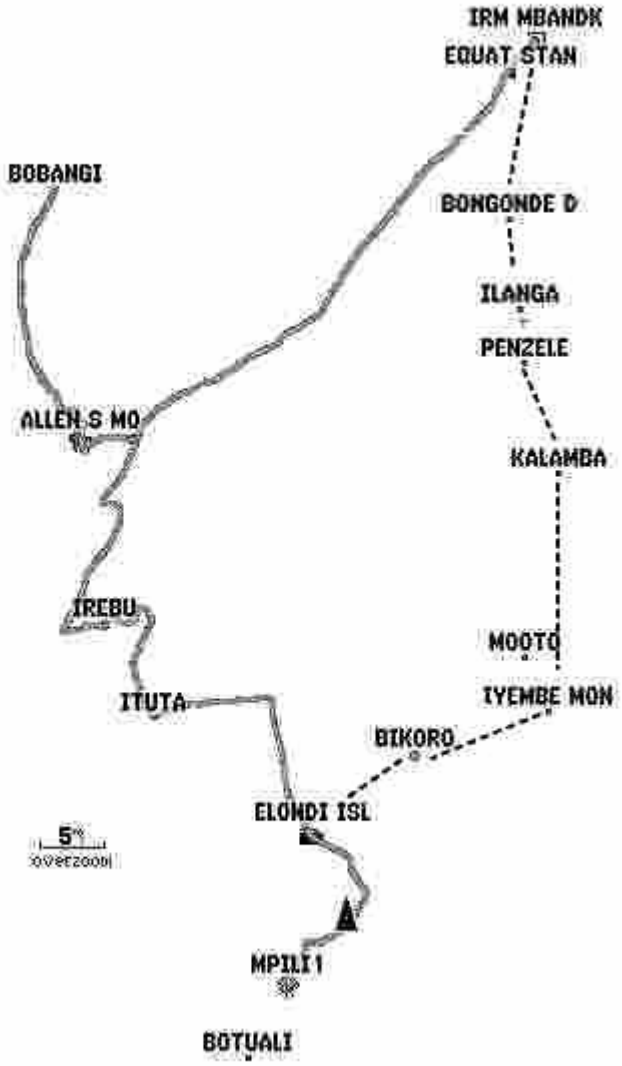
Location of this expedition (oval) in western Democratic Republic of the Congo. (Image source: ©Mapquest.com)

The native rural villages in which we spent one or more nights included Bongonde Drapeau, Kalamba-Beambo, Iyembe Monene, Botuali, Ituta, Bobangi, and Mobenzeno. We also stayed in Bikoro and visited Mabali Forest Reserve along Lac Tumba, Mpili1 village, Bienge Island in Lac Tumba, and traveled by pirogue across Lac Tumba and along the Congo River, Ubangi River, Irebu Channel, Monioto Channel, and Lombambo River.

The following figure presents a schematic of our travels:



Marcot used a global positioning system (GPS) unit (Garmin eTrex Legend) and recorded the following specific routes from Mbandaka. North is to the top; to scale.



In the above figure, dotted lines represent four-wheel drive routes, and solid lines represent pirogue (canoe) water routes. The gap at the bottom between the villages of Mpili1 and Botuali was covered by trekking overland.

The following table summarizes the distances we traveled on various legs of the expedition within DR Congo:

From	**To**	**Via**	**km (mi)**	**Comments**
Kinshasa	Mbandaka	airline	587 (365)	
Mbandaka	Bikoro	4WD	104 (65)	\1
Bikoro	Mpili1	pirogue (canoe)	33.1 (20.6)	\1
Mpili1	Botuali & return	trek	20.0 (12.4)	\1
Mpili1	all other points & return to Mbandaka	pirogue	276.2 (171.6)	\2
Mbandaka	Kinshasa	airline	587 (365)	
TOTALS				
		airline	1175 (730)	
		4WD	104.4 (64.9)	
		pirogue	339.3 (210.8)	
		trek \3	20.0 (12.4)	
		TOTAL	1639 (1018) – including airline 464 (290) – ground only	

\1 Likely underestimate, because based on straight-line measures point to point on GPS map.
\2 Accurate GPS track measures.
\3 Does not include many km additional trekking at individual villages and forest sites.

The following table summarizes our daily itinerary. See Appendix 2 for details on contacts.

Date (2004)	Location	Contacts	Forest types and activities	Key observations
20 August	Travel from U.S.			
21 August	Arrived in Kinshasa 7:30pm; night at Grand Hotel			
22 August	Kinshasa; night at Grand Hotel	George Akwah, Lyse Pilon, Jose Cabrera, of IRM	Visited office, and IRM boat docked along Congo River in Kinshasa	Explored maps, discussed the project
23 August	Kinshasa; night at Grand Hotel	John Flynn, Tchamou Nicodeme, John Schamper at USAID; Lisa Steel, Didier Devers, Andre Kamdem Toham, Germaine Monkoto, Jef Dupain, Jean-Robert Bwangoy-Bankanza	Meetings at USAID, IRM	Discussed the IRM project work on community forest planning, and USAID's role in CARPE
24 August	Flight from Kinshasa to Mbandaka; night in Mbandaka	Alfred Yoko, George Akwah, Laurent Nsenga, Jean Bernard Mibeko, others at IRM	Meetings at IRM office in Mbandaka	Briefed on IRM's role in the CBFP project, COAIT methods
25 August	Mandaka; night in Mbandaka	Jean Marie Benishay, Gov. Yves Mobando Yogo; Fr Ebwasa-Bela; Lars Lovold and Lionel Diss; Noangi Jean (small logger)	Meetings with IRM; Provinical Coordinator of the Environment; Rainforest Foundation Norway	Briefed on governmental roles in forest planning, and experience of a small logger
26 August	Field expedition begins from Mbandaka; night in Bogonde Drapeau village	village participants in the COAIT mapping process	disturbed (secondary) forests to and around Bogande Drapeau	
27 August	Bogande Drapeau village	villagers involved in timber and forest resource extraction	trekked secondary forests, shifting cultivation landscapes, hand sawyer site	Learning local tree species, timber and nontimber resources, Lingala and French terms
28 August	Kalamba-Biombo village	village participants in the COAIT mapping process and forest resource use	trekked secondary forests, shifting cultivation landscapes	Observed presentation by IRM of participatory mapping work

Date (2004)	Location	Contacts	Forest types and activities	Key observations
29 August	Kalamba-Biombo village	village participants	trekked secondary forest and fallow agricultural lands in Kalamba	observed oil palm plantations, fresh and old slash and burn sites with manioc and maize, cocoa plantation; shown native medicinal and forest food plants
30 August	Iyembe Monene village	village participants in the COAIT mapping process and forest resource use; includes Pygmies	a.m. trekked in Kalamba forests	observed felling and sawyer operations on a "black wood" tree
31 August	Iyembe Monene village	villagers	trek through secondary forest and shifting cultivation, savanna, primary forest	observed different trees, birds in primary forest and the savanna than in secondary forest and shifting cultivation
1-2 September	Bikoro	local IRM facilitator Arthur Botey Mputela; CREF (Centre de Recherce en Ecologie Forestiere)	visited Mabali Forest Reserve via pirogue, primary forest	observed primary forest conditions in Mabali, red-tailed monkeys, uncut forest conditions
3 September	Mpili1 and Botuali villages	joined by Regional Administrator and his entourage	pirogue across Lac Tumba, Bienge Island, Lombambo River, 10km trek to Botuali	open lake, island village, riparian gallery forest, swamp forests
4 September	Botuali village	villagers	secondary forest environments	old secondary forests, owls and many army ants
5 September	Ituta village	BCI (bonobo) researchers	trek back to Mpili1 village; pirogue down Lombambo River, so. Lac Tumba, Channel Irebu	shifting cultivation of manioc, replanting sequence
6 September	Bobangi village	Bobangi village and le groupement chiefs	Channel Irebu, Congo River, Monioto Channel, Ubangi River	riverine gallery forests
7 September	Bobangi village	Bobangi IRM facilitator (son of the le groupement chief); Bobangi council meeting; joined by Michael	primary forests, timber trees, riverside village huts	reviewed IRM maps of Bobani area, island in the Ubangi River

Date (2004)	Location	Contacts	Forest types and activities	Key observations
		Brown IRM president		
8 September	Bobangi to Mobenzeno villages	closeout discussion in Bobangi with village council	pirogue back down Ubangi River to Mobenzeno	toured riverside market at Mobenzeno, saw river village setting
9 September	back to Mbandaka	local Mobenzeno villagers and fishers	foret inundee (seasonally flooded forest) in Mobenzeno; pirogue to Congo River back up to Mbandaka	use of forest inundee for fishing and wildlife habitat; riparian gallery forests along Congo River
10 September	Mbandaka	IRM office	closeout discussions with IRM Mbandaka	
11 September	back to Kinshasa		flight to Kinshasa; photos from airplane	
12 September	Kinshasa	Dale Rachmeler, Michael Brown, Alain Karsenty	IRM Kinshasa closout	
13 September	Kinshasa	John Flynn	USAID closeout	
14 September	Kinshasa; evening flight	Didier Devers	WWF Kinshasa closeout	
15 September	reached home (OR and CA)			

Appendix 4. Map categories included on the community participatory maps developed by Innovative Resources Management in the Democratic Republic of Congo portion of Landscape #7 under the CARPE program. (French names are given for some of the more commonly used categories.)

Hydrographic
- river
- permanent watercourse
- seasonal watercourse
- lake
- permanent marsh
- seasonal marsh
- small island in the lake (stone only)

Vegetation
- (upland) forest (terre firme forêt)
- wet, not swampy, forest (forêt inondée)
- swampy forest with water and mud (forêt marécaguese)
- island (vegetated)
- savanna (savane)
- inundated savanna (savane inondée)
- saline vegetation (salt licks, soil minerals)

Sacred sites
- cemetery
- sacred grove

Agriculture and forest exploitation
- cocoa plantation (cacaoyer)
- coffee plantation (caféier)
- oil palm plantation (palmeraie)
- rubber plantation (hévéa)
- non-timber forest product harvesting zone (zone de cueillette)
- habitations, settlements (complexes ruraux)
- fallow lands (after agriculture, shifting cultivation) (jachère)
- community timber harvesting zone (coupe villageoise)
- forest reserve (reserve; viz., Réserve de Mabali)
- animal rearing (elévage)
- forest concession (concession forestière)

Hunting and fishing
- gun hunting (chasse au fusil)
- fishing (pêche)
- stream access (vegetation rivulaire)

Terrestrial and aquatic animals
- elephant
- hippo
- leopard
- buffalo
- monkey and bonobo

- bush pigs
- antelope (duiker)
- bongo
- python
- crocodile
- turtle
- waterbirds
- water chevrotain

Birds

- parrot

Villages

- habitats by size (0-1000, -5000, -10,000, -35,000 inhabitants)
- agricultural camps (temporary family residence)
- hunting camps
- fishing camps (seasonal)
- pygmy camp
- school
- health center
- administrative headquarters of territory

Appendix 5. Mammals potentially occurring in the area around Lac Tumba and Landscape #7 in Democratic Republic of the Congo.

The following list was compiled by Bruce Marcot based on species range distribution maps in Kingdon (1997).

PRIMATES

Hominidae
bonobo or 'pygmy' chimpanzee – *Pan paniscus*

Colobidae
Tshuapa red colobus – *Piliocolobus tholloni*
Angola pied colobus – *Colobus angolensis*
Guereza colobus – *Colobus guereza*

Cercopithecidae
golden-bellied mangabey – *Cercocebus chrysogaster*
black mangabey – *Lophocebus aterrimus*
Allen's swamp monkey – *Allenopithecus nigroviridis*
De Brazza's monkey – *Cercopithecus neglectus*
Wolf's monkey – *Cercopithecus* (*mona*) *wolfi*
red-tailed monkey - *Cercopithecus* (*cephus*) *ascanius*

Prosimians – Loridae (prev. Lorisidae)
potto – *Perodicticus potto Faustus*

Prosimians – Galagonide (prev. Galagidae)
Demidoff's galago – *Galagoides demidoff phasma*
Thomas' galago – *Galagoides thomasi*

CHIROPTERA

fruit bats, Megachiroptera, Pteropodidae
straw-colored fruit bat – *Eidolon helvum*
rousette bat, Egyptian fruit bat – *Rousettus aegyptiacus*
Angola fruit bat – *Lissonycteris angolensis*
collared fruit bat – *Myonycteris* spp.
hammer bat – *Hypsignathus monstrosus*
singing fruit bats – E*pomops* spp.
golden fruit bat – *Casinycteris argynnis*
flying calf – *Nanonycteris veldkampi*
nectar bat – *Megaloglossus woermanni*

insect bats, Microchiroptera
sheath-tailed bats, Emballonuridae
black hawk bat – *Saccolaimus peli*
African sheath-tailed bat – *Coleura afra*
tomb bats – *Taphozous* spp.

slit-faced bats, Nycteridae
slit-faced bats – *Nyceteris* sp.

large-winged bats, Megadermatidae
yellow-winged bat – *Lavia frons*

horseshoe bats, Rhinolophinae
horseshoe bat – *Rhinolophus* spp.

leaf-nosed bats, Hipposiderinae
leaf-nosed bats – *Hipposideros* spp.

vesper or common bats, Vespertilionidae
hairy bats – *Myotis* spp.
woolly bats – *Kerivoula* spp.
butterfly bats – *Chalinolobus* (=*Glauconycteris*) spp.
serotine bats – *Eptesicus* spp.
Moloney's flat-headed bat – *Mimetillus moloneyi*
Schlieffen's twilight bat – *Nyctecius schlieffeni*
pipistrelles – *Pipistrellus* spp.
evening bats – *Scotoecus* spp.
house bats – *Scotophilus* spp.
long-fingered bats – *Miniopterus* spp.

free-tailed bats, Molossidae
guano bats – *Tadarida* spp.
wrinkle-lipped bats – *Chaerophon* spp.
other species

INSECTIVORA

otter shrews, Tenrecidae, Potamogalinae
giant otter shrew – *Potamogale velox*

shrews, Soricidae
climbing shrew – *Sylvisorex granti*
white-toothed shrews – *Crocidura* spp.

elephant shrews or sengis, Macroscelidea
soft-furred elephant shrews ro sengis, Macroscelidinae
four-toed elephant shrew or sengi – *Petrodromus tetradactylus*

RODENTIA

squirrels, Sciuridae
Congo rope squirrel – *Funisciurus congicus*
Thomas' rope squirrel – *F. anerythrus*
fire-footed rope squirrel – *F. pyrropus*
red-legged sun squirrel – *Heliosciurus rufobrachium*
African giant squirrel – *Protoxerus stangeri*

anomalures, Anomaluridae
Lord Derby's anomalure – *Anomalurus derbianus*
lesser anomalure – *A. pusillus*
Beecroft's anomalure – *A. beecrofti*

dormice, Myoxidae (= Gliridae)
African dormice – *Graphiurus* spp.

porcupines, Histricidae
crested porcupine – *Hystrix cristata*
brush-tailed porcupine – *Atherurus africanus centralis*

cane-rats, Thryonomyidae
savannah cane-rat – *Thryonomys gregorianus*
marsh cane-rat – *T. swinderianus*

rat-like rodents, Muroidea

dendromurines, Dendromurinae
climbing mice – *Dendromus* spp.

pouched rats, Cricetomyinae
giant pouched rat – *Cricetomys gambianus*

murid rats and mice, Muridae
brush-furred mice – *Lophuromys* spp.
velvet rat – *Colomys goslingi*
long-footed rats – *Malacomys* spp.
African wood mice – *Hylomyscus* spp.
multimammate rats – *Mastomys* spp.
common mice – *Mus* spp.
rusty-nosed rats – *Oenomys* spp.
narrow-footed woodland mice – *Grammomys* spp.
shaggy swamp rats – *Dasymys* spp.
bush-rats – *Aethomys* spp.
target rat – *Stochomys longicaudatus*
hump-nosed mice – *Hybomys* spp.
zebra mice – *Lemniscomys* spp.

CARNIVORA

mustelids, Mustelidae
ratel (honey badger) – *Mellivora capensis*
swamp otter – *Aonyx congica*
spot-necked otter – *Lutra maculicollis*

mongooses, Herpestidae
long-snouted mongoose – *Herpestes naso*
slender mongoose – *H. sanguinea*
Ansorge's cusimanse – *Crossarchus ansorgei*
marsh mongoose – *Atilax paludinosus*

genets and civets, Viverridae
blotched genet – *Genetta tigrina*
servaline genet – *G. servalina*
giant servaline genet – *G. victoriae*
central African linsang – *Poiana richardsoni*
African civet – *Civettictis civetta*
African palm civet – *Nandinia binotata*

cats, Felidae
seral cat – *Felis serval*
golden cat – *F. aurata*
leopard – *Panthera pardus*

PHOLIDOTA

pangolins, Manidae
long-tailed pangolin – *Uromanis tetradactyla*
tree pangolin – *Phataginus tricuspis*
giant pangolin – *Smutsia gigantean*

UNGULATA

hyraxes, Hyracoidea
tree hyrax – *Dendrohyrax dorsalis*

elephants, Elephantidae
African elephant – *Loxodonta Africana*

hippopotamuses, Hippopotamidae
hippopotamus – *Hippopotamus amphibious*

pigs, Suidae
red river hog – *Potamochoerus porcus*
common warthog – *Phacochoerus africanus*

chevrotains, Tragulidae
water chevrotain – *Hyemoschus aquaticus*

bovids, horned ungulates, Bovidae
African buffalo – *Syncerus caffer*
bushbuck – *Tragelaphus scriptus*
bongo – *T. euryceros*
sitatunga – *T. spekei*
bush duiker – *Sylvicapra grimmia*
blue duiker – *Cephalophus monticola*
Peter's duiker – *C. callipygus*
black-fronted duiker – *C. nigrifrons*
yellow-backed duiker – *C. silvicultor*
bay duiker – *C. dorsalis*

Appendix 6. Crosswalk among English, French, and Lingala key terms related to forest resources. See text for further descriptions and explanations. Compiled by Bruce Marcot.

English	**French**	**Lingala**
non-timber forest product (NTFP)	produits forestiers non-ligneux (PFNL)	(no strict term)
biodiversity	biodiversitie	nkita a ya zamba ("richness of the forest," referring to all products and all resources)
forest	forêt	zamba
animals	les animeaux	nyama
tree	arbre	nzete
wildlife	les animeaux sauvage (more strictly, "la vie sauvage")	bomoi ya zamba
sustainable	durable (as in "lasting")	ya koumela
fish	poisson	mbisi
bird	oiseau	ndeke
owl	hibou	esulungutu
plank, board (as of lumber)	planche	libaya (singular)
wilderness	(no term)	(no term; see text for explanation)
primary (old, uncut) forest	forêt primier	(no term; forest not cut for agriculture; see text for explanation)
spirit grove	lieux sacrés	(no term; "bilma" means spirit; see text)
cemetery	cimétiére	malita
shifting (slash-and-burn) cultivation	agriculture itinerante sur brulis	mosala ya koloma (but no specific term for "shifting" per se, such as the French term "merchant")
right holder (traditional, customary use)	ayant droit	?