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Shaping forest safety nets with markets: Adaptation to climate change under changing roles of tropical forests in Congo Basin

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ABSTRACT

Tropical forests hold several goods and services used by forest-dependent people as safety nets to traverse difficult periods of resource supply. These same goods and services are constantly surrounded by emerging markets linking remote communities with major urban centers nationally and internationally. How these markets affect adaptation remains unclear. This paper examines the roles of markets in non-timber forest products that normally serve as safety nets for forest communities, and the implications for climate change adaptation in the Congo Basin. Following the identification and prioritization of forest-based development sectors for adaptation by stakeholders, the types of markets and trades surrounding the identified sectors were examined in two provinces in the Democratic Republic of Congo as a case study in order to evaluate revenue flows and their potential contribution to adaptation by local communities. The distribution of the market revenue leaves local people with returns much lower than the worth of the commodity, while wholesalers and retailers reap most of the benefits and profit from the high variability in volume and market earnings for the same commodity across provinces. Markets may increase the value of a commodity as observed in this study, but their contributions to adaptation appear highly limited for local communities following their distribution among the stakeholders in the market chain. This is likely to be worse in free market settings, especially when it diminishes the safety net roles of forest goods and services. Markets should therefore complement rather than substitute forests roles for adaptation to climate change in tropical forest countries. Capturing the benefits of trade for adaptation is crucial but will require policy reforms and further research that addresses the complexity in benefit sharing.

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1. Introduction

Natural resources are inextricably linked to development processes such as peace, stability, livelihood security, human health, and economic growth (Wollenberg and Ingles, 1998; Cunningham, 2001; CBFP, 2005), which are also underlying factors for vulnerability to both climatic and non-climatic impacts (Brooks et al., 2005; Adger, 2006). Forests are considered “safety nets” in that people draw on available natural resources to meet emergency shortfalls and to keep them from being worse off in times of need (Belcher, 2005). The traditional safety net functions of forest holdings are likely to give way as rural livelihood shifts to a cash-based economy accelerated by the emerging market systems. The danger of this shift, however, is the potential chaos and exacerbation of vulnerability of the poor majority owing to the systematic disappearance of what constituted their safety nets. As global food supplies change partially due to local climate change (Jones and Thornton, 2003; Gregory et al., 2005) and global energy crisis (Cassman, 2007), the gap-filling role of forests among the poor of the world will only increase. A disproportionate share of family income is already being spent on food, thereby increasing the vulnerability of the poor to changes in food prices (Mendelsohn, 2008). In low latitudes where forest cover is relatively high, like in the Congo Basin, rain-fed farming is predicted to be vulnerable to warming (Mendelsohn, 2008) such that the safety net role of forests is only expected to soar.

The Congo Basin forests represent historical associations of multiple stakeholders that have varying interests in and values for the ecosystem goods and services. Ancestral secret places epitomizing the heritage of over 30 million forest-dwelling indigenous people in the Central African region are one of the important values of the Congo Basin forests. Amid centralized state ownership of forests that severely limits rights and access to resources (CBFP, 2006; Sunderlin et al., 2008), the forests continue to serve a backstopping or safety net role by providing essential nutritional supplements including provision of protein through bush meat (Wilkie and Carpenter, 1999; Nasi et al., 2008), lifelines during crisis periods of food shortages (Dudley et al., 2008), and as primary provider of household energy (UNEP, 2006) for the rural majority. Through provision of medicinal products, forests commonly serve as frontline interventions for household health care for the majority of people (Ndoye et al., 1998; Colfer et al., 2006) and provide economic leverage for countries in the region that strive for economic growth and development (CBFP, 2006).

Economic activities centered on Congo Basin forests have rapidly expanded beyond industrial roundwood trade within the last two decades (Cunningham et al., 2008). Besides products of logging, which has dominated forest commercial activities with a unilateral hold by governments in the region, there are also non-timber forest products (NTFPs) that are important resources for subsistence and commercial use. In this paper, NTFPs are plant and animal products (with the exclusion of timber) harvested from forests, such as edible plants, animal products, mushrooms, snails and other living animals, edible nuts, gums, medicinal plants, firewood, forage, etc.

Unlike timber forest products, which are predominantly in government hands, NTFPs are surrounded by individual and community practices that in most cases provide direct

economic, social, cultural, and environmental benefits (Butler, 1992; Arnold, 1995; Dewees and Scherr, 1996; Peters, 1996; Cocks and Wiersum, 2003; Shackleton and Shackleton, 2004; Stoian, 2005). There have also been significant surges in commercial importance of NTFPs (Ndoye et al., 1997, 1998; Laird, 1999), linking remote regions with major urban and global consumer markets usually in an unregulated framework. The size of trade in both timber and non-timber forest products threatens the integrity of the forest ecosystem and the continuous provision of goods and services with potential consequences for the livelihoods of those who directly depend on these forest goods and services.

Contemporary changes in the Congo Basin propelled by emerging markets of both formal and informal sectors bring about surges in market demand and pricing, which in turn impact resource extraction practices. Illegal logging practices, for example, are on the rise (Cerruti and Tacconi, 2006) in tandem with increasing timber exports from the region to emerging markets in China (Canby et al., 2008). Continuously high levels of hunting are flagged as a likely cause of future reductions in household supply with bush meat protein in the region (Nasi et al., 2008) with the projected extinction of some species of forest mammals in less than 50 years. Outside household consumption, illegal and unregulated trade in many NTFPs, for instance bush meat, flourishes in “black” markets.

The supply of various markets near and far with different types of forest-based commodities is mostly driven by market forces. This situation increases the likelihood of change in the role and use of natural resources wherever they are found and may affect the security buffer of the system. Newly created attention to and preoccupation with the Congo Basin forests are accompanied by emerging challenges and opportunities in addressing global issues of climate change, deforestation, and Millennium Development Goals for countries in the region. The well-being of about 50 million people who live within the perimeter of the forests, and who are currently disadvantaged in other developmental opportunities, is also challenged.

Carbon trade under the “Reduced Emissions from Deforestation and forest Degradation” (REDD) mechanism is a potential market entry into the Congo Basin whose potential contributions are a function of projections determined by the incremental carbon stocks over a given period of time. Although the implementation modalities remain to be defined, there are questions of local participation and equity (Kanninen et al., 2007; Seymour, 2007) drawing from other previous experiences with globally linked markets such as timber. Counterbalancing REDD implementation in the Congo Basin with economic, developmental, and adaptation benefits is crucial in achieving an evenly beneficial distribution of the mechanism across sectors and among the multiple stakeholders that share the forest goods and services.

The objective of the paper is to evaluate the role of markets on NTFP that so far, serve as safety nets sustaining the livelihoods of forest communities, and the implications for climate change adaptation in the Congo Basin region.

Beside the services forests or NTFPs offer for direct consumption and cash returns, the paper also discusses the role income generated by forest sector markets can have for adaptation and if that can supersede or substitute the direct use of the forest resources currently serving as safety nets.

Besides the availability of livelihood resources, climate change adaptation stretches beyond livelihood and is considered as a national development issue which requires the role of governments as well as other development actors (see for example Smit and Pilifosova, 2001; Davidson et al., 2003; Agrawala, 2005; Klein et al., 2007).

The structure of the paper is such that the next section highlights climate change impacts and risks in the Congo Basin forest. Thereafter in Section 3, the logical framework and study approach is outlined. Adaptation priorities according to stakeholders in the Congo Basin are presented in Section 4 while the marketing of NTFPs and its influence on livelihood and adaptation to climate change is discussed in Section 5. Section 6 further explores other marketing and trading possibilities in the forest sector such as forest carbon and its influence on livelihood and adaptation to climate change, while Section 7 presents possibilities of enhancing interventions to improve livelihood adaptation. Concluding remarks are presented in Section 8.

2. Climate impacts and risks in the Congo Basin

All the projections of climate change zoom in on the vulnerability of Africa and its inability to respond to the scale of the problem (Stern, 2006; IPCC, 2007) especially with regard to the poor majority whose livelihoods are directly linked to climate-driven sectors. The Congo Basin forests face similar climate challenges that put at risk future and previous developmental efforts in the region. Van Dijk (1999) in his study on changing accessibility to NTFPs resources in Cameroon through a survey of local communities noted that many NTFPs are more scarce nowadays than in the past for several reasons, ranging from climatic stresses, increased demand for NTFPs, population growth, increased logging and fuelwood harvesting activities, forest conversion to agricultural land, low or declining soil fertility, ecosystem degradation associated with intensified crop production, wild fires, and weak enabling government policies.

Forest ecosystem goods and services provide security portfolios for over 80% of the population living in or near the Congo Basin forests and contribute to poverty alleviation and national development (CBFP, 2006). The different forest types present in the basin have different associated climate risks (Table 1). With anthropogenic disturbances, the amplification of climate impacts on the Congo Basin forests would have major consequences through direct and indirect pathways that may well restrict the provision of ecosystem goods and services. This consequence is highly unavoidable with the continuously increasing rate of deforestation in the region (FAO, 2007; Laporte et al., 2007).

3. Study approach

3.1. The logical framework of the study

Blending livelihood, markets and climate change adaptation, which by themselves are complex issues, only demonstrate

Table 1 – Altitudinal distribution of dense humid forest types of the Congo Basin and their projected climate risks (IPCC, 2007).

Forest types (altitude of occurrence)	Percentage (%)	Climate risks
Inundated forest and mangroves	7.4	Flooding, sea level rise
Coastal forest (0–300 m)	7.5	Flooding, sea level rise
Intermediate forest (500–1000 m)	81.5	Fire, drought
Submontane forest (1000–1600 m)	2.8	Temperature increase
Montane forest (>1600 m)	0.8	Temperature increase

Source: Adapted from CBFP (2006).

the complexity in tackling an integration of the three especially in a supportive role. This would definitely not lean to any simple form of linearity in a logical framework such as the sustainable livelihood framework or vulnerability assessment concept. The sustainable livelihood framework has been used in discussing the role of forest in several other studies using the different capital pools that forest provide (see for example Ashley and Carney, 1999; Bebbington, 1999; Nhan-tumbo et al., 2003; Wolmer et al., 2004; Soini, 2005; Kusters et al., 2006). Its perceived limitation for this study is threefold: first, the role of market is not well-defined in this framework. Second, the framework considers policies, institutions and processes as factors that influence the different capital assets to result in livelihood strategies. We considered it not prudent to replace these influencing factors with markets because market system itself is largely shaped by these factors. Thirdly, the livelihood framework considers not the impact of the externality as the problem, in this case, climate variability and change, but the vulnerability of the five capital assets. If we have to consider the vulnerability, then there will be a need to first conceptualize vulnerability in terms of impacts and adaptive capacity, with impact itself conceptualized in terms of exposure and sensitivity, this ultimately would be outside the scope of the paper.

Departing from the well-established important role of forests and forest resources for rural livelihoods, especially in Africa (see for example Ambrose-Oji, 2003; Ndoye and Tieguhong, 2004; Ruiz-Pérez et al., 2004; Sunderland and Ndoye, 2004; Shackleton et al., 2008), this study is meant to provide a new information on the role of markets of NTFP for adaptation to climate change. The logical framework commences with the regional priority for adaptation set by the stakeholders through a participatory stakeholder's forum. This is followed by exploring how best these priorities can be met; safeguarding safety nets currently in the forest holdings, or turning them into cash holdings (cash safety nets) from trade that could provide the opportunity to acquire other services or products outside the forest, that can contribute to their adaptation to climate change. This could provide the opportunity for diversification of asset bases. To explore the potentials for adaptation of these priority sectors, the study then looked at the surrounding markets of some of the sectors and only those that involved the participation of the local

communities in the transactions. The cash opportunities for the local communities were then weighed vis a vis other players at the marketplace across the commodity value chain. This was further examined among various potentially vulnerable groups like smallholder farmers who are also forest-dependent and classified as one of the most vulnerable groups to impacts of climate change.

The study later on drew inferences on the situations whereby new markets such as carbon trading can modify the safety net role of forest not only for community adaptation but for the mitigation of global green house gas emissions.

3.2. Study method

The study was conducted as part of ongoing research by the Congo Basin Forests and Climate Change Adaptation projects of the Center for International Forestry Research in Central Africa. The project approach is based on a science-policy dialogue process, which follows the identification and engagement of multiple stakeholders in participatory actions at the onset, for setting adaptation priorities, assessing vulnerabilities, identifying adaptation options, and implementing adaptation (Nkem et al., 2007). Stakeholders included representatives of international and sub-regional organizations, national partners and organizations involved in environmental issues, government departments, United Nations Framework Convention on Climate Change national focal points, national research institutions, non-governmental organizations, universities, community groups, independent experts, and resource persons from the respective countries of Cameroon, Central African Republic, and Democratic Republic of Congo. During the project kick-off meeting the 65 participating stakeholders were grouped by country to identify and prioritize forest-based development sectors for adaptation. The common criteria used for prioritization were based on (1) relevance to households, (2) relevance to national development, and (3) degree of vulnerability of these sectors to climate change as perceived by stakeholders (see Nkem et al., 2008, for details of the procedure). Using the national outcomes of the prioritization process, the frequency of occurrence of a particular sector was averaged across the three countries in order to constitute a list of regional priorities for adaptation shared by the participating countries. Using the two sets of information, a matching analysis was undertaken of corresponding market activities in NTFPs linked to the development sectors prioritized for adaptation by the regional stakeholders in the Congo Basin forests.

A survey was also carried out on the trade of NTFPs in local markets in the Democratic Republic of Congo provinces of Equateur and Bandundu. Equateur province (latitude 1°, longitude 20.5°) has over 30.6 million hectares of forest (26%

of the country's forest), while Bandundu province (latitude 4° and longitude 18°) has 14 million hectares of forest cover (Kaimowitz and Staver, 2004). These two provinces have high agricultural potential but face declining agrobiodiversity. Among the many ethnic groups present, Bantus and Pygmies are the major indigenous communities in both provinces, Bantus being the majority.

Data for the study were collected from eight markets in total. Five markets (Ekunde, Lomata port, Mbandaka II, Mbandaka III, Wendji-Secli) were selected in Equateur province and three markets (Central Kikwit, Idiofa, Kazamba [Kikwit]) in Bandundu province based on their roles in the assembly and distribution of NTFPs, the presence of Bantus and/or Pygmies, their accessibility, and their appeal to rural communities and urban populations. In each market, traders were selected randomly but following their geographic location in the market. After explaining the purpose of the study we administered a questionnaire to traders willing to collaborate. The questionnaire had previously been tested to explore how well it captured relevant information about NTFP traders and certain adjustments were made before questionnaire administration in this study.

A total of 212 local traders, both men and women, involved in the NTFP trade were surveyed using semi-structured questionnaires. Fifty-seven traders (21 males and 36 females) were surveyed in Equateur province and 155 (33 males and 122 females) in Bandundu province. Each respondent was interviewed separately and each interview lasted for about 1 h. Data on the following were collected: prices of products along the value chain, volume of products traded and socioeconomic characteristics of the people involved in the NTFP trade (Ndoye et al., 2007). Both qualitative and quantitative (statistics) methods were used to analyze the collected data.

4. Adaptation priorities for Congo Basin forests

The stakeholder prioritization process was achieved at two levels; national and regional (Table 2). The forest-based sectors corresponded to development sectors such as household energy, health, potable water, and food security. Sectors were linked to the provisioning services of ecosystems that characterize household goods. The outcome of the prioritized sectors undoubtedly emphasizes the livelihood challenges and the recognized vulnerability of livelihood system in the region.

The prioritization process provides an important opportunity for synergy between national development goals and national adaptation needs from the forest. This approach is also attractive to policymaking because it allows for common

Table 2 – Sectors identified and prioritized by multiple stakeholders during kick-off meeting.

Cameroon	Central African Republic	Democratic Republic of Congo	Regional level
Food (NTFPs)	Food (NTFPs)	Food (NTFPs)	Food (NTFPs)
Water (potable)	Water (potable)	Energy (wood fuel)	Water (potable)
Research	Biodiversity	Water	Energy (wood fuel)
Energy (wood fuel)	Health (medicinal)	Health (medicinal)	Health (medicinal)

actions using national budget allocations without fear of duplication of efforts under scarce resources. In addition, evaluation of national forest policies and their implications on the flow of the goods and services that underlie these sectors would provide support to national policies. Pooling of actions for adaptation is crucial especially under diminishing resources and lack of capacity. Finding areas of common interest is crucial for there to be common actions especially through policy. Prioritization at the regional level allows for the identification of shared priorities for adaptation by a number of countries that could be addressed using a regional adaptation planning approach. As a transboundary natural resource pool, this may facilitate the use of a regional framework institution like the Forestry Commission of the Central African States, currently responsible for coordinating REDD in the Congo Basin forests, for similar implementation of regional adaptation strategies especially as both constitute forest-based climate change response actions in the region. Setting of priorities in line with the perceptions and experiences of stakeholders of climate change may turn out to be crucial in calling for a change in their business-as-usual practices (e.g., unsustainable NTFP extraction and trading practices, law abiding and enforcement) as adaptation measures and sustainability of the forest ecosystem.

5. Exploring the linkages between the prioritized sectors and market systems

In order to understand the potential contributions of markets to adaptation, it is important to take into consideration the common preferences of the people who share and use the forest resources. The degree of connectedness to the marketplace of some of the sectors may provide an indication of the add-on values the market can provide the prioritized sectors (Table 3) and of how dependent the sector may be on market instruments for achieving the full worth or value for adaptation. In this framework, each of the prioritized sectors was evaluated using the following criteria. (i) Does sector require market to deliver its full benefits for adaptation? (ii) Is the sector currently connected to any market system in terms of commodities? (iii) Will markets for goods and services of the sector be beneficial or detrimental to adaptation?

6. NTFP markets for livelihood and climate change adaptation

The collection of NTFPs is widespread in the Congo Basin. Among NTFPs collected and commonly commercialized are charcoal (makala), *Marantacea* leaves, *Gnetum* spp. (Eru or Fumbua), *Dacryodes edulis*, caterpillars, mushroom, fish (smoked and fresh), and bush meat. Women predominate in the trade of NTFPs. Of the 212 traders sampled in Bandundu and Equateur provinces 79% and 63%, respectively, were women. Markets play important roles and have high potential in swapping safety nets in commodities for safety nets in cash liquidity. A substantial volume of NTFPs harvested contributes significantly to household income. The survey of trader households in the Equateur province of Democratic Republic of Congo showed that selling six NTFPs earned average monthly revenue of US\$225, a sum comparable to two elementary school teacher salaries of US\$80–120 (Table 4). Some of the differential capacity in using and benefiting from markets was, however, related to the level of literacy.

Charcoal understandably represented the largest removal of carbon from the system, its production stretching almost year round. This was closely followed by palm wine. Charcoal and palm wine, with their higher total income returns in both provinces, involve destructive collection methods that affect forest structure and integrity. The collection of *Gnetum* spp. represents defoliation which, if done sustainably, allows for regeneration.

Caterpillars and mushrooms were also prominent market commodities in trade income because of their services as dietary sources of protein. The impacts of climate variability and change on mushrooms and caterpillars constitute a major challenge for adaptation because of the collection volume and their nutritional roles for households. The recorded differences between the two provinces (Table 4) highlight the unevenness of NTFP distribution and production across landscapes. Sparse distribution of NTFPs in a landscape potentially shapes the spatial patterns of livelihood vulnerability, especially as they represent supplementary food supplies for local communities. Unit income values varied among NTFPs depending on the traded amount and the income returns (Table 4). Commodities such as charcoal or palm wine, which involve destructive collection methods may

Table 3 – Framework for assessment of trade impacts: characterization of potential benefits of trade in forest goods to three livelihood assets of the sustainable livelihood framework (adapted from DFID, 1999).

Forest goods	Trade benefits across scale and capital pools	Financial benefits	Social benefits	Environmental benefits
NTFPs (medicinal purposes)	Local benefits at stand management level	High	High	Low
	National benefits through mosaic of forest land use	Moderate	Moderate	Low
	International benefits to global community	Low	Low	Low
NTFPs (food for human and livestock)	Local benefits at stand management level	High	High	Low
	National benefits through mosaic of forest land use	Moderate	Moderate	Low
	International benefits to global community	Low	Low	Low
Wood fuel (fuel wood and charcoal)	Local benefits at stand management level	High	High	Very low
	National benefits through mosaic of forest land use	High	Moderate	Very low
	International benefits to global community	Low	Low	Extremely low

Table 4 – Market volume and value of major NTFPs traded in Bandundu and Equateur provinces.

NTFPs	Bandundu				Equateur			
	Volume (kg) per trader	Value (US\$) per trader	Unit value (kg/\$)	Time ^a (months)	Volume (kg) per trader	Value (US\$) per trader	Unit value (kg/\$)	Time ^a (months)
Caterpillar	54.8	70.4	0.78	4	66	11.1	5.95	6
Charcoal	240.3	24.1	9.97	4	2948	230.4	12.80	12
<i>Gnetum</i> spp.	82.5	52	1.59	5	1475	684.5	2.15	12
Kola nut	0.1	0.2	0.5	1	22.2	11.8	1.88	10
Mushroom	7.5	9.5	0.79	3	47.3	8.0	5.91	6
Palm wine	121.7	6.3	19.32	1	3298.6	407.9	8.09	12

^a Number of months for which information was gathered on the specific NTFP.

provoke forest degradation (World Future Council, 2009), actually had lower unit income values in both provinces than caterpillars and mushrooms, which involve simple collection methods with minimal forest disturbance.

Although NTFP trade generates income, we observed in this study that the distribution of income along the product's value chain (Fig. 1) can still leave highly vulnerable the producer or local farmer who does the actual collection. For all the NTFPs, there was a significant difference between what the farmer received and the wholesale and retail prices of the same commodity. Even factoring in the transaction cost, the margin in some cases almost doubled prices is considered too high.

Market values are sometimes determined by what happens in other sectors, which complicates the planning process. For example, a bumper harvest of groundnut easily results in increased market value of *Gnetum* spp. because of the latter's use in preparing the local dish. Market activities are sometimes separated along gender lines, with women dominating the retailing of some of the NTFPs while men dominate wholesale activities. The distribution of market benefits along those lines may also explain the gender-differentiated vulnerability. Such information is crucial in planning adaptation strategies in such communities.

The market values of some NTFPs may provoke over-harvesting, thereby jeopardizing the resilience of those NTFPs and affecting net productivity and community composition. Better targeted adaptation strategy could involve domestication practices for some of the NTFPs with high market value.

For instance, *Gnetum* spp. is a strategic NTFP in the Democratic Republic of Congo which needs to be promoted by encouraging its cultivation and its incorporation in multi-strata agroforestry systems. In addition, the capacity of rural communities (including women, minorities, and marginalized groups) needs to be developed so that they produce and market *Gnetum* spp. in sustainable ways.

Other NTFPs that have an important market are caterpillars, charcoal, *Marantacea* leaves, and palm wine. The utilization of caterpillars and *Marantacea* leaves is friendlier to the environment than the exploitation of palm wine and charcoal. These products will continue to be important because of growing poverty and the energy problem in the Democratic Republic of Congo. The production of caterpillars may be threatened if more forest concessions were allocated in the future. In general, trees that are hosts of caterpillars, such as *Entandrophragma cylindricum* (sapelli), provide valuable timber, which leads to frequent conflicts between rural communities and timber companies (Ndoye and Tieguhong, 2004). Like in many other countries in Central Africa the production of palm wine is done in an unsustainable manner as it involves killing the tree. In Cameroon, according to Ndoye (1995), the cost to society of each palm tree killed through palm wine tapping ranges from 70,000 to 129,000 CFA francs (i.e., US\$150–280). A number of identified constraints confront the marketing of NTFPs by households as identified by this study. These include long distances, limited market outlets and access, high transport cost, low shelf life of many products,

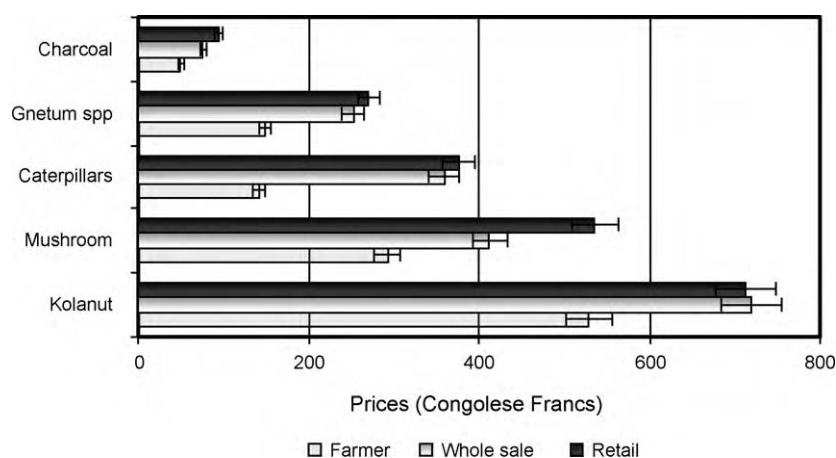


Fig. 1 – Comparison of farmer earnings and wholesale and retail prices of top five NTFP sales at local markets in Banbundu and Equateur provinces.

taxes, corruption practices such as bribery, etc. The study found that women (63%) dominate the trade in NTFPs and have more experience than men since they start earlier in life (at 15 years) than men (at 23 years). This is facilitated by the level of analphabetism.

NTFPs are essentially the niche for poor populations (Arnold and Ruiz-Perez, 1998), which makes them relevant for addressing health problems, poverty, and adaptation to external shocks and stresses. There are also gender issues with more women involved in gathering, processing, and commercialization, which provides the opportunity for empowerment. Eighty-five percent of the 212 trader households surveyed use medicinal plants (the share is as high as 100% among Pygmies) to cure a wide range of ailments (back pain, cold, diarrhea, malaria, measles, rheumatism, worms, etc.). This use can be largely explained by the prevailing poverty and the lack of income for the purchase of pharmaceutical products. The use of NTFPs is not limited to local communities; Western multinational pharmaceutical companies are involved in producing organic or alternative medicines, some of which are extracts from tropical forest plants such as *Pausinystalia johimbe*, *Physostigma venenosum*, *Prunus africana*, *Strophantus gratus*, and *Vocanga africana* (Walter, 2001). Bark harvest of *Prunus africana* in 1999, for example, earned US\$700,000 for the economy of Cameroon and was worth over US\$200 million to the pharmaceutical companies that process the bark (CARPE, 2001). This emphasizes the spatial distribution of use and the potential economic impacts of the trade in NTFPs.

7. Matching the roles of forest-based markets as alternative safety nets for adaptation

The safety net function of forests at local, national and global levels will be challenged especially under the emergence of new markets and trading opportunities in NTFPs including unconventional commodities and services like carbon as incentive mechanisms for greenhouse gas emission reductions. Under such circumstances, several safety net scenarios and outcomes are envisaged.

One scenario is the transition from local to global safety roles that will certainly usher in new actors, instruments, regulations, and challenges that may tilt the equilibrium position of the safety net role of forests for adaptation away from local communities. In addition, the new dynamics of offshore stakeholders and market systems may alter local activities through their specific dynamics and approaches. Negative feedback on local demand can however be avoided by putting in place special alternatives or considerations such as integrating local adaptation priorities in the new global safety net roles of Congo Basin forests especially under REDD. The anticipated market in carbon trade through REDD is associated with the prioritized sectors in one way or the other wherever REDD is implemented. The integration of adaptation priorities into REDD schemes will likely be a challenging task. Compatibility and acceptability of this co-existence or integration, however, will depend on several factors surrounding the scheme including methodology, baselines, policies and regulations, etc. Thus market instruments should comple-

ment rather than substitute forests roles for adaptation to climate change in tropical countries. This approach emphasizes the need to strive for the use of multiple pathways in responding to climate change as well as promoting co-existence and co-benefits. For example biodiversity conservation and watershed protection as co-benefit of REDD, could prove more instrumental for adaptation by supporting some of the priority sectors people identified for adaptation (see Lopez-Feldman and Wilen, 2008). In this case, it is not the direct income per se from REDD that is beneficial.

Another scenario is envisaged where REDD is implemented in the Congo Basin and more money would reach same groups of people represented by NTFP market traders from REDD than does at present through the NTFP market, if they are part of the REDD actors. Following the nature (nationally and sub-nationally managed) and sophistication of the trading scheme surrounding REDD, the participation of local traders or business people is very unlikely drawing from the examples of CDM in Sub-Saharan Africa. Whatever be the case with REDD implementation, the concern however is that the income from REDD might not necessarily be in the possession of the most vulnerable groups such as farmers in order to have the desirable impact on their adaptation capacity in a way that shifts their dependence out of direct forest resource use. Similarly, the disproportionate share of the revenue returns from the trade in NTFPs might not be currently creating any uprising simply because local communities still have in place forest asset pools at their disposal as safety nets. However, this tranquility is likely to disappear if these safety nets in forests no longer existed to the communities. Thus, market instruments should be considered with caution because they are not necessarily guarantees to enhance adaptation and substitute community dependence on forests that currently serve as safety nets.

8. Intervening with forest-based markets for climate change adaptation

Market systems should offer opportunities for revenue generation crucial for growth and development at any scale of operation. Not everyone, however, stands a chance in marketplaces (Scherr et al., 2003), especially not the local communities. In the climate change negotiation process, markets are viewed as important instruments for both generating incentives for action and providing the capital base for responding to the urgent need for greenhouse gas emissions (GHGs) reduction, with the presumption of revenue trickle-down effects for local adaptation to current and future climate impacts. Similarly, revenues from other markets for forest products should contribute to poverty alleviation through enhancement of the adaptive capacities of local communities. As systems with different drivers, operational levels, and institutional requirements, however, the harnessing of market instruments for adaptation poses major challenges. How market systems are positioned and used under climate change crisis will determine the directional shifts in vulnerability and adaptation of the most vulnerable and poorest majority in Africa. It is therefore important to be cautious in using markets and in examining the implications

of the steady displacement of safety net roles of forests under the expanding trading portfolios of forest goods and services in global, regional, and national market frameworks and mechanisms as well as the likelihood of undermining local needs and priorities for adaptation and national development.

Following the analysis of the market connection in this study, none of the prioritized sectors in Central Africa were market-based sectors that primarily depended on market revenue generation for adaptation. The sectors mostly represented need-based sectors crucial for adaptation rather than their monetary values. There are currently connections between some of the sectors and the markets. For example, wood fuel energy as charcoal and firewood has large markets in both rural and urban centers. Income from the wood and charcoal trade constitutes a significant proportion of family income that can contribute to adaptation. There are also markets surrounding NTFPs for food and medicinal products stretching offshore. Although there are prospective markets for each of these sectors, they have primarily backstopping roles for adaptation. Furthermore, revenues received from selling NTFPs enable households to pay for their children's school fees (Tieguhong and Ndoye, 2007). This investment may enable parents to adapt to climate change in that the educated children may in the future have a job and send money to their parents on a regular basis to pay for the basic needs of the households.

Revenue generated through market systems if well managed and appropriately used, can play important roles for adaptation. Like safety nets in forest goods and services, it can serve as a security bond for urgent use for adaptation actions or other forms of interventions. For this to occur, however, there needs to be clear definition of whether adaptation should be embedded in the public or private domain, or perhaps a combination of the two, and what regulations are needed to structure the activities. Unlike government welfare systems and social security endeavors, adaptation needs are difficult to estimate and easily managed at the endpoint or on the micro-level of household (Tompkins and Hultman, 2007). Under state ownership, forest resource revenues are centralized in state treasuries. Using these revenues for adaptation will therefore require a central control or distribution system. Thus it can be argued that there should be public funding for adaptation since the state is in care of all the resources and the funds. Under public management, the setting of adaptation priorities poses major challenges that could without doubt be bulked into politics of constituencies and special interest blocs. Under such hegemonies, public roles for adaptation can easily be transformed or transferred into disaster management and intervention since disasters easily stick out as national emergencies for priority interventions. Disaster interventions do not represent adaptation because they are retroactive rather than proactive and because they cannot be classified as autonomous adaptation. How well markets can contribute to adaptation depends therefore on whether adaptation is in the public or private domain.

9. Conclusion

Safety nets are important measures for mitigating risks and uncertainties especially those linked to human well-being.

The choice of safety nets is therefore crucial especially for rural families with limited options other than largely depending on food gathering from the forest for survival. Although there are different forms of safety nets, switching from one form to the other require new skills to deal with the context that might not immediately fit into the current potentials and knowledge base of some forest communities. The arts of trading for example have an important role to play in the ability to explore markets. Pygmies, unlike the Bantus in the Bandundu and Equateur provinces of the Democratic Republic of Congo, had the lesser experience in selling NTFPs. This fact is important in the evaluation of the potential benefits of markets and their implications for different communities in the shift of forest safety nets to trading commodities as alternative safety nets in markets. How REDD and other emerging markets in the Congo Basin will recognize rather than displace the traditional safety net roles of forest will be crucial for adherence and in expanding the benefits for achieving other climate change responses following the inseparable roles of forest for healthcare, nutritional base, and economic well-being of a great majority of people and nations in the Central African region.

REDD seems to raise so much appetite in the region in anticipation of the monetary earnings through the market instrument rather than a menu-based strategy for responding to climate change in totality of the problem especially in line with the priorities for adaptation, which has to be pragmatic in using the multiple roles of forests simultaneously. As a natural resource-dependent system for livelihoods and national development, there is a risk in constricting security lifelines available in the forests as emission reduction takes precedence over adaptation. The interfaces between forests under REDD schemes and forest for livelihood adaptation and national development need to be further explored since all three are crucial for both mitigation and adaptation.

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