Biodivers Conserv (2007) 16:2401–2427
DOI 10.1007/s10531-007-9188-0

ORIGINAL PAPER

Cocoa farms in the Mount Cameroon region: biological and cultural diversity in local livelihoods

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Received: 13 December 2006 / Accepted: 28 April 2007 / Published online: 21 June 2007
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Abstract A study was undertaken around Mt Cameroon to examine the role of biological and cultural diversity in the livelihood strategies of indigenous villagers and migrants to the region. Surveys of resources consumed and sold by 118 households were undertaken in five villages over the course of 1 year, the perspectives and practices of cocoa farmers documented, and useful tree species retained or planted on six cocoa farms mapped. Cocoa farms in this region generate more significant benefits for biodiversity conservation and local livelihoods than commercial plantations, but also place pressure on forest reserves and require chemical inputs. Roughly 50 tree species are commonly retained or planted on cocoa farms, primarily for timber or food, with many of these having high conservation value. Average tree density of non-cocoa trees was 15 trees per hectare, with tree densities higher, and a larger percentage of species used, on indigenous Bomboko farms than migrant farms. Both migrant and indigenous households rely on forest as a complement to farm income, but indigenous households do this to a far greater extent, while also making extensive use of fallow and home gardens. Indigenous households also derive roughly four times the income from wild and native species compared to migrants. While diversified cocoa farms contribute to conservation and livelihoods in the region, indigenous

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livelihoods grow from and require the conservation of a broader range of species and habitats, including natural forest.

Keywords Biodiversity · Cameroon · Cocoa · Cultural diversity · Livelihoods · Non-timber forest products

Introduction

The conservation of biological diversity by necessity integrates managed landscapes outside of protected areas, and involves strategies to maximize the retention of biodiversity and improve livelihoods (CBD 1992). Cocoa farms, often a threat to forests and biodiversity in the tropics, can also provide environmental and livelihood benefits that outweigh those of other agricultural systems, particularly when cocoa is grown in agroforests like those of southern Cameroon, Bahia in Brazil, and eastern Ghana (Ruf and Schroth 2004; Gockowski et al. in press). Cocoa farms that retain significant numbers of indigenous shade trees, as well as planted fruit and other trees, replicate structural and functional elements of the forest: they contribute to soil conservation, thermal regulation, genetic and species conservation, carbon sequestration, and watershed protection, and provide habitat for wildlife while serving as reservoirs for seeds from the forest (Kotto-Same et al. 1997; Leakey and Tchoundjeu 2001; Sonwa et al. 2001; Zapfack et al. 2003; Gockowski et al. in press).

In addition to these environmental services, non-cocoa trees on farms provide useful products consumed for subsistence and sold in local markets (Sonwa et al. this issue). Non-cocoa trees contribute across seasons to household livelihoods, and provide supplemental income when cocoa prices fall or disease strikes. Cocoa farms also hold in reserve timber species that can be harvested for home construction, to provide cash for farm improvement or household use, and which would otherwise be harvested from forests (Ruf and Schroth 2004; Gockowski et al. in press).

Cocoa was introduced to Cameroon by the German colonial administration in the western coastal areas, including around Mount Cameroon, in 1886 (Ardener 1996). During this time, the Germans introduced a range of plantation crops from around the world into Cameroon through the Victoria (now Limbe) Botanic Garden, at the foot of Mount Cameroon. The Trinitario variety of cocoa they introduced was from Venezuelan and West Indian planting material, with distinctive red-podded trees. The result is cocoa with unusually high fat content and a red-colored powder (Wood 1991). The Trinitario variety, called "German", is still planted around Mount Cameroon today. In South and East Cameroon, Trinitario trees were mixed with Amelonado from Fernando Po, Equatorial Guinea. Amelonado cocoa was first introduced to the Central and West African region through Principe (1822), Sao Tome (1830) and Fernando Po (1854). Cocoa plantations on Fernando Po relied on imported labor from West Africa, and—with the exception of Cameroon—Amelonado cocoa spread throughout the region when cocoa laborers returned home (Wood 1991).

Unlike the commodity crops rubber, tea, banana and oil palm, cocoa is grown largely on small-holdings in Cameroon. Farm size averages roughly 3 ha, with variations by region, wealth, cultural practices of the individual farmer, and farming intensity (Gockowski 2000). Both women and men play a role in the cycle of cocoa production, although cocoa is

primarily viewed as a "men's crop" (Guyer 1984; Malleson 2000; Gockowski et al. in press).

Cocoa farms in southern Cameroon tend to have a higher density of shade trees than cocoa grown in West Africa (Zapfack et al. 2002; Sonwa et al. 2003; Ruf and Schroth 2004; Gockowski et al. in press). Gockowski et al. (in press) report that when viewed using satellite imagery, the vast majority of indigenous Beti cocoa agroforests in Southern Cameroon are indistinguishable from closed canopy forest. The cocoa agroforests of southern Cameroon, managed by the same groups for close to 100 years, have integrated and become part of complex traditional management systems (Guyer 1984; Sonwa et al. 2000; Carriere 2002; Ruf and Schroth 2004; Gockowski et al. in press). For example, the Beti use 254 species found on cocoa farms, for 392 purposes, and retain an average density of 162 non-cocoa trees per hectare (Gockowski et al. in press).

As we will see, the cocoa farms around Mount Cameroon fall on a continuum between those with little or no shade in West Africa and the complex cocoa agroforests of southern Cameroon (Sonwa et al. this issue; Oke and Odebiyi in press). The Mount Cameroon region is characterized by relatively high population densities, and significant pressure on land and resources. Some old, diverse cocoa farms persist, managed by the offspring of original indigenous farmers, but the bulk of cocoa farming in the region is undertaken by migrant farmers, and the trend on indigenous cocoa farms is towards simplification. Even in these simplified systems, however, the retention and planting of non-cocoa useful species provide important environmental services and livelihood benefits. This is particularly the case when cocoa farms are compared to the commercial oil palm, tea, banana and other plantations owned by the Cameroon Development Corporation (CDC) and, increasingly, local and urban elites around Mount Cameroon.

This paper explores the relationship between cocoa farms, livelihoods and biological and cultural diversity in the Mount Cameroon region. We examine the retention and planting of useful species, some with high conservation value, on cocoa farms, and then look more broadly at the role of biodiversity in the land use strategies and livelihoods of indigenous and migrant farmers. Indigenous and migrant farmers' dependence upon biodiversity is viewed through the contribution of native and wild species, and of diverse habitats including forest, to local livelihoods. The implications for biodiversity conservation of cocoa farm management and the value of biodiversity to indigenous and migrant households are also explored.

Methods

The Mount Cameroon region

Mount Cameroon is on the southwest coast of Cameroon, on the Gulf of Guinea. At 9.1° east and 4.5° north, it is the last active member of a range of volcanoes that extend from the island of Principe, around 100 km to the southwest, through Fernando Po of Equatorial Guinea (2,850 m) to the highlands of Adamoua in Cameroon and Obudu in Nigeria (Letouzey 1985). It is the highest mountain in West Africa, at 4095 m, rising rapidly from the Atlantic Ocean to the summit 20 km inland, with two distinct peaks, Mount Cameroon (locally known as Fako) at the north-east, and the older Mount Etinde (1715 m) at the south-west (Letouzey 1985; Fraser et al. 1998). Mount Cameroon is one of the most biologically diverse sites in Africa, with roughly 2500 indigenous and naturalized plant species (Cable and Cheek 1998). Located in the Guinean Forests of West Africa, it is part

of a 'biodiversity hotspot' (Conservation International 2007), and comprises lowland and lower montane rainforest, upper montane and sub-alpine rainforest, and montane and sub-alpine grasslands (Ndam 1998).

Mount Cameroon harbors a patchwork of habitats, land uses and people. The indigenous groups living around Mount Cameroon include the Bakweri, Bomboko, Bakolle, Balong, Isubu, and Wovea. All have a long history of interaction with external groups, including European traders, missionaries, and German and English colonial administrations. In the last decades of the 1800s, following a series of battles, Bakweri villages were relocated by the Germans in order to establish the plantations that remain today, and are currently managed by the CDC (Kofele-Kale 1981; Ardener 1996; Sharpe 1996). Boundaries between villages and plantations continue to be negotiated as part of what is called the "Bakweri land question", and in the last decade some villages have re-acquired marginal lands taken from them more than 100 years ago. The Bakweri have also brought their case to the African Human Rights Commission (BLCC 2006).

Workers on the plantations have long been drawn from other parts of Cameroon, in particular the Bamenda highlands, and other parts of Southwest Province (Ardener et al. 1960; Ardener 1996). Migrants from other parts of Cameroon and Nigeria also live as settlers and farm in the area. In 1960, indigenous groups made up 30% of the population of Victoria Division (Ardener 1996). A recent study estimated that the indigenous Bakweri population makes up less than a quarter of the roughly 250,000 people in the Mount Cameroon region (Schmidt-Soltau 2003). There are significant differences between villages, however, with many remaining almost entirely indigenous, and others—like the Bomboko village included in this study—having less than 10% indigenous residents.

Study villages

This study was undertaken in five villages around Mount Cameroon—Ekonjo, Etome, Upper Buando, Likombe and Bova Bomboko (Fig. 1). The first four villages are indigenous Bakweri villages found on the southern slopes of Mount Cameroon. Migrant, or "stranger" as they are locally known, farmers rent or buy land in the vicinity of these indigenous villages, but do not reside within the village, living instead in plantation camps and villages closer to towns. The population of the indigenous Bakweri villages range in size from 61 to 265 (Table 1). All villagers earn the majority of their living from farming, and some are only farmers, but most indigenous households also collect non-timber forest products (NTFPs), include hunters, healers, traders, or support themselves in other ways in addition to farming.

The fifth village, Bova Bomboko, is located at the northeastern foot of Mount Cameroon and was originally an indigenous Bomboko village but is now dominated by migrant farmers. Bova Bomboko abuts the roughly 26,667 ha Bomboko Forest Reserve, created in 1939 as the Bomboko Native Authority Forest Reserve. Bova Bomboko is now populated primarily by cocoa farmers from other regions of Cameroon (primarily Northwest, Southwest, West, and Centre Provinces) and Nigeria. Less than 10% of the population today is indigenous Bomboko. The population of Bova Bomboko is significantly larger than that of the other study villages, totaling 1151 individuals in 212 households (Table 1). As found in the village census, Bova Bomboko also has a younger population, with the majority under age 40. Only 11% of the population is over the age of 40 (2% over the age of 60), compared with more than 30% of the population of indigenous villages over the age of 40, and 11% over the age of 60. The vast majority of the inhabitants of Bova Bomboko

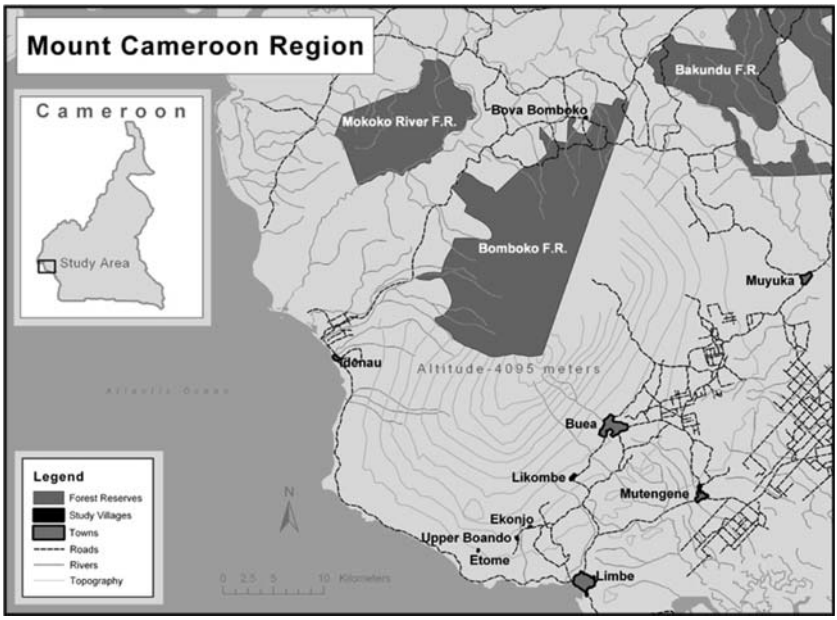

Fig. 1 Study region around Mount Cameroon showing the Forest Reserves (F.R.)

Table 1 Population, structures and households in five study villages in the Mount Cameroon region in 2000

Villages	Community type	Number of permanent residents	Number of separate structures or houses	Number of households living in village	Number of households in the household survey (# of individuals in these households)
Bova	Bomboko	<10%			indigenous; remaining migrant
1151	129	212	36 (268)		
Etome	Indigenous	67	18	10	10 (67)
Ekonjo	Indigenous	61	25	19	19 (61)
Likombe	Indigenous	265	79	61	23 (119)
Upper Buando	Indigenous	66	25	15	15 (66)

Source: village census

are farmers and earn the bulk of their income from farming, particularly from cocoa. Cocoa farmers report, and the household surveys demonstrate, that cocoa accounts for well over 50% of most households' income in Bova Bomboko; an additional 40% of income comes from other crops like plantains, cocoyams, and cassava. Less than half of all households harvest NTFPs and these earn around 5% of their income from about a half dozen NTFPs (e.g. *Ricinodendron heudelotti* (njangsang), *Irvingia gabonensis* (bush mango), *Gnetum africanum* (eru), *Piper guineense* (bush pepper), *Cola lepidota* (monkey cola), *Garcinia cola* (bitter cola), and bushmeat).

Survey methodology

The research on cocoa farms reported in this paper was part of a larger research project, undertaken around Mount Cameroon between 1998 and 2004. The project addressed a broader range of research questions than the cocoa study, and was focused on diversity and change in indigenous and migrant relationships to the environment. The project also employed a wider range of ethnobiological methods, including free-listing, additional household surveys, resource-specific surveys, tree trails, and others. This broader project informed the cocoa research, but will not be reviewed here (see Laird in press).

The initial phase of research included a village census and household surveys of resource use. The census was undertaken in the five study villages—Likombe, Etome, Ekonjo, Upper Buando, and Bova Bomboko—in a total of 317 households. Every household in each village was visited, and information collected on all members of the household and family, including: gender, age, relationship to household head, education level, residency (permanent, temporary, outside village), occupations, and relatives in village. For each household, sources of income were initially evaluated using pie charts (and at times stones, seeds, or other representations). The total number of structures in each village, as well as the total number of active households, were recorded (Table 1). In addition, demographic surveys were undertaken of migrant farmer households living outside of, but farming in proximity to, indigenous Bakweri villages included in the study—in Batoke, Saxenhof, and Wututu.

Following the village census, we undertook more intensive daily household surveys to document resources gathered for subsistence use and sale. In the larger villages, a sample of households was selected, stratified according to gender of household head, age, relative wealth, education level, and source of income (including extent of reliance on forest—e.g., hunters, herbalists, weavers, and NTFP collectors depend more on the forest than those that primarily farm). In Likombe, 23 households were included in the household survey, and in Bova Bomboko, 36 households. In Etome, Ekonjo, and Upper Buando, household numbers are small enough that all households were included in the daily surveys.

In order to examine the broader role of biological and cultural diversity in indigenous and migrant livelihood strategies, we measured the contributions of different habitats, management systems, and species. Broken down crudely for the purpose of analysis, these are the habitats of home gardens (compounds), farm (including cocoa farms), fallow, and forest; cultivated and "wild" species ("wild" incorporating all things not intensively cultivated, including those semi-domesticated); and native and introduced species (Tables 5, 6). The daily household survey recorded all things collected and consumed, or sold by households in order to move beyond identifying and listing what is generally reported as 'useful', to quantifying the nature of use. The household survey allowed comparison of differences in resource use and management between ethnic groups, and study villages of different size, geography, proximity to forest, markets, and urban centers, and other factors. In each village, households were interviewed for five consecutive days, every other month, over the course of a year (2000–2001). With a total of 118 households included in the study, multiplied by 30 days across the year, a total of 3540 day surveys were administered. A total of 8779 entries for food harvested and bought in local markets were recorded for all villages combined across the year (Table 2).

In order to calculate a monetary value for products harvested from cocoa farms and other areas for subsistence, we undertook market surveys. For each village, a study in the main local market was undertaken. Prices for products in the rainy and dry season were recorded. For medicines, wild greens and fruits, forest ropes, and other products that are

Table 2 Number of plant products harvested from home gardens, farms, fallow and forest and bought by households in each study village in the Mount Cameroon region over the course of one year[a]

Village	Household type	Products harvested	Products bought
Bova Bomboko	<10% indigenous; remaining migrant	1226	944
Etome	Indigenous	519	232
Ekonjo	Indigenous	690	455
Likombe	Indigenous	1473	835
Upper Buando	Indigenous	903	368
Batoke	Only migrant households surveyed	143	302
Saxenhof	Only migrant households surveyed	225	197
Wututu	Only migrant households surveyed	127	140

[a] Plant uses include food, medicine, household use, construction, fuelwood, cultural use

Source: Daily household survey

not widely sold, we selected a low figure (e.g., 100 CFA per bundle for medicines), or used a substitute product value. This approach undoubtedly undervalued these resources, but allowed for their incorporation in the analysis (Campbell and Luckert 2002). In any case, in contrast to staple foods and fuelwood, household surveys are a poor way to capture the use of medicinal plants, many wild foods such as mushrooms or bushmeat, and other products that are used inconsistently, collected sporadically, or often under-reported in household surveys (Laird in press).

Cocoa-specific surveys

Building upon the village census and household surveys described above, research was undertaken to look specifically at cocoa farming in Bova Bomboko, the only study village to intensively farm cocoa. This research sought to evaluate: 1. the extent of farmer dependence on chemical inputs; 2. the multiple products (non-timber and timber) found on cocoa farms, and by extension the retention of biological diversity on farms; and 3. reasons for pressure on the Bomboko Forest Reserve from new cocoa farms. In part this research was undertaken in collaboration with staff from the Mount Cameroon Project, as part of their efforts to explore the potential for certification to promote ecologically and socially sound cocoa production.

Cocoa farmer surveys were undertaken with 66 households—all households included in the daily household survey (36), and an additional 30 cocoa farmers selected according to the same criteria as the first 36 households. The bulk of these farmers originate outside the area, primarily in Northwest Province, followed by Southwest Province, and other parts of Cameroon and Nigeria. A small number of cocoa farmers are indigenous Bomboko. Migrants from the South West Province were distinguished as a group in this survey because they share many species and traditions with indigenous households around Mount Cameroon, and—as other parts of the larger study demonstrated—have greater knowledge of species names and uses than other migrants (Laird in press). The "cocoa farmer survey" explored current management practices (varieties, schedule, use of pesticides, yields, etc.); existing incentives to clear farms from forest; basic marketing structures; land tenure and resource rights; and the socioeconomic profile of the planting, harvesting, processing, transporting and marketing of cocoa. Households were also asked which trees, shrubs and other useful products are found on cocoa farms: tree name; use; whether retained or planted;

estimated number per farm; average years on a farm; and who retained or planted it (some species derive from the time when parents or grandparents managed the farms). Households were also asked to rank different habitats in importance as a source of NTFPs—village/compound; "chop" (food crop) farm; fallow; cocoa farm; secondary forest; primary forest or "black bush"—and to list the types of NTFPs found in each habitat.

Following these household-based surveys, and a series of walks on farms and in forest to 'ground-truth' the household survey results, we surveyed six cocoa farms (total area of 26.1 ha) in order to identify and map the distribution of useful NTFP and timber species retained or planted. The mapping exercise was intended only to provide an illustration of reported practices of retaining or planting a more diverse suite of species on farms; the sample size of six farms is too small to draw broader conclusions from the maps alone. Farmers included in the cocoa farm surveys represented different ethnic groups, farmer age, size and age of farm, and proximity of farm to the Reserve. Four farmers are migrants from the north-west (Nkambe, Widikum, Ngie, and Noni) and two are indigenous Bomboko. Farm sizes range from 3.8 to 7.2 ha. Two farms abut the Bomboko Forest Reserve. Due to the sensitivity of farming within the Reserve, none of the large number of cocoa farms inside the Reserve was included in the mapping (although these farms were represented in the household survey portion of the research). Two of the cocoa farms, those owned by Bomboko, are old and well-developed and were passed down through many generations.

The research team included this paper's authors, two village research assistants, and a field botanist and tree spotter from the Limbe Botanic Garden. Voucher specimens were collected when species were not easily identified in the field, and specimens lodged at the Limbe Botanic Garden. A GIS specialist created maps of each farm, and plotted the location of useful non-cocoa trees on the farm, and agricultural extension and community development staff from the local conservation project, The Mount Cameroon Project, also participated in the household level cocoa surveys.

Results and discussion

The most significant result from this study is that indigenous households depend to a much greater extent upon local biodiversity than migrant households. This is manifested in the retention or planting of a higher density and diversity of non-cocoa trees on cocoa farms, and the use of a wider range of non-tree species on those farms, as well as livelihoods reliant not only on farms, but a wider range of habitats and both native and wild species. In this section we present and discuss these and other results from this study, and examine their impact on biodiversity conservation, beginning with an overview of cocoa farming practices in Bova Bomboko, including the use of chemical inputs. We then discuss cocoa farm establishment in the rich lowland forest of the Bomboko Forest Reserve; the retention and planting of useful species, many with high conservation value, on cocoa farms; the broader role of biological and cultural diversity in the livelihoods of indigenous and migrant households; and the impact of land tenure and resource rights on farm establishment and tree retention on cocoa farms.

Cocoa farming in Bova Bomboko

As reported in the cocoa farmer survey, cocoa farms in the Bova Bomboko region average between 3 ha and 4 ha, with indigenous Bomboko farms tending to be of greater size than

those of migrants. Most cocoa farmers in Bova Bomboko are migrants to the region who learned cocoa farming from friends or neighbors when they arrived (43%), from parents who had been cocoa farmers (37%), or from agricultural extension or other services following employment in local forest reserves or plantations (20%). In contrast, all indigenous Bomboko farmers learned cocoa farming from their parents, but many were also taught it in school.

The main cocoa varieties planted in this region are "German", the Trinitario variety introduced by the Germans, and the Amelonado varieties "Amazon" and "Barombi Kang". "German" cocoa takes longer to produce, but is also longer lived and more resistant to pests and diseases—an important consideration in this region. Cocoa farmers face a range of pests and diseases, with the main problems reported in the cocoa farmer survey being insects like mirids (capsid) and ants, and fungal diseases like black pod (*Phytophthora* spp.) and "yellow" or "wilt" (*Ceratocytis fimbriata*). Black pod is particularly prevalent in areas like Mount Cameroon without a pronounced dry season and with long periods of high humidity (Wood and Lass 1987). It can cause 80% yield loss when farms are left untreated with fungicides (Tondje 2000). Some farmers cut lower branches on shade trees and weed around cocoa to reduce the humidity, and all cut out shade trees that are considered to promote black pod or excessive dampness within farms (e.g., those with big leaves like the 'umbrella stick', *Musanga cecropiodes*). All farmers use a cocktail of chemicals (e.g., Gamaline, Nodox, Redomile, Kocide) to control pests and diseases; fertilizer use is minimal due to the fertility of the volcanic soils. Chemicals are the largest investment made by farmers, and one considered prohibitive but necessary. Their widespread use clearly undermines some of the environmental benefits gained from cocoa farms relative to other agricultural systems (e.g., food crops) in the region.

With liberalization of the cocoa sector in the 1990s, farmers were freed from the often dysfunctional and corrupt marketing board system, but became vulnerable to predatory intermediate sellers of chemicals and buyers of cocoa, and the whims of international markets for the prices they are paid. They have yet to resolve the resulting institutional and marketing problems (Tchoungui et al. 1995; Wirsiy and Lysinge 2003). Most farmers in Bova Bomboko purchase chemicals from agents who come to the village from the regional cities Kumba and Douala, and who often sell at inflated prices and advance funds against future sales. In addition to chemicals, farmers pay for laborers to harvest, prune, spray and clear—all jobs primarily done by men—and break and join/heap cocoa (primarily women). Chemicals and hired labor consume half of all earnings. Farmers must also pay for fuelwood and ovens to dry the cocoa (jobs performed by men), and for the cost of transporting cocoa (performed by women, men and sometimes children). Cocoa growing is difficult and labor-intensive work, but it generates more cash income than other crops for farmers, and—as reported in the cocoa farmer survey—is used to pay for critical living costs, with school fees topping the list, followed by medical expenses, food, and improvements to home or farm.

Cocoa farm establishment in forest

The majority of cocoa farms in the Bova Bomboko region are found outside the Bomboko Forest Reserve. The forest reserves in this area have been contentious from the start (Sharpe 1996), however pressure on the Bomboko Forest Reserve has increased significantly in recent decades. Today, much of the Reserve abutting the road and villages is already logged, and a significant portion is under cocoa and "chop" (food crop) farms

(Etuge 1999; Mount Cameroon Project 1997; Tchouto 1999). Migrants are responsible for the majority of forest clearance in the area, after buying or leasing the land from indigenous communities. What remains intact in the Reserve is lowland evergreen forest, which is the richest in rare endemic species and of the highest priority for conservation in the Mount Cameroon area (Cable and Cheek 1998).

In part, pressure on the Reserve is due to the limited availability of land, absence of controls and respect for Reserve boundaries, and the needs of migrants from regions with little available land and few employment opportunities. But undisturbed forest, or "black bush", is also considered a good place in which to clear a farm by more than 80% of the 66 households participating in the cocoa farmer survey. The reasons include soil fertility, with cocoa growing faster, bearing earlier, and producing higher yields; fewer pests and diseases, so less money spent on chemicals; higher inter-crop yields in the early stages (e.g., plantain and cocoyam); and greater availability of water in the dry season. Ruf and Schroth (2004) refer to these advantages as a "forest rent": throughout the world, planting cocoa after clearing primary forest results in lower investment and production costs than planting on previously used crop or fallow land.

The drawbacks of clearing a farm in the 'black bush', as reported in the cocoa farmer survey, are primarily the high labor involved in felling and clearing the farm, and the distance from the village. Squirrels and other animals are also likely to attack cocoa pods, and some said that over time—in 4–5 years—the humidity of the forest made pest and disease problems worse. Furthermore, as one penetrates the Reserve the altitude increases, and cocoa is considered to bear poorly at higher altitudes. Given the scarcity of land available around villages, and the continuing needs of the many households facing economic hardship in the region, however, pressure on the unique forest of the Reserve is likely to continue. The extent of this pressure was not quantified as part of this study, but the combination of chemical inputs and forest clearance associated with cocoa farms is clearly a threat to biodiversity conservation in the region. Although the broader economic and social problems that drive forest clearance in the area are difficult for most conservation programs to tackle successfully, certification schemes that integrate ecological, organic, and fair trade criteria might provide incentives to reduce both chemical use and forest clearance in the region.

Useful species retained or planted on cocoa farms

Outside the Bomboko Forest Reserve, cocoa farms can play a positive role in biodiversity conservation as part of a patchwork of managed landscapes. Retention or planting of useful trees during farm establishment or in subsequent years can contribute to both diversified livelihoods and biodiversity conservation. These non-cocoa trees provide shade for cocoa and are used for timber, food (fruit or spice), and to a lesser extent for fuelwood (Table 4). Many useful food and fuelwood trees are also found on "chop" (food crop) farms, but the bulk of species used for timber are found on cocoa farms, held in 'reserve' for future use.

The cocoa farmer survey found that farmers retain roughly 15 non-cocoa tree stems per hectare, with older Bomboko farms having higher numbers, with an average of 20 trees per hectare. For illustration, in Fig. 2 the four migrant-owned farms average 11.3 trees per ha compared with 22 trees per ha for the two Bomboko farms. In Côte d'Ivoire migrant farmers also tend to use less shade than indigenous farmers; there, indigenous farmers averaged 37 non-cocoa trees per ha, while migrants averaged 21 trees per ha (Ruf and

Schroth 2004). Studies from southern Cameroon cocoa agroforests report far higher densities of non-cocoa trees per ha, often more than 150 trees per ha (Gockowski 2000).

Non-cocoa tree densities, and average number of tree species per hectare, are found throughout the country to vary according to cultural tradition and ethnic group, age of farms, proximity to markets, and intensity of farming (Sonwa et al., in press; Sonwa et al. 2000; Gockowski et al. in press; Carrier 2002). In Bova Bomboko, the cocoa farmer survey found the average number of non-cocoa tree species on farms was roughly five species per hectare. Indigenous Bomboko use a higher percentage of non-cocoa species on their farms than do migrant farmers (85% for Bomboko compared with 75% for Northwestern migrant farmers in Fig. 2; Table 3). Retained or protected forest trees, unlike planted fruit trees, are

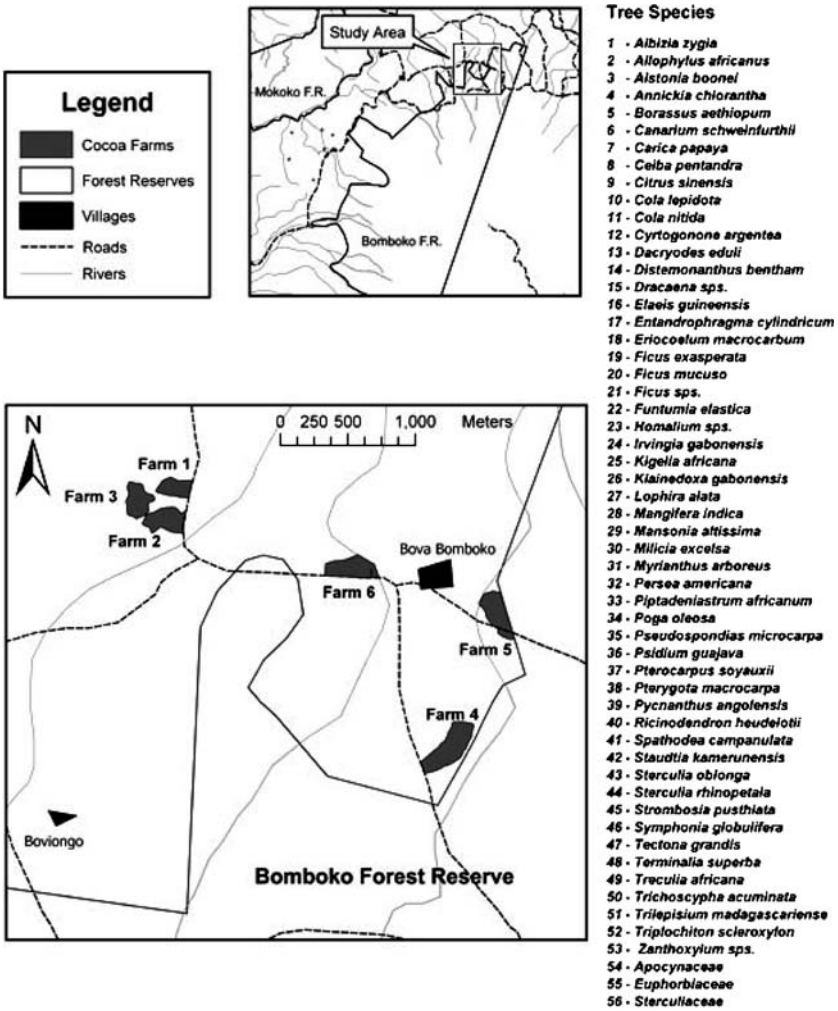

Fig. 2 Tree species retained or planted on six cocoa farms near Bova Bomboko, Mount Cameroon region. The numbers in the farm maps show the positions of individual trees as listed in the tree species list. Farms 1–4 are migrant farms, and farms 5 and 6 are indigenous cocoa farms

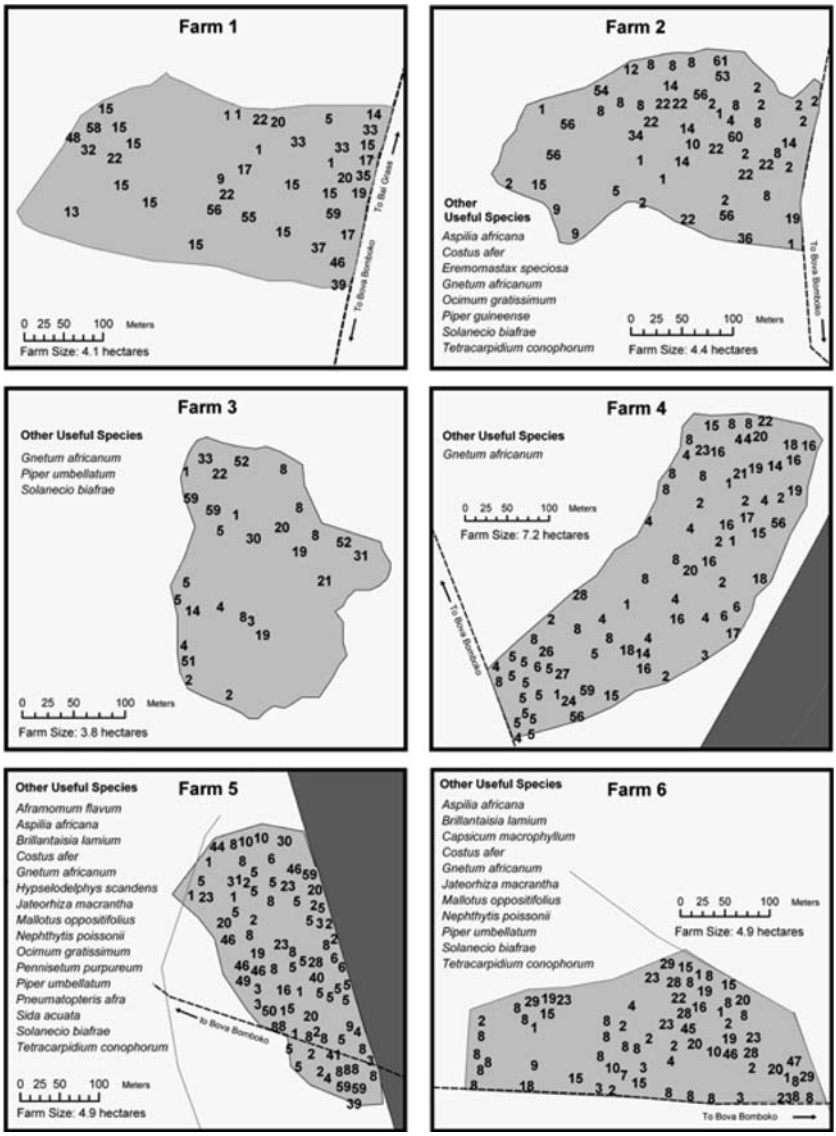

Fig. 2 continued

more or less evenly spread to provide shade to cocoa, and, in some cases, to increase soil fertility (Fig. 2).

As well as being useful, species retained on cocoa farms are often of conservation importance in the Mount Cameroon region. Of the 44 most commonly retained or planted species found on cocoa farms, 38 are native species, and of these many have high conservation value as threatened species, or support wildlife (Table 4). According to a ranking system for the conservation value of plant species in the Mount Cameroon region, examples of those with high conservation value retained on cocoa farms include *Cola lepidota*, *Cordia aurantiaca*, and *Milicia excelsa* (Cable and Cheek 1998; Table 4). The

Table 3 Farms surveyed for useful plant species in Bova Bomboko, and illustrated in Fig. 2

Farm	Farm size (ha)	Farmer's ethnic group (age)	# Non-cocoa tree stems on farm (# per ha)	# Non-cocoa species on farm (# per ha)	Species with largest number of stems (# of stems found on the farm)	% Non-cocoa species on farm which are used (beyond shade)	Primary use categories for retained or planted trees (# of species in category)
Farm 1	4.1	Nkambe (40)—migrant	42 (10.2)	21 (5.1)	*Sterculia rhinopetala* (10), *Ceiba pentandra* (5), *Lophira alata* (3), *Staudtia kamerunensis* (3)	67%	Timber (5), fuelwood (5)
Farm 2	4.4	Widikum (70)—migrant	56 (12.7)	21 (4.8)	*Dacryodes edulis* (10), *Elaeis guineensis* (10), *Staudtia kamerunensis* (7)	71%	Food (6), timber (5)
Farm 3	3.8	Ngie (40)—migrant	38 (10)	17 (4.5)	*Dacryodes edulis* (13), *Elaeis guineensis* (4), *Pterocarpus soyauxii* (2)	82%	Food (9), timber (6)
Farm 4	4	Noni (45)—migrant	88 (12.2)	23 (3.21)	*Persea americana* (12), *Elaeis guineensis* (12), *Triplochiton scleroxylon* (9), *Dacryodes edulis* (6)	78%	Timber (10), food (5), medicinal (2)
Farm 5	4.9	Bomboko (27)—indigenous	140 (28.6)	28 (5.7)	*Elaeis guineensis* (17), *Dracaena* sp. (8), *Ceiba pentandra* (8), *Dacryodes edulis* (7)	82%	Timber (12), food (10), medicinal (2)
Farm 6	4.9	Bomboko (65)—indigenous	77 (15.7)	23 (4.7)	*Elaeis guineensis* (17), *Dacryodes edulis* (7), *Sterculia rhinopetala* (5), *Terminalia superba* (5)	87%	Timber (10), food (8), medicinal (3)

IUCN Red List (2006) cites as "vulnerable" for Cameroon *Entandophragma cylindricum, Lophira alata*, and *Pterygota macrocarpa*, and as "near threatened" *Milicia excelsa* and *Triplochiton scleroxylon*.

Species planted on cocoa farms

Agricultural crops are planted on young cocoa farms, and around the edges of older farms. These include cocoyams (*Colocasia esculenta*), plantains (*Musa paradisiaca*), cassava (*Manihot esculenta*), maize (*Zea mays*), pineapple (*Ananas comosus*), banana (*Musa sapientum*), fluted pumpkin (*Telfairia occidentalis)*, and greens like bitterleaf (*Vernonia amygdalina*), waterleaf (*Talinum triangulare*), and huckleberry (*Solanum scabrum*). Most farmers also have "chop farms", which are the primary source of their food crops. Native food species like the woody climber 'kaso' (*Tetracarpidium conophorum*), and medicinals like the herbs 'majama jombe' (*Eremomastax speciosa*) and 'masefo' (*Ocimum gratissimum*) are also planted on some cocoa farms.

Exotic fruit trees are among the most common trees planted on cocoa farms. These include: orange (*Citrus sinensis*), mango (*Mangifera indica*), apple (*Eugenia malaccensis*), pawpaw (*Carica papaya)*, guava (*Psidium guajava*), and avocado (*Persea americana*). The leaves and bark, and sometimes fruit, from a number of these trees are also used as medicines. Common to every farm, and planted in the highest densities of all tree species, are the native plum (*Dacryodes edulis*) and oil palm (*Elaeis guineensis*). The native cola (*Cola nitida*) is also planted, as well as the raphia palm (*Raphia hookeri*). The highly popular spice trees njangsang (*Ricinodendron heudelotii*) and bush mango (*Irvingia gabonensis*) are occasionally planted, but more often are retained or protected when they arise in a farm (Table 4). On some farms planted tree species are distributed throughout the farm, while on others they are planted on the farm edges (e.g., oil palm, plum, and pawpaw on Farm 5; Fig. 2).

The suite of preferred planted and retained species appears to be roughly constant throughout the region, and across migrant and indigenous communities, with regional and cultural variations surfacing farther down the list of preference. Sonwa et al. (2001, 2003) found plum, oil palm, bush mango, milk stick (*Alstonia boonei*), mango, guava, avocado, and citrus species the most common on cocoa farms, with plum planted by 80% of farmers. Gockowski et al. (in press) report bush plum, avocado, and mango as the top trees planted on Beti farms. Malleson (2000) remarks on the range of fruit trees planted with cocoa around the Korup National Park, in particular avocado and cola nut. In a synthesis of literature from Cameroon, Asare (2005) lists the following as the preferred species in cocoa farms: bush plum, bush mango, avocado, njangsang, orange, and mango; following this list are a mix of timber species, as well as oil palm, and colas. Oke and Odebiyi (in press) report oil palm, cola, orange, mango, guava, avocado, and njangsang in the top 10 non-cocoa tree species retained on farms studied in Ondo State, Nigeria.

Species retained or protected on cocoa farms

Roughly 20 species are regularly retained on cocoa farms for use as timber and construction (Table 4). These include iroko (*Milicia excelsa*), akom (*Terminalia superba*), mahogany (*Entandrophragma cylindricum*), obeche (*Triplochiton scleroxylon*), and kandang (*Sterculia rhinopetala)*. A third of all cocoa farmers interviewed had retained these species on their farms. A number of timber species also provide popular seeds or fruits, consumed by people as well as wildlife, including *Canarium schweinfurthii* (which

Table 4 Most commonly retained or planted tree species on indigenous and migrant cocoa farms, and most commonly cited uses, in Bova Bomboko, Mount Cameroon region, organized alphabetically by species

Species	Family	Conservation star*	Native/ exotic	Retained/ planted	Timber/ construction	Food/spice	Medicine	Fuelwood	Other
Albizia zygia (DC) J.F. Macbr.	Leguminosae-Mimosoideae	Pink	Native	Retained				X	
Alstonia boonei De Wild.	Apocynaceae	Green	Native	Retained	X		X (fever, breast milk)	X	
Annickia chlorantha (Oliv.) Setten & P.J. Maas	Annonaceae	Pink	Native	Retained			X (fever)		
Borassus aethiopium Mart.	Palmae	X	Native	Retained					Bomboko use for pinning poles; difficult to fell
Canarium schweinfurthii Engl.	Burseraceae	Red	Native	Retained	X	X (fruit)			Resin for protection
Carica papaya L.	Caricaceae	X	Exotic	Planted		X (fruit)	X (fever)		
Ceiba pentandra Gaertn.	Bombaceae	Pink	Native	Retained					Difficult to fell
Citrus sinensis (L.) Osbeck	Rutaceae	X	Exotic	Planted		X (fruit)			
Cola lepidota K. Schum.	Sterculiaceae	Gold	Native	Retained		X (fruit)			
Cola nitida (Vent.) Schott & Endl.	Sterculiaceae	Pink	Native	Retained and planted		X (stimulant)			
Cordia aurantiaca Baker	Boraginaceae	Blue	Native	Retained	X				Carving drums; gum
Dacryodes edulis (G.Don) H.J. Lam	Burseraceae	Green	Native	Planted, some retained		X (fruit)			

Table 4 continued

Species	Family	Conservation star*	Native/ exotic	Retained/ planted	Timber/ construction	Food/spice	Medicine	Fuelwood	Other
Distemonanthus benthamianus Baill.	Leguminosae-Caesalpinaceae	Pink	Native	Retained	X				
Elaeis guineensis Jacq.	Palmae	X	Native	Planted		X (oil,wine)			Thatches
Entandrophragma cylindricum (Sprague) Sprague	Meliaceae	Red	Native	Retained	X				
Eugenia malaccensis L.	Myrtaceae	X	Exotic	Planted		X (fruit)			
Ficus exasperata Vahl.	Moraceae	X	Native	Retained				X	X (scrub pots with leaves)
Irvingia gabonensis (Aubry-Lecomte ex O'Rorke) Baill.	Irvingiaceae	Pink	Native	Retained and planted		X (spice)			
Lophira alata Banks ex Gaertn. F	Ochnaceae	Red	Native	Retained	X				
Mangifera indica L.	Anacardiaceae	X	Exotic	Planted and retained		X (fruit)	X		
Mansonia altissima A. Chev.	Sterculiaceae	Gold	Native	Retained	X				
Milicia excelsa (Welw.) C.C. Berg	Leguminosae-Papilionoideae	Scarlet	Native	Retained	X				
Myrianthus arboreus P. Beauv.	Cecropiaceae	Green	Native	Retained		X (fruit)	X		
Persea americana Miller	Lauraceae	X	Exotic	Planted		X (pear/ avocado)			

Table 4 continued

Species	Family	Conservation star*	Native/ exotic	Retained/ planted	Timber/ construction	Food/spice	Medicine	Fuelwood	Other
Piptadeniastrum africanum (Hook f.) Brenan	Mimosaceae	Red	Native	Retained	X				
Poga oleosa Pierre	Anisophylleaceae	X	Native	Retained	X				
Pseudospondias microcarpa (A. Rich.) Engl. Var. *Microcarpa*	Anacardiaceae	X	Native	Retained	X	X (fruit)			
Psidium guajava L.	Myrtaceae	X	Exotic	Planted		X (fruit)	X		
Pterocarpus soyauxii Taub.	Leguminosae-Papilionoideae	Red	Native	Retained	X				Carving, personal care
Pterygota macrocarpa K. Schum.	Sterculiaceae	Red	Native	Retained	X				
Pycnanthus angolensis (Welw.) Warb.	Myristicaceae	Pink	Native	Retained	X				
Raphia hookerii G. Mann & H. Wendl.	Palmae	Pink	Native	Planted		X (wine)			
Ricinodendron heudelotii Mull. Arg.	Euphorbiaceae	Green	Native	Retained and planted		X (spice)			

Table 4 continued

Species	Family	Conservation star*	Native/exotic	Retained/planted	Timber/construction	Food/spice	Medicine	Fuelwood	Other
Spathodea campanulata P. Beauv. subsp. *Campanulata*	Bignoniaceae	Green	Native	Retained				X	Carving
Staudtia kamerunensis Warb.	Myristicaceae	Pink	Native	Retained	X			X	
Sterculia oblonga Mast.	Sterculiaceae	Pink	Native	Retained	X			X	
Sterculia rhinopetala K. Schum	Sterculiaceae	Pink	Native	Retained	X				
Strombosia grandifolia Hook.f.ex. Benth.	Olaceae	Green	Native	Retained				X	
Strombosia pustulata Oliv.	Olaceae	Green	Native	Retained				X	
Terminalia superba Engl. & Diels	Combretaceae	Pink	Native	Retained	X				
Treculia africana Decne. subsp. Africana var. Africana	Moraceae	X	Native	Retained		X (seeds)			
Trichoscypha acuminate Engl.	Anacardiaceae	Green	Native	Retained		X (bush bonbon)			
Trilepisium madagascariense DC.	Moraceae	X	Native	Retained	X	X (seed)			
Triplochiton scleroxylon K. Schum.	Sterculiaceae	X	Native	Retained	X				

*Based on a system developed by W. Hawthorne in Ghana and modified for the Mount Cameroon region, as in Cable and Cheek (1998) and the Limbe Botanic Garden database, as created by Tchouto and Hawthorne (1997). In descending order of conservation importance: black, gold, blue, scarlet, red, pink, green

Source: Household cocoa farmer survey, farm visits, mapping of non-cocoa trees on 6 cocoa farms

also yields a resin burned for protection from evil spirits), *Pseudospondias microcarpa*, and *Trilepisium madagascariense*. Others, like tobacco stick or 'womba' (*Cordia aurantiaca*) and camwood (*Pterocarpus soyauxii*) are used for carving.

Fuelwood species (some also used for timber or construction) are used to dry cocoa or for household use. They include: makoba (*Staudtia kamerunensis)*, whitewood (*Strombosia pustulata*), redwood (*Strombosia grandifolia*), small leaf (*Albizia zygia*), and milk stick (*Alstonia boonei*), which is also widely used as a medicine (Table 4).

In addition to timber species, the spice tree species njangsang (*Ricinodendron heudelotii*) and bush mango (*Irvingia gabonensis*) are regularly retained on at least half of all cocoa farms, as well as "chop" farms. The native (and very important to most indigenous villages) *Myrianthus arboreus*, used for fruit and medicine, and the seed-producing *Treculia africana* are also retained on some farms. The only tree retained solely for its medicinal properties is *Annickia chlorantha*, the yellow bark of which is used widely to treat malaria and other fevers. Many cocoa farms have numerous boma (*Ceiba pentandra*) retained for shade, some say to fertilize the soil, and others because they are too difficult to fell; they were also previously the burial place for albino people.

In addition to trees, useful climbers and herbs are found on cocoa farms. The spice and medicinal climber bush pepper (*Piper guineense*) was reported as an important product from cocoa farms by a third of households. Monkey cola (*Cola lepidota* and *C. ficifolia*) are also retained, as are cola (*Cola nitida*) and bitter cola (*Garcinia cola*). Wild vegetables are harvested from some cocoa farms, with the most common and valuable—eru (*Gnetum africanum*)—harvested from a third of the farms, and 'kalavanje' (*Solenecio biafrae*) and to a lesser extent 'nyamambole' (*Brillantasia lamium*), from a smaller proportion, mainly indigenous Bomboko or migrant farmers who have been in the region for long periods of time.

Cocoa farmers also harvest medicinal herbs, with Bomboko using a more extensive range of species than migrants. On the farms mapped, for example, Bomboko make use of around 14 non-tree useful species on their farms, while most North-westerners used around 3–4 species (Fig. 2). These include *Aspilia africana*, *Costus afer*, *Piper umbellatum* and *Sida acuta*. Chewstick and medicinal shrubs like *Mallotus oppositifolius* and *Leea guineensis* are also used. Bomboko also make use of spice herbs (*Aframomum flavum*), species with wrapper leaves and mat or basket-making stems (e.g., *Hypselodelphys scandens*, *Megaphyrynium macrostachyum*) and forest ropes (*Nephthytis poissonii*) found on cocoa farms. Powerful "country fashion" (complex medicinal and healing practices unique to the area) medicines are also collected from cocoa farms, including 'limoni' (*Jateorhiza macrantha*) and the fern *Pneumatopteris afra*.

Biological and cultural diversity in indigenous and migrant livelihoods

Knowledge and use of non-cocoa species on farms

As demonstrated in the cocoa farmer and household surveys, Bomboko farmers know and use a wider range of species on their cocoa farms than migrant farmers; they also use them for a wider range of purposes (Table 5; Fig. 2). However, knowledge of the rich and diverse flora found on cocoa farms inherited from their elders appears to be fading in the young Bomboko who use fewer of the species found on their farms, and in most cases know a more limited range of uses for those they do use, than older Bomboko farmers. For example, on one farm, an old individual of *Kigelia africana* (an important medicine,

Table 5 Annual mean income in CFA[a] and annual mean number of items collected by indigenous and migrant households that were: 1. cultivated or wild, and 2. native or introduced species, in five villages in the Mount Cameroon region

Household type	Number of households in survey	Income from cultivated species (CFA)	Income from wild species (CFA)	Income from native species (CFA)	Income from introduced species (CFA)	Number of collections of cultivated species	Number of collections of wild species	Number of collections of native species	Number of collections of introduced species
Bakweri/Bomboko (indigenous households)	72	820,231 a	563,141	637,659	775,657 a	178	157 a	195 a	138
Migrants—SouthWest[b]	11	1,817,832 b	156,585	194,323	1,779,762 b	184	46 b	85 b	144
Migrants—NorthWest (30), other parts of Cameroon (2), Nigeria (3)	35	1,195,490 ab	127,993	145,115	1,176,682 ab	184	51 b	81 b	154
All households combined	118	1,024,533	399,580	450,237	988,208	180	115	151	143
Significance (*P*)		0.020	0.780	0.705	0.018	0.213	<0.001	<0.001	0.28

Source: Household survey, in five study villages

Means within the same column that do not share a superscript are significantly different from each other by Tukey hsd

[a] 500 CFA = approximately $1US

[b] Farmers from the South West Province share many species and traditions with indigenous households around Mount Cameroon and have greater knowledge of species names and uses than other migrants

protector, and component of "country fashion") was ring-barked by the young inheritor of the farm, who preferred to make room for exotic fruit trees. Indeed, the farms captured in the maps (Fig. 2) fold together historical and present views of usefulness and farm management. The older cocoa farms, for example, retain an overstory of *Ceiba pentandra* not found in younger farms, multiple *Dracaena* spp., once used in house building and for cultural purposes by Bomboko (and still used elsewhere as boundary markers), and *Borassus aethiopium*, which is also difficult to fell, but was previously used in house building. Many species used by other indigenous villages in the area, and the four Bakweri villages in this study, remain unused or unknown, even to many Bomboko, who are now far outnumbered and largely oriented towards the cash economy of cocoa and land sales.

It is important to note, however, that while Bomboko on average have far more knowledge of useful species than migrants, and that knowledge in this community is fading, there are significant variations by individual. For example, some of the younger Bomboko retain an interest in the knowledge of their parents and grandparents, and some migrant farmers have lived most or all of their lives in the area and have a strong interest in useful species. Farmers from South West Province, in particular, come from similar biological and cultural backgrounds as indigenous Bakweri and Bomboko. It is for this reason that SouthWest farmers were distinguished from migrants from other regions in the analysis of the household survey results (Tables 5, 6). However, even the North West migrant farmer on Farm 4 (Fig. 2, Table 3), knows multiple uses for many species found on his farm (e.g., he uses 'womba' (*Cordia aurantiaca*) for house construction and to carve drums, and *Pterocarpus soyauxii* to make xylophones, beehives, medicine, to rub on skin, and as a timber). On average, however, the trend at present is away from the biologically and culturally diverse cocoa farms of the indigenous Bomboko, which are dependent upon traditional knowledge and practices, towards a simpler cocoa farm that yields fewer environmental, livelihood and cultural benefits.

The role of different habitats in livelihoods

Indigenous and migrant livelihoods extend beyond the boundaries of cocoa farms, and incorporate a range of different habitats and species. Cocoa farms provide numerous useful products to households in Bova Bomboko, but as we have seen—with some important exceptions like bush plum, oil palm, njangsang and bush mango—the bulk of species found on cocoa farms are used for timber, or are exotic fruit trees. By far the most significant source of NTFPs reported in Bova Bomboko is the forest, usually secondary forest but also the "black bush" of the Reserve, in which many have farms. 70% of households in the cocoa farmer survey cited forest as the primary source of NTFPs, followed by cocoa farms. The main products harvested from both sites include: njangsang, bush mango, eru, bush pepper, monkey cola, bitter cola, and bushmeat. These are products well-known and valued by migrants as well as indigenous Bomboko, and are widely used throughout the region (Ndoye et al. 1997; Sunderland et al. 1999; Sunderland and Ndoye 2004).

For both migrant and indigenous households, despite the relative diversity of cocoa farms, and the overall dominance of farms in livelihoods, natural forest continues to provide a complement to farm income. This is the case to a much greater extent for indigenous cocoa farmers, and other indigenous farmers in the region than for migrants. In addition, compounds and fallow provide a wide range of primarily subsistence products for indigenous households, while most migrants have extremely simple compound plantings, and make limited use of fallow, with the exception of migrants from South West Province that make use of significantly more of value from fallow than those from other regions

Table 6 Annual mean CFA[1] contribution and number of items harvested per household from compound, farm, fallow and forest by indigenous and migrant farmer households in five villages in the Mount Cameroon region

	Number of households in survey	Compound (CFA)	Farm (CFA)	Fallow (CFA)	Forest (CFA)	Total (CFA)	Compound (no.)	Farm (no.)	Fallow (no.)	Forest (no.)	Total (no.)
Bakweri/Bomboko—indigenous households	72	104,016 a	799,491	89,924 a	313,832	1,307,263	123 a	354	116 a	56 a	649
Migrants—SouthWest[2]	11	19,179 b	1,730,565	63,487 a	115,030	1,901,261	45 b	380	22 b	24 b	471
Migrants—NorthWest (30), other parts of Cameroon (2), Nigeria (3)	35	16,564 b	1,225,237	27,078 b	72,548	1,341,427	36 b	325	26 b	29 b	416
All households surveyed	118	70,169	1,012,567	67,162	223,733	1,516,650	90	348	80	45	563
Significance(*P*)		<0.001	0.093	<0.001	0.463		<0.001	0.647	<0.001	0.029	

Source: household survey, in 5 study villages

Means in the same column that do not share a superscript are significantly different from each other by Tukey hsd.

[1] 500 CFA = approximately $1US

[2] Farmers from the South West Province share many species and traditions with indigenous households around Mount Cameroon and have greater knowledge of species names and uses than other migrants.

(Table 6). Migrants often source from cocoa farms, albeit fewer species in more limited quantities, many of the same products indigenous households collect from fallow, including fuelwood and construction materials.

As Table 6 demonstrates, combined indigenous household income from compounds, fallow, and forest makes up almost 40% of the value of products harvested, compared with roughly 10% for migrant households. Indigenous households also collect at least twice as many items in a year from the forest and five times as many from fallow. These include high value forest products like timber and bushmeat, as well as hundreds of species difficult to capture and value properly in household surveys and used, for example, as medicine, wild foods, and for cultural purposes.

The use of native and wild species

Indigenous households use a significantly larger number of species, for a wider range of purposes, than migrants to the region. They make use of hundreds of species (more than 400 plant species are included in the checklist from this study alone), while migrants make regular use of roughly 30 species. Migrants harvest high-value NTFPs like eru, bush mango, njangsang, and bush pepper, but are often unfamiliar with the full range of useful species in their adopted home. They lack historical and cultural connections to the species and landscapes in which they farm, may not have access to resources, and usually seek to maximize cash income (often returned to their original village). This is a common phenomenon across the country (e.g., Mbenkum 1993, on Kilim). As a result, migrant households tend to buy a larger portion of their food and other needs (Table 2; Ambrose-Oji 2003).

Both migrant and indigenous communities around Mount Cameroon incorporate species from around the world into their livelihoods. Close to 100 of the more than 400 species used by indigenous households were introduced to the region. However, indigenous households derive roughly four times the annual household income from native and wild species than migrant households, and bring 2–3 times as many wild and native items into the home (Table 5). Indigenous households also source more than five times as much food from the wild as non-indigenous households.

Biological and cultural diversity

It is important to emphasize that "indigenous" communities are diverse, both within and between villages, and display varied individual and cultural preferences. For example, indigenous Bomboko in the cocoa-growing region earn significantly more from cultivated and introduced sources than indigenous Bakweri from Likombe, Etome, Ekonjo, and Upper Buando (roughly 2,620,000 CFA per year for Bomboko compared with 690,000 CFA per year for Bakweri). Bakweri annual income from wild sources is, in turn, three times that of the Bomboko (roughly 600,000 CFA compared to 200,000 CFA), and the number of wild items collected in a year by Bakweri is 159 compared with 115 for the Bomboko. Bomboko livelihoods combine cocoa farming and traditional practices that involve a greater reliance on diverse habitats and species. But as traditional knowledge and practices are lost, the dependence of local people upon biodiversity within and outside cocoa farms has declined, and with it mechanisms that help to promote and conserve biodiversity in managed landscapes.

Concepts of 'indigenousness' have been used to further political ends in recent decades in Cameroon, and often result in little more than power or resource grabs, or conflict

(Konings and Nyamnjoh 2003; Jua 2001; Sharpe 1996). The indigenous people around Mount Cameroon are neither naïve, harmonious conservationists, nor a homogenous "community" (Sharpe 1996). Indigenous groups seek to maximize cash income, will mine species when commercial opportunity presents itself—as in the case of bushmeat, timber or valuable medicinal plants for export (e.g., *Prunus africana*)—and will sometimes sell land to migrants to farm, and to local elites for plantation development (although selling land to outsiders technically is forbidden under customary law). But traditional resource management practices, even those under pressure, also reflect deep historical and cultural connections to place and species, represent traditional as well as personal preference, and include a wider range of strategies to reduce risk and diversify livelihood options based on local plant and animal resources. These practices are dependent upon biodiversity, and are an important element of biodiversity conservation in the managed landscapes of Mount Cameroon. By far the most significant factors influencing biodiversity conservation in the Mount Cameroon region originate outside of local villages. These include economic hardships faced by communities in other regions that force migrants into the area in search of livelihoods, and expansion of commercial agriculture plantations, and to a lesser extent logging, under the control of government, corporations, or urban and local elites.

Land tenure and resource rights

Land tenure and resource rights play an important role in how cocoa farms are managed, including the retention and planting of non-cocoa tree species, and the management and use of biodiversity in migrant and indigenous livelihoods. As part of the cocoa farmer survey we examined farmer awareness of existing statutory and customary law. Cameroon law (Land Tenure and State Lands, Ordinance No 74/1, July 6, 1974) grants ownership of vacant land, without permanent cultivation, or any land without certificates of title, to the State. This grows from French colonial law, which replaced the British law granting "vacant" land to local communities, in the form of Native Authorities (Burnham and Sharpe 1997; Sikod et al. 2000). The 1994 Forestry Law, like the 1973 and 1981 forestry laws it repealed, puts all forest resources under the control of the State, in line with the State's long-standing practice of establishing hegemony over natural resources (Egbe 2001).

In practice, however, in Bova Bomboko land is administered by the Bomboko chief and traditional village council according to customary law. Of the migrants farming in the Bova Bomboko region, as reported in the cocoa farmer survey, some rent land from the Bomboko, but more than 60% have bought their land from the village chief and hold "native title" to the land. Most do not have a title deed from the government, and consider the chief's customary title adequate. This is common throughout Cameroon, where in 2001 only 3% of lands in rural areas were registered, compared with 80% in towns (Egbe 2001). Throughout Cameroon, planting perennial tree crops like cocoa has long been used to establish ownership over land, and this practice was supported by the Land Tenure Code of 1974; however, the 1994 Forestry Law requires that such planting follows acquisition of a certificate of title (Egbe 2001). The status of farms located within the Forest Reserve is unclear: some farmers claim to have purchased native title to lands within the Reserve, while others state that this is not possible.

In Bova Bomboko, all farmers consider the non-cocoa trees on their cocoa farms to be the property of the farmer, and most do not think they need permission from the chief or the government to fell them. None were aware that naturally growing trees on private land,

and all trees planted or naturally growing on land without a title deed (the vast majority), are considered the property of the State. Under the 1994 Forestry Law (section 8), communities retain customary rights, or *droit d'usage*, to collect "all forest, wildlife, and fisheries products freely for their personal use, except protected species", but only for subsistence use. A third of those surveyed were aware of the law requiring a permit to fell timber trees for sale (Besong 1995; Egbe 2001). In general, however, lack of awareness of their limited land and resource rights would suggest that composition of non-cocoa trees on farms is not significantly impacted by these concerns, and would help to explain the high percentage of timber trees found on farms. Land tenure and resource rights do not appear to be decisive factors in the extent of biodiversity retained on most cocoa farms.

Rights to access species not found on farms were less clear, however. Whereas indigenous villagers view forest as communal property, available to all in the village, migrants' access to the full range of habitats (e.g., fallow and forest in various stages of succession) and resources appears more limited outside of the farms they clear. In Tables 5 and 6, contributions of different habitats to livelihoods in Bova Bomboko were broken down for migrants from the North West Province (and other parts of Cameroon and Nigeria) and those from the South West Province. Farmers from the South West Province share many species and traditions with indigenous households around Mount Cameroon, and—as other parts of the larger study demonstrated—have greater knowledge of species names and uses than other migrants (Laird in press). However, as Tables 5 and 6 show, South Westerners use only moderately more native and wild species, and those from forest and fallow, than migrant households from other regions. This suggests that the use of local plant resources by migrants was not only limited by lack of local knowledge of their uses, but also by access rights to forest resources in an area that is not their traditional home, as well as their greater preoccupation with cocoa growing compared to the local farmers.

Conclusion

Cocoa farms around Mount Cameroon are not the complex cocoa agroforests of southern Cameroon, but are located in one of the most important areas for biodiversity conservation in West-Central Africa. Because this region is characterized by high population densities and intense pressure on land and natural resources, conservation strategies must include the retention of biological diversity in managed landscapes such as cocoa farms. All cocoa farmers in the region retain and plant useful non-cocoa trees, but within and outside of cocoa farms most indigenous households value biodiversity to a greater extent than migrants. Traditional knowledge and practices are in flux in many households, but indigenous livelihood and land use strategies dependent upon biodiversity continue to provide significant benefits for conservation. Biodiversity conservation in the Mount Cameroon region should recognize and bolster indigenous livelihood strategies that maximize biological and cultural diversity; seek to discourage species mining and land sales for commercial agriculture; and address the destructive pressures on forests and biodiversity originating outside the region.

Acknowledgements This project benefited enormously from the contributions of its research team: Frida Engange, our dear late friend and research collaborator from Mapanja village; Ebile Adolf, Esuke Christina and Ebong Harrison from the Mount Cameroon Project-Buea; Maurice Betafor and Elias Ndive from the Limbe Botanic Garden; and Julius Ewange from Bova Bomboko. The final maps built on the work in Bova Bomboko by Ebong Harrison and the project team, and were created by Holly Porter Morgan and Brian Morgan, at The New York Botanical Garden. Kind support and assistance from the Mount Cameroon

Project in Buea/GTZ, was provided by Jorge Linke and Eva Gonnermann. Sincere thanks to Goetz Schroth, Ruth Malleson, Emmanuel Nuesiri, Celia Harvey, and two anonymous reviewers for extremely helpful comments on earlier drafts of this paper, and to James Douglas for his invaluable assistance with data analysis and other support.

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