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PEOPLE, RULES, AND ORGANIZATIONS SUPPORTING THE PROTECTION OF ECOSYSTEM RESOURCES (PROSPER)

AGRICULTURE VALUE CHAIN ASSESSMENT

SEPTEMBER 2014

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ACRONYMS

AGRHA	Action for Greater Harvest
AML	ArcelorMittal Liberia
ASNAPP	Agribusiness in Sustainable Natural African Plant Products
CFA	West Africa Franc
CFMP	Community Forest Management Plan
COP	Crude Palm Oil
ENNR	East Nimba Nature Reserve
EPO	Equatorial Palm Oil
FDA	Forestry Development Authority
FDP	Fertilizer Deep Placement
FED	USAID Food and Enterprise Development Project
FFS	Farmer Field School
Ha	Hectare
ICCO	International Cocoa Organization
Kg	Kilogram
LAC	Liberian Agricultural Company
LAMCO	Liberian-American-Swedish Minerals Company
LD	Liberian Dollar
LFSP	Liberia Forest Support Program
LIBINC	Liberian Incorporated
LIFE	Livelihood Improvement for Farming Enterprises
LISGIS	Liberia Institute of Statistics and Geo-Information Services
LPMC	Liberia Produce Marketing Company
LRCFP	Land Rights and Community Forestry Program
Mt	Metric Ton
NGO	Nongovernmental Organizations
PROSPER	People, Rules and Organizations Supporting the Protection of Ecosystem Resources

SHOPS	Smallholder Oil Palm Support
STCRSP	Small Holder Tree Crop Revitalization Support Project
USAID	United States Agency for International Development

EXECUTIVE SUMMARY

Since 2007 the United States Agency for International Development (USAID) has played a leadership role in promoting community forest management and land tenure reforms in Liberia. Recognizing the significant link between poverty and poor forest use and management, USAID-funded activities in this sector have always been coupled with support to livelihood improvements in the targeted communities. As part of its overall goal, the People, Rules, and Organizations Supporting the Protection of Ecosystem Resources (PROSPER) program aims to reduce threats to biodiversity of community forests through improvements in sustainable economic livelihood opportunities that support biodiversity conservation and income generation. With limited resources available, it was evident that program investments would need to selectively target livelihood interventions that provide the best opportunities for increased and long-term income generation. Given the significant role of agriculture in all of the program's target areas, this assessment was designed to determine which agricultural value chain(s) to support and develop in PROSPER communities.

The assessment was conducted using a variety of methods to collect information. The assessment team reviewed lessons learned from previous forestry programs in Liberia, conducted desk research on past studies and local publications, designed and implemented multiple surveys, and interviewed diverse stakeholders in the agricultural sector including farmers participating in the Farmer Field School, traders, marketers, transporters, women groups, representatives of associations, and agro-input suppliers in the PROSPER communities of Nimba and Grand Bassa counties. Eight selection criteria were developed in order to score and rank the various crops: *suitability for target population; potential for value addition; existing demand and growth potential; potential to increase income; labor requirement; capital requirements; time between start-up and first returns;* and *impact on reducing threats to biodiversity*. Nine crops were assessed: cassava, cocoa, coffee, hot pepper, oil palm, plantain, rice (lowland and upland), and rubber.

The forest communities supported by PROSPER are primarily involved in shifting cultivation for subsistence production. Even in communities where cash crops (cocoa, coffee, oil palm, or rubber) are grown, the majority of farmers work on two acres or less. Lack of infrastructure (mainly feeder roads) makes transportation costs high and puts many markets out of reach for program beneficiaries. These factors, in addition to the above-mentioned selection criteria, needed to be seriously considered by the program in assessing which value chains to invest in over the four remaining years of the program.

After careful analysis, cocoa, hot pepper, oil palm, and plantain emerged as the top value chains for consideration. Each proved to have a good balance of labor and capital requirements and high potential for reducing the threats to biodiversity, while also being suitable for the target population. These crops also have a strong domestic market and, in the case of cocoa, strong export market potential. In the case of oil palm and cocoa, previous and current investment by other donors has strengthened key aspects of these value chains, allowing PROSPER beneficiaries the opportunity to take advantage of these improvements. Upon closer review of PROSPER program resources and the remaining duration of the PROSPER program, these four value chains were finally narrowed down to cocoa and oil palm.

1.0 INTRODUCTION

The United States Agency for International Development (USAID) has played a leadership role in promoting community forest management and land tenure reforms in Liberia. USAID supports community forestry activities as a means to:

- Assist the Government of Liberia in protecting the country's extensive natural resource endowment for the betterment of its people;
- Promote clear and enforceable land tenure and property rights systems to protect the interests of poorer Liberians from elite capture;
- Increase investment of poorer Liberians in their land and thereby augment their income through the sustainable use of their natural resources;
- Encourage decentralization and greater participation of all Liberians in the governance of the nation; and
- Reduce the likelihood that the country will return to civil war.

To build on previous investments in the forestry and agricultural sectors, particularly the Land Rights and Community Forestry Program (LRCFP, 2007–2011), USAID contracted Tetra Tech ARD to implement the People, Rules, and Organizations Supporting the Protection of Ecosystem Resources (PROSPER) program. The overall goal is to introduce, operationalize, and refine appropriate models for community management of forest resources for local self-governance and enterprise development in targeted areas of the country. PROSPER is designed to accomplish that by improving human, legal, regulatory, and institutional capacities in environmental awareness and wise stewardship of natural resources with the aim of extending community-based forest management and agricultural enterprise development throughout Liberia.

As part of its overall goal, PROSPER aims to reduce threats to biodiversity of community forests through improvements in sustainable economic livelihood opportunities that support biodiversity conservation and income growth. In view of the limited resources available for livelihood development, investments need to be focused on livelihood interventions that provide the best opportunities for increased and long-term income. This assessment serves as an instrument to help decide which value chain(s) to support and develop in PROSPER communities.

PROSPER communities are mainly involved in shifting cultivation for the production of subsistence food crops such as rice, cassava, and plantain; only a small quantity is sold for cash to purchase necessary household items and to cover other household obligations like school fees.[1] Prior to the civil war, in many

[1] Shifting cultivation is an agricultural system in which plots of land are cultivated temporarily, then abandoned and allowed to revert to their natural vegetation while the cultivator moves on to another plot. The period of cultivation is usually terminated when the soil shows signs of exhaustion or, more commonly, when the field is overrun by weeds. The length of time that a field is cultivated is usually shorter than the period over which the land is allowed to regenerate by lying fallow. The fallow period in Liberia is currently seven to ten years. Increasing pressure on available land for agriculture, caused by alternative land use (e.g., mining and large agriculture concessions), leads to invasion of older forest types (secondary and primary) in the quest for relatively fertile land for agriculture. Trees are cut and burned and the cleared forestland becomes part of the shifting cultivation fallow cycle.

communities, individual farmers cultivated small plots of land with cash crops like cocoa, rubber, and coffee. Most of these trees and shrubs were neglected and abandoned by their owners during the war. Currently, most of them are far beyond their production prime and produce very little with no inputs.

The main tools used are the cutlass, hoe, and ax. Subsistence-level, shifting cultivation agricultural production systems do not usually involve external inputs such as agrochemicals, fertilizers, seeds, and pesticides. In PROSPER target communities, shifting cultivation has contributed to deforestation as trees are cleared for small subsistence farms. To reduce the pressure placed on forests in these communities by this practice, there is a strong need to increase the yield levels of food and cash crop production, which currently is very low. Unlike subsistence farming, however, cash crop production requires external inputs. Unfortunately, there are currently very few agro-input dealers operating in PROSPER's sites, and the infrastructure required (primarily feeder roads) to bring goods to the market is very poor. In order for communities to move beyond subsistence farming, both the input and infrastructure obstacles need to be overcome.

This assessment examines the value chains of various major agricultural commodities produced in the PROSPER sites to determine which crops have the best potential to generate income and reduce the threats to biodiversity. PROSPER used a variety of methods to gather and analyze information: desk research; interviews with organizations and experts on various crops and markets; and field visits and interviews at local key markets in the PROSPER communities.

The PROSPER team that conducted the assessment was comprised of staff from Action for Greater Harvest (AGRHA) and ACDI/VOCA. The team members were Josephus K. Nyepan, Konah G. Gbean, Alfred D.G. Gray, J. Hodo Bedell, and Peter de Waard. They were supported in the communities by the PROSPER heads of office, D. Nuah Biah (Tappita), Martin Vesselee (Sanniquellie), and Joseph Taylor (Buchanan).

2.0 PURPOSE OF THE ASSESSMENT

The purpose of this assessment was to identify the most appropriate crops for support by the PROSPER livelihood component in order to provide sustainable income for households in the program communities and contribute to reducing threats to the biodiversity of community forests. This assessment examined crops and products for which there is an existing demand and long-term growth potential. The assessment also looked at value chains that cater to both domestic markets and foreign markets.

3.0 METHODOLOGY

The assessment team used various methods to collect information. The information for this assessment was gathered through desk research, surveys, observations, and conversations with Farmer Field School (FFS) farmers, traders, marketers, transporters, women groups, representatives of associations, and agro-input suppliers in the PROSPER communities of Nimba and Grand Bassa counties. Traders are defined as those who buy at weekly markets or on roadsides, and then take the product somewhere else, and marketers as people who sell at the weekly market (wholesale or retail).

A questionnaire was used to interview traders about local markets. For information on northern Nimba, studies and publications from ArcelorMittal were used.

The legacy of the civil war and the many years of relief operations that resulted have bred a culture of dependency and incentives for communities to cater to projects and nongovernmental organizations' (NGO) interests in order to receive handouts. Alhough these relief operations ended several years ago, they are still in people's memories. This legacy colored surveys and appraisal responses in the earlier projects (LRCFP and the Liberia Forest Support Program [LFSP]). Given the culture of dependency, projects need to be prudent when conducting market surveys and employ a careful approach so as to avoid eliciting responses that do not reflect rural people's actual situation, aspirations, and needs for livelihood support. Although the survey did interview PROSPER FFS participants, the bulk of people interviewed were traders and transporters in various marketplaces. Forty-seven FFS participants were interviewed in small groups (six to seven people each). Fifty-nine traders and 11 transporters were interviewed using a short questionnaire. As this was not a comprehensive assessment, informants were primarily those already directly engaged in agriculture activities under the PROSPER program.

The PROSPER assessment team drew up a list of key selection criteria (see Section 6). Crops were weighted and ranked.

4.0 CROPS AND MARKETS BY TARGET AREA

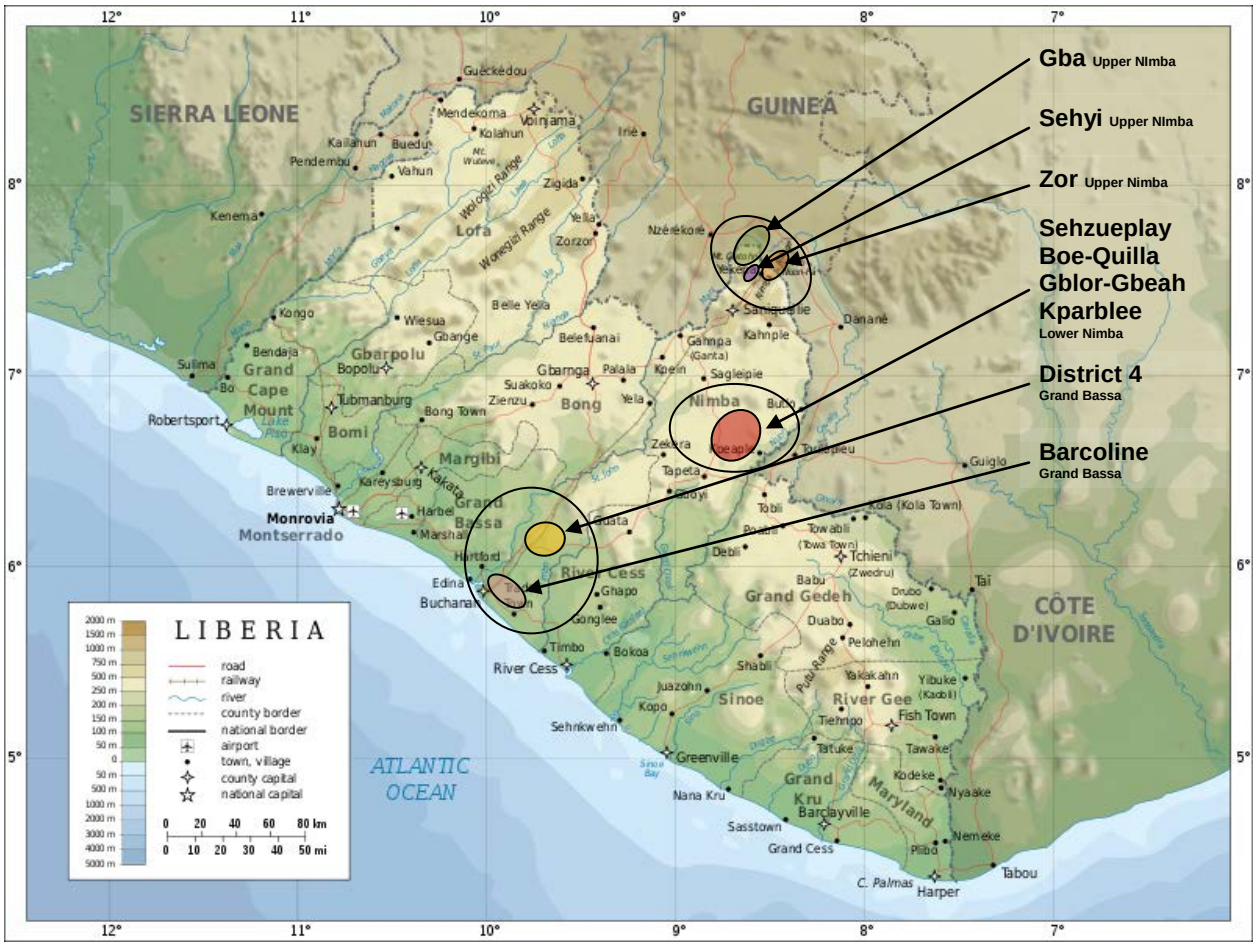
PROSPER is working in seven communities in Nimba County and two in Grand Bassa County. These communities can be divided into four areas with different socio-economic and geographical characteristics that have an impact on the supply chain of goods and services and the movement of products to their markets. The population density in Nimba County (40 persons/km²) is much higher than in Grand Bassa (28 persons/km²). Accessibility of production areas to markets and the proximity of these markets are important factors that have shaped types of agricultural production. The improvement of infrastructure, such as roads and ports, that are currently under development in some PROSPER communities will have a positive impact on the development of markets and will lower the costs and increase the reliability of supplying products to the market. In the following sections we highlight important aspects of the production patterns, markets, and infrastructure in the PROSPER communities. In this assessment, the Sehyi community will not be highlighted separately but will be included in the Gba community.

FIGURE 1: GRAND BASSA AND NIMBA COUNTIES

4.1 UPPER NIMBA

Zor, Bleih, and Sehyi (north of Sanniquellie) have been focal points for USAID-funded community forestry projects (LRCFP, LFSP, and PROSPER) since 2008. The Gba community is part of the Sanniquellie-Mahn District with approximately 25,367 inhabitants, and the Zor community is part of the Gbehlay-Geh District and has about 32,176 inhabitants (Government of Liberia, 2009).

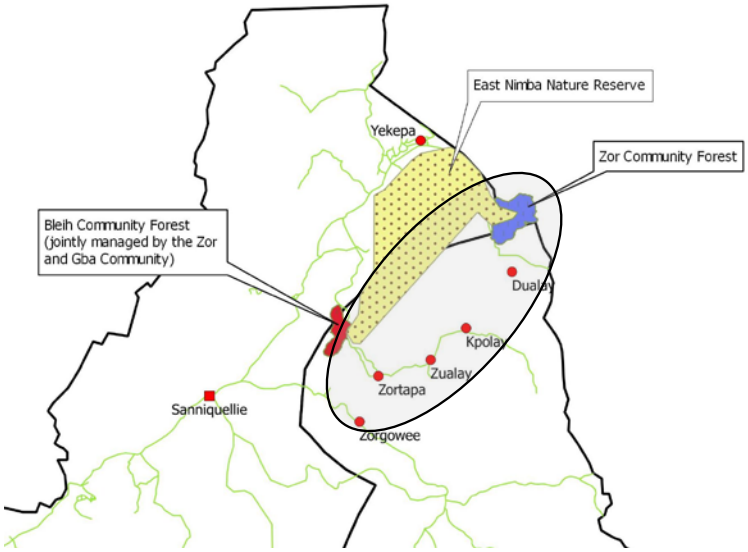
FIGURE 2: PROSPER SITES



The communities are located in the northern part of Liberia's "central corridor." Major infrastructure here includes the railroad from the port city of Buchanan to Yekepa and the paved road from Monrovia to Gbarnga that continues (unpaved) to Ganta, Sanniquellie, and Yekepa. This infrastructure has been critical to the movement of goods to Liberia's largest urban areas and to external markets via the ports. As a result, most of Liberia's economic development over the past 50 years has been concentrated along this corridor. The unpaved part of the major trunk road from Monrovia to Yekepa is currently under rehabilitation and is expected to be in service before PROSPER ends. Unpaved lateral roads and bridges connecting towns and villages to the trunk road are in poor condition. Some unpaved feeder roads that connect town and villages to the lateral roads have been rehabilitated recently and are in good condition, although heavy use (particularly by overloaded trucks) threatens to destroy these roads again. The mining activities by Liberian-American-Swedish Minerals Company (LAMCO, 1960–1990) and currently by ArcelorMittal Liberia (AML, starting in 2007) have always had an impact on the towns in the northern part of the Gba community. Logging has occurred in many places in the Zor and Gba communities. The feeder roads and the log bridges are part of that legacy. Currently no logging companies are active in northern Nimba (Gba and Zor). The production of planks for the domestic market by chain saw operators is a major activity. Charcoal production north of Sanniquellie largely serves the Sanniquellie and Ganta City markets. The increased work force for AML also has increased the demand for charcoal in Yekepa (USAID, 2012b).

4.1.1 Zor Community

FIGURE 3: ZOR COMMUNITY



Agricultural production in Zor. Most farmers in the Zor community are engaged in the production of upland and swamp rice, cassava, peppers, plantain, bitter balls, okra, and eddoes.[2] Rice, cassava, and small vegetables are primarily grown for household consumption. A few households in each town and village own stands of fruit trees—e.g., coconut and kola—and sugar cane. Men and women have different roles in agricultural production: men are generally involved in land preparation (shifting cultivation) for subsistence crops while both men and women perform the planting, crop maintenance, and harvesting. Men transport the harvest to the homestead. Numerous smallholders in the Zor community cultivate tree crops like plantain, oil palm, cocoa, and rubber, although cocoa and oil palm are more dominant tree cash crops.[3] Men are predominantly involved in the production of tree crops while women traditionally perform local processing of oil palm.

Land available for shifting cultivation and permanent agriculture in Zor has been reduced by the establishment of the East Nimba Nature Reserve (ENNR) (13,569 ha) in 2003 and the two community forests—the Bleih (614 ha) and the Zor (1,112 ha)—in 2011.[4]

Markets in Zor. The major markets in Zor play an important role as aggregation points for agricultural products, especially for food crops such as pepper, plantain, eddoes, rice, and cassava. Rubber and cocoa are mainly sold to agents that roam the towns. Rubber is also sold directly to nearby buying stations. The local markets typically have a section for small "retail" sales and a section for wholesale transactions.

Markets are held on fixed days in the week and buyers with transport (cargo and pick-up trucks) frequent these markets. The major markets in Zor are in Zolowee, Zualay, Dulay, and Karnplay.

Traders come from Monrovia, Gbarnga, and Kakata. Transporters operating trucks, pick-ups, taxis and motorbikes offer their services to transport bags of produce to Sanniquellie, Ganta, or Monrovia. Pepper, plantain, eddoes, and cassava are perishable crops with seasonal fluctuations. Rice is primarily a household food crop, but it is sold when cash is needed; the sale of rice is spread over several months following the harvest. Cassava is the food security crop that can be harvested when household rice supplies are low. Small quantities are sold when cash is needed. Most rice, eddoes, and cassava go through local markets to Sanniquellie, Ganta, and Yekepa. Plantain, which has a longer shelf life than cassava and eddoes, is also transported and sold in Monrovia. The Zor area has a number of operating

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2 *Colocasia esculenta.*

3 Botanically speaking, plantain is not a tree. Plantain has been grouped here with tree crops because it is often cultivated on the same spot for a long time.

4 The official surface area of the ENNR is 13,569. In an agreement made in 2010 between the FDA and the Zor community, the boundary shifted westward to accommodate strong wishes of the Zor community. The renegotiated boundary resulted in a reduction of the total area from 13,569 to 11,553.

steam mills that process sugar cane and distill it into cane juice—a local rum. Large quantities of cane juice (in five-gallon containers) are exported to Ivory Coast.

Roads in Zor. The road between Zorgowee and Dulay (adjacent to the Zor community forest) is one of the main lateral roads into the Zor community and is often is in bad shape. During the rainy season, puddles are sometimes so deep that it is difficult for vehicles to pass. In the dry season, areas with large boulders and deep erosion gullies, exposed and formed during the rains, make navigation very difficult. The Zorgowee-Zortapa-Zualay-Dulay road recently has been rehabilitated with funding from the Swedish International Development Cooperation Agency, and is now in excellent shape. The road between Sehyikimpa (between Sanniquellie and Zolowee) via Zorgowee to Kanplay has been maintained by the United Nations Mission in Liberia battalion in Sanniquellie and is in reasonable condition. However, overloaded trucks will quickly destroy the roads and culverts. There is no control on axle weight in Liberia and, to maximize their profits, trucks are often loaded far beyond capacity.

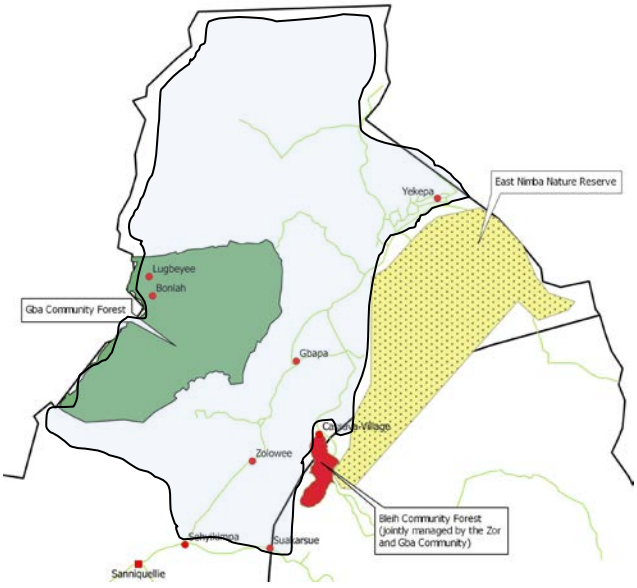
TRADE RELATIONSHIP

Some of the area's trade lines are quite sophisticated. Aggregators (most of them women) send bags of peppers by a trusted motorbike rider from outlying communities to Ganta. The motorbike operator is paid for his services by the aggregator. In Ganta, the bags are loaded by the taxi union into a contracted taxi. Often the taxi driver/owner is related to the aggregator or originates from the same town/village. Bags of peppers are labeled with a phone number and seller's initials. The trader/aggregator will inform the receiver in Monrovia (often a family member) that a consignment has left. Shortly before the taxi driver arrives in Monrovia (Red Light market), he calls the intended receiver to tell him/her when and where the goods should be collected. The receiver pays the taxi driver for transporting the goods. The taxi driver also receives a carefully sealed envelope that contains payment for the product. This envelope finds its way back via the taxi driver and motorbike driver to the aggregator/trader at the weekly market.

4.1.2 Gba Community

Agricultural production in Gba. Agriculture production in the Gba community is similar to that in Zor (upland rice, cassava, plantain, pepper, bitter ball), although large areas of land have been made off limits for agriculture use. The Gba community forest (10,939 ha) and the AML mining area at Tokaday can no longer be used for shifting cultivation, resulting in increased pressure on available forest fallow land. The dominant farming system is shifting cultivation with a current fallow cycle of seven to ten years. Yields for upland rice and cassava farming are very low—approximately 800 kg/ha for rice and about 5,500 kg/ha for cassava (CRS-JICA-MOA, 2012; Kruiper, 2013). The principal tree cash crops produced in Gba are rubber, cocoa, and oil palm.

FIGURE 4: GBA COMMUNITY (LIGHT BLUE)



Markets in Gba. There are weekly markets in Gbapa, Bonlah, Lugbeyee, and Sanniquellie in the Gba community. Individuals living close to these towns walk or, less frequently, use a taxi (either a car or motorcycle) to get to the markets. Seventy-eight percent of rural households transport their surplus subsistence produce to a sales point on a road outside their hometown (ArcelorMittal, 2010). Very few sell immediately from their homestead. An ArcelorMittal study reports that a substantial amount of unregulated petty trading takes place in Bonlah and Lugbeyee (northwest of Gba community) across the border with Guinea. Nzerekoré

is the second largest town in Guinea, with an estimated population of 278,000, and is located less than 30 kilometers away from the Gba community. The Gba community is the only PROSPER-supported community that has banking services, though all banks are located in Yekepa in the far north of the county.

Roads in Gba. The main road between Ganta and Yekepa is maintained by ArcelorMittal, but it deteriorates quickly when there are heavy rains. The road is scheduled to be rehabilitated and paved starting in 2014. Many feeder roads and bridges are in very poor condition, rendering many roads impassable except for four-wheel drive vehicles or motor bikes, effectively cutting off the towns during rainy season. The road to Makinto and Sehyigeh is also in a poor state of repair. The towns of Camp 4, Gbapa, and Zolowee, have better access, being located on the main road, but there is no regular public transportation. The "shortcut" between the Gba community and the Zor community from Grass Field to Zortapa has been impassible since 2011 because of a collapsed bridge. The rehabilitation of the Yekepa-Monrovia road will increase transport opportunities (frequency and competition) and will reduce wear and tear on vehicles, therefore reducing the cost of transport. Nevertheless, the remote towns will remain comparatively isolated. Improved roads will also make it inexpensive to transport cheap imported rice to PROSPER-supported communities, potentially suppressing the local market price for rice.

The railroad from Yekepa to Buchanan is used exclusively to transport iron ore for ArcelorMittal to the port of Buchanan.

Socio-economic changes in Gba, Zor, and Sehyi communities. ArcelorMittal's mining activities in Northern Nimba have had a positive effect on employment growth in the area. In Yekepa, houses for laborers have been rehabilitated and the increased workforce has created a demand for food crops and charcoal. In other towns such as Camp 4, Gbapa, Zorgowee, and Sanniquellie, a growing number of inhabitants have found employment with ArcelorMittal. It is expected that the anticipated second phase of the ArcelorMittal mining operations will create further employment opportunities. These jobs have had an effect on all communities in northern Nimba, including Zor and Sehyi. Further, the employment opportunities at ArcelorMittal will attract people from outside Nimba County, which will lead to an increase in the area's population density. PROSPER has observed that various members of the Gba and Zor communities have found employment with ArcelorMittal or with one of its subcontractors. Furthermore, some farmers have given up farming in favor of wage employment with the mining company. Community members have reported that because of the employment opportunities with ArcelorMittal, it is more difficult to find casual labor for farm work. It is expected that road rehabilitation and paving of the Yekepa-Sanniquellie road, which runs through the Gba community, will have a large impact on the availability of goods and services in the Gba community. A new high-voltage power line has been constructed that runs from the Ivory Coast through the Zor community to Sanniquellie and further south to Ganta. It is not yet known whether communities along the line will be able to connect to the grid in order to start using electric machines for agro-processing and other small-scale enterprises.

Cell phones have made large inroads into rural parts of Liberia, although coverage outside Sanniquellie and Yekepa is sporadic. Currently only a very small percentage of farmers in this area have cell phones, making it untenable to transmit market price information to them by SMS. In addition to the lack of cell phone coverage, the potential for cell phone charging is limited.

4.2 LOWER NIMBA

PROSPER sites Gblor-Gbeah, Sehzueplay, Boe-Quilla, and Kparblee are all situated around the Big Gio forest. The major town in the area is Tappita in the South West corner. The main road from Ganta to Zwedru runs along the western and southern periphery of the Big Gio forest (from Graie Town via Tappita to Diala) and is the main supply road in and out the Big Gio area.

The economy of the area is based predominantly on subsistence farming. As in the case of northern Nimba, rubber and cocoa farming were established in the 1970s and 1980s. However, the civil war of 1990–2003 left most of these smallholder farms in ruins. There are no plans to pave the major trunk road from Ganta to Zwedru before the end of the PROSPER program. The main feeder road runs from Graie Town northeast toward the Ivory Coast border and then south around the Big Gio forest, connecting to the main road in Diala ("Diada" on this map in Figure 5). This road connects most of the major towns and villages in the PROSPER communities. The road and bridges that connect all the villages around the Big Gio forest are in bad shape, damaged by heavy traffic of overloaded trucks.

FIGURE 5: LOWER NIMBA, WITH 4 COMMUNITIES AND TOWNS AROUND THE PROPOSED BIG GIO COMMUNITY FOREST (LIGHT GREEN)

Commercial logging has been undertaken in many places in the communities. As in northern Nimba, the feeder roads and the log bridges are part of that legacy. The production of planks for the domestic market by chain saw operators is a major activity in the communities, especially in villages along the main road where heaps of planks can be seen waiting to be picked up by buyers. Small-scale charcoal production takes place around Tappita to supply the Tappita "urban market."

Big Gio communities. The Gblor-Gbeah, Sehzueplay, Boe-Quilla, and Kparblee communities are reported on as a group in this assessment because they are very similar in land use and economic and agricultural activities. It is envisaged that each community will manage a part of the Big Gio forest as their community forest, after their respective applications for a Community Forest Management Agreement and Community Forest Management Plan (CFMP) have been approved by the Forestry Development Authority (FDA).

Agricultural production. Most farmers grow upland rice, plantain, cassava, peppers, and bitter balls on a subsistence level. Shifting cultivation is the dominant farming system. Rice, cassava, and small

vegetables are primarily grown for subsistence while plantain is sold as a cash crop. Rice is the dominant staple crop. The yields of upland rice are very low (estimated 800 kilos paddy/ha).[5] The sun-dried paddy is stored at the homestead, often in the outside kitchen above the cooking place. Smoke from the cooking fire acts as a deterrent to insects and rodents that attack the rice. Some of the paddy (sometimes also referred to as "seed rice") is sold locally when cash is needed. When the rice stock has been depleted, cassava becomes the staple food of choice. A few households own stands of fruit trees—grapefruits, oranges, and kola. Men and women have differentiated roles in agriculture. Men are generally involved in land preparation (shifting cultivation) for subsistence crops while planting, crop maintenance, and harvesting are done by men and women. The harvest is transported from the farm to the homestead by men. Tree crops (for example, rubber and cocoa) are present, but most smallholder farms consist of old trees and are neglected and overgrown. Production per acre for these old rubber trees is very low (USAID, 2013). Besides rubber and cocoa, plantain and pepper are major cash crops. Firestone has several buying stations in the communities that produce rubber.

It is not possible to provide a reliable estimate of the current production of crops per hectare, acre, or household, or how much is sold—production plots vary widely in size. Farmers do not keep records of their production, nor do they keep records of what the family consumes and what is sold.

Markets. There are very few markets in the PROSPER-supported communities around the Big Gio forest. The main markets are in Graie (Sehzueplay, Monday), Tappita (Wednesday), and Old Yourpea (Kparblee, Thursday). The main crops sold are plantain, pepper, and bitter ball. Old Yorpea is the most distant from the main road and can only be reached by road via Graie. The road connection from Old Yourpea to Diala is blocked by a broken bridge and can only be used in the dry season when the water in the riverbed is low. The Tappita market is the largest in the area. Agricultural products are loaded on trucks and pickups to be taken to Monrovia or to Zwedru. Plantains bound for Monrovia are loaded by the "head" and heaped on the bed of a truck, while the plantains bound for Zwedru are transported as individual fruits stacked in a large bag.[6] The amount of plantains traded in Tappita, both during our observations in November 2012 and in January 2013, was the highest of all markets we surveyed. The second crop in volume was peppers followed by eddoes and cassava (small quantities). No rice was offered for sale at the market in wholesale quantities (50-kg bags). Small quantities of locally produced rice were offered for sale by the "cup" at the "retail" market in Graie and Tappita. Most farmers do not have access to transportation, so only the few farmers who do not need to travel a great distance bring their plantain to the market. Some farmers bring their plantain to the roadside and sell from there to passing trucks/traders. Others sell to the "agents" of aggregators who engage motorbike operators to transport the product to the aggregation sites where it is loaded onto trucks. With the exception of palm oil, no other major tree crop (cocoa or rubber) is sold through these retail and wholesale markets.

SELF-MARKETING

A plantain growers association in Diala received a small truck from a donor organization. The truck makes regular trips to Monrovia to sell loads of plantain. The association finds it extremely difficult to sell their product there because other transporters have fixed relations with marketers and wholesalers. Further, the truck has green NGO license plates because it was purchased duty-free by a donor, which results in harassment. Bribes often are solicited to allow passage. While the association sells enough to cover their operational costs, no funds have been set aside for the maintenance or replacement of the truck.

[5] Seed rice (or paddy) is the harvested rice that contains the rice hull or husk (20%) and bran (11%) layers. A huller will remove the husk or hull for brown rice, while an extra step is needed to remove the bran for white rice. A 100-kilo paddy will produce approximately 80 kilos of brown rice or 69 kilos white rice.

[6] A plantain head is the harvested fruit stem with the various "hands" of fruits attached to it. A head can be two to three feet long.

Plantain loaded for transport to the aggregation point.

Photo: USAID PROSPER

Roads around the Big Gio. The road system in the communities around the Big Gio is not well-maintained and is difficult to use in many places, especially during the rains. Many of the roads were constructed by logging companies in the 1960s and 1970s to transport timber logs out of the forest (D. Nuah Biah, personal communication). Most bridges are made from logs and are in bad condition. There is no government (county) maintenance program for feeder roads. Some feeder roads in Nimba County are currently being rehabilitated with donor funding. The few rehabilitated roads are very quickly damaged again by overloaded trucks, especially during the rainy season. No bicycle or animal (e.g., donkeys) transport options are available; therefore the costs of bringing products to a market are high (by motorbike, taxi, or pick-up truck). Because transport charges are calculated by volume or by estimated weight, the transport costs for low-value crops (e.g., cassava) are high compared with high-value crops (e.g., cocoa).

4.3 GRAND BASSA

FIGURE 6: GRAND BASSA COUNTY

The PROSPER-supported communities in Grand Bassa County—District 4 and Barcoline—are quite distinct from those in Nimba County. The towns in Grand Bassa are smaller than those in Nimba, and many of them are found at the end of a road, with very sparse traffic. Grand Bassa County agriculture, based on shifting cultivation, is a mix of (upland) rice and cassava. The coastal zone agricultural activities are described as cassava with rice and (river) fishing (FEWS NET, 2011). There is a slight emphasis on cassava over rice. While coconut trees line the beaches and the fruit is harvested in large quantities from wild growing trees year round, this is not a major cultivated crop for the area.

Barcoline and District 4 are in the coastal zone. The major socio-economic developments in Grand Bassa in the past 50 years have been driven by the iron ore mining operations (enrichment, transport, and shipping) of LAMCO (1960–1990) and ArcelorMittal (2007–2037); agriculture-related foreign investments, e.g., oil palm (Equatorial Palm Oil [EPO]); and the large rubber concession of the Liberian Agricultural Company (LAC, established in 1959 by UNIROYAL Inc.).[7,8] Both LAC and EPO have operations in District 4 and aim to engage small farmers to grow oil palm or rubber that they can process at their facilities. The Barcoline community lies along the Atlantic coast. It has a sizable fishing industry and is a major charcoal producer for the city of Buchanan. There are no agricultural concessions within its boundaries, although the northwestern part is adjacent to the

[7] EPO claim to have access to 34,398 ha (Palm Bay Estate) in Grand Bassa (www.epoil.co.uk/aboutus.aspx Nov 2013). Palm Bay was a concession area of Liberian Incorporated (LIBINC). LIBINC was once the largest palm oil plantation in the country, and was established in 1965 in a 40-year concession agreement. During the war, the plantation was taken over by former employees and squatters. In the absence of any formal management control, residents of the concession area harvested the trees in an unsustainable manner and the health of the trees deteriorated quickly. In 2005, EPO negotiated with the Government of Liberia a takeover from LIBINC and an extension of 40 years whereby EPO would rehabilitate the plantation.

[8] LAC produces 15,000 tons of rubber annually on 56,000 acres.

former tailings operations of LAMCO that had an enrichment plant in Buchanan. There are some indications that an investor is interested in re-processing these tailings to extract the remaining iron ore.

Timber companies have been logging the Grand Bassa area for export timber for many decades. Grand Bassa County is sparsely populated with a density of 28 people per square kilometer and has the fifth-largest land mass in Liberia. The port town of Buchanan was constructed in 1960 by LAMCO for the export of iron ore. Today, Buchanan is the second-largest city in Liberia and has the second-largest port in the country, making it a main market for agricultural products. In 2013, the 95-kilometer road rehabilitation between Firestone and Buchanan was completed; the 180 kilometers from Buchanan to Monrovia comprises the first major trunk road to be rehabilitated in Liberia. This road facilitates movement of products from Grand Bassa to the major market in Monrovia with more than one million consumers.

4.3.1 District 4

FIGURE 7: BARCOLINE (BLUE) AND DISTRICT 4 (PURPLE)

District 4 is an isolated community.[9] No major through roads cross the area, so the only option for taking agricultural products to markets is by passing vehicles. District 4 has a small weekly market in Benzohn, the major town in District 4.

Agriculture production. The major agricultural production system is shifting cultivation. Cassava and upland rice are the dominant crops. Plantain, wild oil palm, and cocoa are small cash crops. The subsistence farming requires no external cash inputs. The main tool used for farming is the cutlass. No input supplier services the area, and the few shops (general stores) do not stock fertilizers, seeds, or agro-chemicals. Most farmers are engaged in the production of upland rice, plantain, cassava, and small amounts of peppers and bitter ball. Shifting cultivation is the dominant farming system. Cassava, rice, and small vegetables are grown for home consumption while plantain is sold as a cash crop. Rice is the dominant staple crop, although cassava is more important than in other PROSPER sites. The yields of upland rice are very low (estimated 800 kilos paddy/hectare). Cassava is an important food crop in District 4. A small number of households have a few citrus trees (e.g., grapefruit or oranges), but there is no organized production of these fruits. Some cocoa trees are found, although the holdings are very small compared with those found in PROSPER sites in Nimba County. Most of the cocoa trees are neglected and overgrown, and yields are small and of very low quality.

Markets. With only a small market in Benzohn, no major through roads, and a long distance to a major town (Buchanan), the cost of marketing agricultural production to obtain cash for school fees or other goods and services for which cash is required is high. The nearest large weekly market is in Compound #3, which is outside the PROSPER site on the road to Buchanan. As in the case of Nimba County, only a very small percentage of farmers in this area have cell phones, making it untenable to transmit market price information to them by SMS. This is coupled with a lack of access to electricity, which limits the possibility for cell phone charging.

Availability of agro-inputs like seeds for green manure practices for the cultivation of groundnuts and cowpeas are nonexistent. Improved seed varieties and fertilizers are not available. Subsistence farmers who choose to use external inputs have to pay high prices for these inputs because the transport costs

[9] PROSPER's District 4 is the northern part of District 4. The Barcoline community is located in the southern part of District 4.

associated with bringing these products to these communities are very high. Further, the prices offered for agriculture products from these communities are low since the trader has to recover his/her transport costs. Private agriculture inputs suppliers have not set up sales and distribution points in District 4 because the possible market (cocoa) is too small and the associated costs are too high. Moreover, currently, other areas offer better opportunities.

Roads in District 4.The road system in District 4 is in poor condition. Some villages are only accessible by foot. Many of the roads were constructed by logging companies in the 1960s and 1970s. The roads receive no maintenance. Bridges are made from logs and are often in dangerous condition. Due to the low frequency of use, the roads "survive," but they can only be navigated by 4x4 vehicles during the rainy season. A substantial increase in road traffic would cause rapid deterioration and make the roads impassable. Because of the low population density and the low level of economic activity, the use of motorbike, taxi, or pick-up truck is much less frequent than in PROSPER's Nimba County sites. The population of the entire District 4 is estimated to be 30,454 (Government of Liberia, 2009).

4.3.2 Barcoline

Barcoline is the only PROSPER site that is located in the proximity of a large town (Buchanan, population 34,270; Government of Liberia, 2009). The shoreline of Barcoline has potential for tourism and provides income to fishermen. Fish processing, mainly smoking, is widespread in the villages along the coast. This activity is almost exclusively done by women. Wild coconut harvesting takes place along the entire coastline. Some small coconut smallholder plantations exist but are not managed. Coconut water is sold in Buchanan by street vendors.[10] Barcoline is the only PROSPER community that identified charcoal production as a major threat to biodiversity in its forest areas. In Barcoline, charcoal making is an integral part of shifting cultivation. In other, more remote PROSPER-supported communities, the fallow agricultural forest is cut, brushed, and burned, whereas in Barcoline, the felled trees are used to make charcoal. The proximity to Buchanan makes this an economically viable activity. Transport from remote fields to a major transport feeder road entails major costs (time, money, and management).

Agriculture production. As in many other PROSPER sites, Barcoline farmers produce cassava and upland rice mainly for their own consumption, and occasionally to sell for cash. Very little income is derived from cocoa, rubber, or wild oil palm collection and processing. The yields of cassava and rice are estimated to be low and not above the averages of the other PROSPER sites. No specific numbers could be obtained due to irregular field sizes, nonstandard measurements (e.g., different sizes of sacks), and inaccurate information provided by farmers (for various reasons).

The soils in Barcoline are sandy and low in fertility. Soils in Grand Bassa are characterized by shallow layers of humus, low organic matter, high acidity, and deficiencies in magnesium and calcium—two plant nutrients that also neutralize acid in the soil.

Rainfall in Barcoline is among the highest of all PROSPER sites.[11] Since charcoal production is part of the current agricultural system, alternative production systems that aim to reduce recourse to shifting cultivation and promote more permanent production systems have to provide a substantial yield increase to compensate for the loss of income from charcoal making. Smallholder coconut farming is not seen as a viable economic opportunity by the Barcoline community. Reasons for this include: (a) the time required for a coconut tree to mature from seedling to fruit-bearing tree is six years; (b) most coconuts consumed

[10] Because of the weight and rather bulky size of the green coconut, it is unlikely that Barcoline coconuts are sold in the Monrovia market. The transport costs would be too high to offer the coconut for sale on the street in Monrovia. The sale of coconut for drinks has visibly increased the last two years in Monrovia.

[11] Referenced in the ArcelorMittal meteorologic data for Port of Buchanan.

in Liberia are collected "free" from the wild; (c) no processor exists to buy produce for an export market in dried coconut or coconut milk; and (d) no improved (e.g. short stem, high-yielding) varieties are available in Liberia. In general, the productivity of farmers is hampered by the limited number and type of tools they possess. The subsistence farmers' tool of choice is the cutlass. Sharpening files, hoes, and axes is often reported to be limited or absent.[12]

Markets. There is no weekly market in any of the Barcoline community towns. For the marketing of fish and agricultural production, the community is dependent on the daily Buchanan market. Traders do buy from fishermen and processors ("smokers") directly, although some processors travel by taxi to Buchanan to sell the fish to vendors at the Buchanan market (wholesale and retail). Agricultural products, like rice or cassava, which are not kept for home consumption but sold for cash, are taken to Buchanan and sold to marketers. Charcoal, an important by-product of shifting cultivation, is carried in bags by producers—often one at a time—over narrow paths to roadside collection points where it is picked up by traders and loaded onto small trucks.

There are very few shops in the Barcoline community. The supply of agricultural inputs (fertilizer, seeds, etc.) is nonexistent there. The survey team did not find any operational mechanical equipment for processing cassava, rice, or oil palm in the Barcoline community.

Roads in Barcoline. The only road linking Barcoline and Buchanan is in poor condition. Fortunately, the absence of through roads in the community reduces the traffic of large, heavy, long-haul trucks on the narrow feeder roads that lead to the various towns in the community. However, this also makes it harder for farmers to sell their products along the roadside. Nevertheless, the relative proximity to Buchanan (and the recently completed paving of the Monrovia-Buchanan road) provides important marketing opportunities for the inhabitants of the Barcoline community.

[12] Survey responses regarding tool possession are often understated because farmers know that many projects and programs will provide tools for free when a shortage is expressed.

5.0 GENERAL SURVEY FINDINGS

In order to obtain additional details concerning the type of products traded in PROSPER's target communities, the assessment team visited several key markets. Information was collected on important cash crops and how they are traded and sold. The survey complements the information on formal trade channels of the traditional export cash crops (e.g., cocoa and rubber) that was collected through conversations with farmers, key informants, and other published studies. A questionnaire was used to interview traders at the local markets. The aim of the interviews was to get a picture of what major commodities are traded at the market, at what price, and where the customers and products come from. The market visits and interviews were conducted in November 2012 and January 2013. The local market visits for the assessment were limited by the agricultural seasons of the various crops. The market visits only provided market snapshots. However, through interviews and conversations with traders, it became clear that plantain, palm oil, and pepper are traded almost throughout the year at the weekly markets in the PROSPER communities (Key informant interviews, personal communication).

The PROSPER team did not interview input supply providers because there are no input providers in the PROSPER communities. The closest input suppliers for upper Nimba can be found in Ganta (not in Sanniquellie). In lower Nimba, the closest input supplier is based in Sacleapea (not in Tappita). Farmers in District 4 and Barcoline can purchase agro-inputs in Buchanan. Wienco, an input supply company from Ghana that entered the Liberian market in 2012, has started a network of agro-input suppliers in the first quarter of 2013 with mixed results. There are no shops that sell fertilizers, seeds, or agro-chemicals in PROSPER communities. Simple hand tools like cutlasses, hoes, and axes are sporadically sold in weekly markets. Hardware stores in larger towns like Ganta, Sacleapea, Sanniquellie, Tappita, and Buchanan generally stock shovels, hoes, and axes.

Conducting a survey in Liberia is a challenge. There are many barriers to overcome, including the multiplicity of languages spoken. Despite precautions taken, there is often some loss of understanding and accuracy in the exchange between interviewers and survey respondents, as well as in the transcription of verbal answers into written ones. Interviewers do not always identify answers that are clearly "out of range" as potential communication issues. The failure to triangulate and clarify such answers can distort the accuracy of the findings. Another survey challenge is the absence of standard weight and volume measurements. From one area to another, and from one product to another, local traders and farmers use a variety of ways to measure agricultural produce. Though perfectly useful for their purposes, it renders cost per volume comparisons difficult and imprecise.

5.1 TRADERS

The team interviewed 59 market traders across the two counties in the following markets: Zualay (13), Zorgowee (10), Sanniquellie (5), Graie (11), Tappita (13) and Compound #3 (7). For the purposes of this survey, traders were defined as market actors who purchased produce either directly from farmers and/or via agents in order to sell the produce to larger traders (often with transport) who then sell to a wholesaler or are connected to wholesalers in the main urban markets and act as agents for them. The team found it difficult to make clear distinctions between traders, retailers, and farmers, since all of these actors could

sell to the final consumer. However, the larger the traders, the more likely they are to specialize and sell only to wholesalers/retailers and to have their own transport so that they can determine when to move goods. Traders who have no transport of their own have to build strong relations with transporters in order to minimize risks and have their goods moved in time. Often these relationships are based on family or village origin ties (see text box above in "Trade Relationships," page 8). Table 1 shows the volumes of the various products encountered during the weekly markets surveyed by the team. It shows that palm oil and plantain are traded in all markets and hot pepper is sold in all but one.

TABLE 1: WEEKLY MARKETS WITH WHOLESALE VOLUME OVER FIVE UNITS EXCEPT FOR PLANTAIN (PLANTAIN VOLUME >40 HEADS)

Production	Unit	Graie	Tappita	Comp. #3	Zualay	Sanniquellie	Zorgowee
Plantain	head	x	x	x	x	x	x
Hot pepper	50 kg bag	x	x		x	x	x
Cowpeas	50 kg bag			x			x
Groundnuts	50 kg bag					x	
Bitter ball/Okra	50 kg bag		x			x	x
Palm oil	5 gallons	x	x	x	x	x	x
Sweet potato	50 kg bag				x		
Cassava	50 kg bag		x			x	
Rice	50 kg bag				x	x	

Another distinction can be made between traders' specializations, usually in either fresh (perishable) or dry goods, and the markets from which they buy. Traders who buy fresh peppers or plantain, for example, from farmers and agents are more dependent on reliable means of transport to get goods quickly to their final destination. Dry goods, including nonperishable palm oil, can be bulked and stored more easily, allowing traders to wait for a favorable transport opportunity or higher market prices.

The amount of working capital a trader can invest in the business is important, since it influences the trader's buying power and ultimately the amount of profit earned. Traders with cash available do make longer-term investments (e.g., a month) and establish relationships with agents that buy for the trader on commission. The trader provides cash to the agent(s) to buy product that should be delivered to the trader within a month. Some small forward-buying relationships have been observed in the cross-border *Griffonia* trade. Ivorian traders, with their own capital, will finance agents to go into Liberia and buy *Griffonia* and deliver it to them at the border.

In terms of volume, the trade in plantain is the largest in all markets, though the absolute volume in Nimba is much higher than in Grand Bassa. Five plantain traders in Zualay reported their volume to be between 10 and 25 heads of plantain per market day, while one reported trades of up to 200 heads in one day. In Tappita, the volume per trader varies from 40 to 60 heads (four out of seven traders) per market day to 200 per market day (one out of seven). Other traders in Tappita deal with smaller amounts, or pack individual plantain fruits in bags for Zwedru. While it is not possible to estimate the volume and total value of plantain that is produced and traded in the PROSPER sites, information gathered from PROSPER field staff living in the communities confirms that plantain is a major cash crop produced by many smallholders.

Hot peppers are sold in all markets. Large bags (50 kilograms) are filled by traders who buy from smaller suppliers. Some of the buyers/traders bring 50-kilogram bags aggregated from farmers in other towns and villages to the market, and top the volume with what they buy on the market that day from farmers and other, smaller traders. At the end of the day, the total volume of bags is loaded on a truck for transport to (mostly) Monrovia. Farmers do not spread their production out very well, and hot pepper floods the market in June and July during the rainy season. Prices drop in this peak production period and rise again in the dry season (December–April). The supply of fresh peppers in this period is very low and is replaced by dried hot peppers.

Liberian consumers value freshness, taste, and appearance in their peppers and are willing to pay a premium for these qualities, particularly in urban markets. During the shortage of fresh and dried pepper, Liberian traders travel to Ivory Coast, Guinea, and Mali to purchase pepper and transport it to Monrovia to make up for any shortfall in local supply (Gerstle, 2006). Given the limited number of markets visited and farmers interviewed, we did not attempt to estimate total production or sales levels in the PROSPER sites.

The supply of palm oil—most of it derived from Dura (wild palm) in PROSPER sites—fluctuates greatly with the season.[13] Supply is lowest and market prices highest during the rainy season. Unlike upland rice farming, in which almost everybody reports being engaged, the collection, processing, and sale of palm oil involves a more select group. At all markets, Dura palm oil is sold retail (in small recycled plastic water bottles or very small plastic bags) as well as wholesale (in five-gallon plastic containers). The surplus oil in Nimba, with an estimated 8,820 households involved in oil palm processing, is sold in Grand Gedeh (Zwedru) and Ganta (Hanif, 2013). Ganta is a palm oil "hub" from which oil is exported into Guinea and transported to Monrovia. Most people involved in the trade are women, while the transportation is primarily done by men.

Like other agricultural commodities, traders selling in neighboring markets use palm oil as foreign exchange, and buy other trade goods to bring back and sell into Liberian markets (Key informant interviews, personal communications). Oil producers and some traders will store oil from the dry season to the rainy season to speculate on prices. The volumes retained by processors and traders for this speculation depend on their cash flow capacity. Of the palm oil traders interviewed, three out of seven indicated that they do this. Quality was rarely reported to be an issue, though rancid, blended, or watered oil occasionally is found in the market. During the transfer from the producers' containers into the traders' containers, traders keep an eye out for contamination. During a recent palm oil marketing study presentation it was noted that the markets for various palm oil products are difficult to understand, except by persons already active in this sector who have good insight into the particular opportunities (ACDI/VOCA-Winrock, 2013). Misinformation and miscommunication on product differentiation, geographic price differences, volume produced and moved, market preferences, and terms of trade seem to be used so as to not expose trade secrets in a competitive market.

An estimated 1,590 Grand Bassa households are involved in oil production, which is significantly lower than in Nimba County (Hanif, 2013). No specific production numbers are available for the PROSPER sites in Barcoline and District 4. We assume that much of the oil produced there is traded for local consumption in small village markets. We also assume that larger surplus volumes are sold in weekly markets (Compound #3), the Buchanan town market, and Monrovia. The team was not able to estimate the current local volume produced and traded. Of the seven larger traders interviewed, three were buying palm oil, although the volume was rather small (a total of ten five-gallon containers) compared to what had been observed in markets in Nimba County. All oil traded was Dura oil.

[13] Sometimes also referred to as "country oil".

6.0 SELECTION CRITERIA

In identifying and assessing value chains and commodities for potential program support, PROSPER was guided by three main principles and eight selection criteria. In determining which value chains and commodities to focus on in this survey, value chains needed to be:

- **Able to achieve high impact:** High-impact value chains have the potential to increase incomes and the number of households or enterprises that experience these changes.
- **Market-driven:** Market-based programming considers that end markets drive the demand of goods and services throughout a value chain and provide incentives for actors to cooperate and compete effectively.
- **Sustainable:** Sustainability is measured in terms of ongoing and resilient trading relationships within the value chain by the targeted population following the exit of the market facilitator/catalyst. Sustainability also implies the ongoing access to the commercial services and inputs needed by value chain actors to develop and grow their businesses and to adapt with changing market trends and demands.

To evaluate agricultural value chains for this survey, the team used the following criteria and definitions to rank different crops. The ranking of the various value chains resulted in an assessment and selection to determine their suitability for support and development in the PROSPER communities.

1. **Suitability for Target Population**

   Does the crop exist in the PROSPER communities, what technical skills are required, and what are the existing skills and levels of familiarity with that crop within the target communities? Building on existing crops and an existing market demand provides a basis for improvement of production in quantity, quality, and timing of the production to earn more cash for the crop produced.

   Ranking: Low=1, Medium=5, High=10

2. **Potential for Value Addition**

   What value is being added in the communities? The team's interpretation of value addition was broad, and ranged from simple drying, to a stable product with a long shelf/storage life that creates opportunities to sell later when prices are higher, to more sophisticated processing activities.

   Ranking: Low=1, Medium=5, High=10

3. **Existing Demand and Growth Potential**

   Is the crop already on the market, either domestically produced or imported? What is the crop's growth potential through domestic end markets, export, and import substitution opportunities?

   Ranking: Low=1, Medium=5, High=10

4. **Potential to Increase Income**

   The potential to increase income should be measured as the return on labor. Certain crops provide all income in a short period, others distribute income over a longer period or year round. Peak production seasons can suppress market prices, especially for commodities produced for the local market.

   Ranking: Low=1, Medium=5, High=10

5. **Labor Requirement**

   How labor-intensive is the cultivation of the particular crop? When are the crop's peak periods (which may constrain the availability of labor)?

   Ranking: Low=10, Medium=5, High=1

6. **Capital Requirements**

   What are the up-front investment costs for the crop?

   Ranking: Low=10, Medium=5, High=1

7. **Time Until Impact**

   How much time the time will it take from starting the activity until tangible results (e.g., cash income) are received?

   Ranking: Long Time=1, Medium=5, Short Time=10

8 **Impacts on Reducing Threats to Biodiversity in Community Forests**

   This condition indicator is not often found in value chain analyses but it is an important indicator for PROSPER. Ranking for this indicator is based on assumptions and hypotheses explained below.

   Ranking: Low=1, Medium=5, High=10

Rationale for inclusion of biodiversity criteria. It could be argued that good yields and a good income from any crop would encourage farmers to clear forest lands to expand their farms—whether it was cassava, rice, cocoa, or oil palm. Farmers grow crops to feed themselves and sell on the market to obtain cash to pay for essential household items, tools, and services (e.g., school fees and health care expenses). Farmers who do not produce a surplus will still forgo household consumption in order to sell products to obtain cash. The argument can be made that it is better to earn this needed cash from a production system that is not based on shifting cultivation but on a permanent agricultural production system. A farmer will react to market demand and will opt, when possible, to maximize his/her return in income for the labor supplied while also balancing risks of crop failure and food security. When farmers are encouraged to diversify their crops to mitigate risk of crop failure or market price fluctuation, and to mitigate the adverse effects on crop yields attributed to climate change, an expansion into perennial crops can be considered a good choice. Will farmers cut down old secondary forest or old forest to plant oil palm, rubber, or cocoa? It seems most likely that they would not. Planting trees using fallow forestland is much easier and can be intercropped. However, the influence of timber logging in old and secondary forest might be substantial when (all) the large trees are removed. This "disturbed" forest might become an easy target for shifting cultivation agriculture fallow system or be used for tree crop cultivation expansion. Roads developed by the logging companies will facilitate future transport of the harvested production.

If farmers feel secure enough to be able to protect their investment against claims by others, they will plant (e.g., oil palm) on farmland cleared by burning. Intercropping with a staple crop is the most likely scenario in the first years of establishing an oil palm farm. The investment cost, however, will be significant. One hundred and eighty trees cost $720 per acre in trees alone. A more likely scenario will be

a gradual increase in the number of trees. Farmers would expand by planting a few additional trees that they could pay for from the proceeds of the oil produced.

PROSPER's objective is to reduce threats to biodiversity in the community forests and the surrounding landscape. Its livelihood approach does not promote the expansion of new areas for any crop but rather aims to increase the productive capacity of existing land used for agriculture, including fallow land. For tree crops, PROSPER supports the rehabilitation of existing smallholder tree farms. For food crops such as cassava, upland rice, and plantain, PROSPER provides demonstrations of yield-increasing techniques and cultivation measures. PROSPER livelihood interventions would not support any activity larger than one acre per farmer. The assumption is that once farmers have seen the benefits that can be earned from rehabilitating one acre, they will be motivated to invest in the rehabilitation of their entire stand themselves. Successful implementation of PROSPER interventions should result in an increase in yield and income from cash and food crops sustainably grown on existing fields. This in turn should successfully demonstrate to farmers that they do not need to rely on shifting cultivation and can improve their livelihood while maintaining their forest lands. Land tenure security will have to be enhanced and rights formalized by the Government of Liberia to create the supporting and enabling environment for this development. A good management plan of the community forest will, in most cases, prohibit the clearing of vegetation and trees for any type of crop to grow within the demarcated community forestry boundaries. A well-conceived CFMP and a well-functioning Community Forestry Management Body broadly supported by the entire community, and that controls shifting cultivation or expansion of permanent agriculture, will be the most effective factors in reducing threats to biodiversity in the community forest.

Value chains and commodities. Based on the principles outlined above, nine value chains and commodities were identified for consideration and subsequently assessed in the two counties where PROSPER operates. Vegetables were not considered in the assessment because the location of the PROSPER sites, often described as "at the end of the road" makes the marketing of these perishable items very challenging. Typically, PROSPER sites are remote and far from the major paved roads, which makes growing vegetables for a predominantly urban market quite risky. The USAID Food and Enterprise Development (FED) Project focuses on vegetable production and the development of marketing channels, including cold storage facilities and cold storage transport. However, these marketing linkages are developed close to the urban areas, especially Monrovia.

The team's selection of the nine crops was not impacted by what other donor-funded programs are currently doing. The sites PROSPER has selected for its activities tend to be in less-developed, forested areas—often described as remote—where no other projects will go. Other programs such as the World Bank-funded Small Holder Tree Crop Revitalization Support Project (STCRSP), the Small Holder Oil Palm Support (SHOPS) Project, and the Livelihood Improvement for Farming Enterprises (LIFE III) do not have activities in the PROSPER sites. However, some of these programs working in adjacent areas (LIFE in Sacleapea [45 km from Tappita], and SHOPS in Sanniquellie and Kanplay) have created momentum, infrastructure, and critical mass from which PROSPER interventions with crops like cocoa and oil palm support can benefit. More important, these programs have generated a wealth of experience on what works and what does not work. The FED project operates in a few villages in PROSPER sites, but has a limited scope of crops it can support. FED focuses on crops that are defined by their importance to food security for Liberia, and not on potentially more profitable crops for farmers like tree crops.

To gather information required to rank the value chains, the team conducted an analysis of all potential crops across the above-listed criteria. Reliable information was difficult to obtain for most crops. Yield estimates by farmers are difficult to check because of the different plot sizes. The trade measures (bag, cup, tub, bucket, etc.) are not standard and therefore comparing yields and prices is often difficult.

For each factor, the team ranked the value chains on a scale of 1 to 10. We considered assigning higher weights to certain criteria (for example, reduced threats to biodiversity and the suitability to target

population as opposed to potential for value addition or time until impact. The team ultimately determined that all the criteria were important, and in the absence of an objective method for assigning value, decided to give each equal weight.

TABLE 2: RANKING OF CROPS

Based on these criteria, the team identified quantitative and qualitative sources of data to rank each criterion and populate the matrix. Most of the criteria required combining data from various sources including reports, field interviews, field observations, and discussions with key informants to arrive at the final assessment.	Staple Crops					Cash Crops			
	Upland Rice	Lowland Rice	Cassava	Plantains	Hot Pepper	Cocoa Rehabilitation	Rubber Rehabilitation	Coffee Rehabilitation	Oil palm Rehabilitation
Suitability for Target Population Ranking: Low= 1, Medium= 5, High= 10	9	8	10	8	10	6	6	4	6
Potential for Value Addition Ranking: Low= 1, Medium= 5, High= 10	2	4	6	2	4	2	1	2	8
Existing Demand & Growth Potential Ranking: Low= 1, Medium= 5, High= 10	6	8	4	6	6	10	10	4	10
Potential to Increase Income Ranking: Low= 1, Medium= 5, High= 10	2	2	2	6	6	10	10	6	10
Labor Requirement Ranking: Low= 10, Medium= 5, High= 1	2	1	2	8	4	8	6	4	6
Capital Required (total costs) Ranking: Low= 10, Medium= 5, High= 1	8	4	6	10	4	8	2	8	2
Time Until Impact Ranking: Long= 1, Medium= 5, Short= 10	6	8	8	6	8	6	2	5	6
Reduced Threats to Biodiversity: Does this crop have a strong or weak possible impact on reducing threats to biodiversity in the community forest? Weak= 1, Medium= 5, Strong= 10	3	4	3	3	3	6	6	6	6
TOTAL SCORE:	**38**	**39**	**41**	**49**	**45**	**56**	**43**	**39**	**54**
RANKING:	8	7	6	3	4	1	5	7	2

6.1 OIL PALM

Oil palm seedlings in a private nursery in Sanniquellie.

Photo: USAID PROSPER

Oil palm is native to Liberia and greater West Africa. According to the Liberia Comprehensive Food Security and Nutrition Survey of 2010, palm oil is one of Liberia's main cash crops in terms of the number of households involved (18 percent; Bishop and Drobia, 2011). Processed from palm fruit, oil palm is the main cooking fat in Liberia. About 50 percent of the palm oil produced in Liberia comes from the wild Dura palm variety, which is found in older secondary forest and riparian forest. Production of the wild Dura tree, which occurs through self-propagation and intentional planting, remains rather low. The fruits have large kernels and relatively little flesh (mesocarp). In contrast, the Tenera type of oil palm is derived from selective cross breeding and is used all over the world in high production plantations. Tenera palm varieties were introduced in PROSPER sites in the 1960s and 1970s, though on a very small scale. No large or medium size palm oil holdings (5–50 ha) are found in any of the PROSPER sites, although relatively large plantations do occur in Nimba and Grand Bassa counties. The Tenera palm fruit has a much smaller kernel ("pit") and a larger

surrounding mesocarp. Palm oil, also referred to as crude palm oil (CPO), is derived from the mesocarp. Since the mesocarp of the Tenera palm is larger than that of the Dura palm (through cross-breeding), the Tenera palm yields much more oil per fruit bunch.

In the domestic market, palm oil from the Dura palm is preferred over the cultivated hybrid versions because of its sweet taste (Bishop and Droiba, 2011). Production of CPO dropped dramatically during and after the civil war. The country turned from an exporter (until the late 1980s) into a net importer. Currently there is a need to assist smallholders with the rehabilitation of old trees and the replanting of new ones.

TABLE 3: CPO DEMAND AND SUPPLY (IN MT) FOR WEST AFRICA

	Production	Net imports	Total Regional Consumption
Ivory Coast	382,923	(189,105)	193,819
Gambia	3,067	38,231	41,297
Guinea	50,000	49,693	99,693
Liberia	**42,500**	**17,742**	**60,242**
Mali	—	42,306	42,306
Senegal	13,136	43,621	56,757
Sierra Leone	54,333	12,226	66,559
TOTAL		***14,714***	***560,673***

Source: COMTRADE; FAOSTAT in Smallholder Palm Oil Market Assessment, USAID SHOPS, December 2013.

Suitability for Target Population. Oil palm is an important food and cash crop for smallholders and is grown in every PROSPER community. About half of the national production comes from wild groves. This percentage is higher in PROSPER communities because of the relatively good forest coverage in the PROSPER sites where the wild Dura grows. Because Dura palm fruit collectors are familiar with the crop in the wild and the knowledge of how to extract oil from the fruit bunches is widespread, this crop would be a good candidate for controlled, managed cultivation of the high yielding Tenera variety.

Nursery operators in Liberia are importing improved, high-yielding Tenera varieties developed in Ghana (Ghana Sumatra) and in the Ivory Coast by the *Centre National de Recherche Agronomique* to revitalize low-producing old Tenera palm grove areas. Furthermore, the rejuvenation of palm groves can happen over time, and each replacement of old palm trees can be self-financed from the earnings from the young, new producing trees. (Score 6)

Potential for Value Addition. The fruits can be locally processed and sold for cooking oil. Oil extraction from dried kernels (currently a waste product) produces a high-value kernel oil and kernel cake, which can be sold as animal feed. Soap production is also a possibility.

Presently Liberia grows more than 160,000 acres of planted Tenera oil palm trees, which constitutes roughly 10 million oil palm trees. Over 98 percent of the trees are more than 30 years old and are in need of immediate replanting.[14] (Score 8)

Existing Demand and Market Potential. There is high demand for CPO at the national, regional, and international levels. The current domestic demand exceeds the supply, and the forecast for global demand is high. Presently crude palm oil is sold in well-established local and regional markets. The price paid for market data suggests that because of taste preferences for Dura, the "sweet" Dura oil fetches a higher price.[15] (Score 10)

Potential to Increase Income. The potential to increase income is very good because palm oil income is possible almost throughout the entire year. The farm gate price for one liter of palm oil is approximately

[14] These calculations do not include the recent planting by concessionaires Sime Darby and Golden Veroleum.

[15] Price data collected in June 2011 in Liberia revealed a large difference between the two types of oils, with Dura at $4.30 per gallon and Tenera at $2.40 per gallon (Bishop and Drobia, 2011).

$0.60–0.70 (June 2013).[16] Wholesalers pay $0.80 for the same amount (June 2013).[17] This is close to the June 2013 world market price of $0.73/liter. Therefore, linking independent smallholders to larger international markets is not likely to add any additional profit or benefit. (Score 10)

Labor Requirement. The majority of labor involved in palm oil production goes toward the harvest and the management of invasive vegetation. The introduction of sheep or goats in more mature groves where the fruits are high off the ground can help to reduce the labor costs where human vegetation management would otherwise be needed. In the earlier stages of the palm cultivation, when the trees are shorter, the trees need protection against goat and sheep. Leguminous (nitrogen fixing) cover crops can be cultivated to suppress weeds and supply nitrogen for the trees. The continuous harvesting requirements present opportunities for employment because it can only be done manually. (Score 6)

Capital Required. The costs of seedlings are high, and subsidization is needed to make them accessible to PROSPER communities. (Score 2)

Time Until Impact. The maturation period for oil palm is about two and a half years. Intercropping with upland rice and plantain (as well as a cover crop to suppress the weeds the first two to three years) is possible in order to earn income from the site. (Score 6)

Reduced Threats to Biodiversity. Rehabilitation of oil palm smallholder farms offers an opportunity for those who have an old farm with unproductive trees to bring back economic production and income without needing to clear any forestland. Planting small plots (e.g., 1/4 acre) with high-yielding hybrid varieties intercropped on cleared land for shifting cultivation would not necessarily be a threat to the biodiversity of the community forest because it replaces part of the shifting cultivation production system with a permanent production system that is a good potential source of food and income, away from shifting cultivation. (Score 6)

Oil Palm Overall Total Score: 54; Ranking: 2

6.2 RICE – UPLAND

Suitability for Target Population. Rice is the number one staple food in Liberia. Most rice is upland rice produced by subsistence farmers in the PROSPER-supported area and is used for home consumption. A small portion finds its way to the local market within the community. The upland soils are very poor in nutrients and organic matter, so the yields are amongst the lowest in Africa. Chemical fertilizers are prohibitively expensive for famers; no input supply chains provide fertilizers for upland rice, nor are there (micro) finance institutions providing credit to farmers to finance the fertilizer. Green manure in crop rotation, compost applications, planting in lines to facilitate weeding, weeding, and water competition are all ways that farmers can increase crop yields, although each requires extra labor that the farmer might not be able to provide. Although upland rice scores very high in its suitability for target population, a growth in yield potential and the potential to increase cash income indicates that upland rice will remain a marginal crop that will stay dependent on shifting cultivation as major soil nutrient provider. (Score 9)

Potential for Value Addition. Most if not all upland rice will be used for home consumption, including the increased yield achieved using improved varieties or through improved planting techniques and the use of green manure. (Score 2)

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[16] Prices are in U.S. dollars unless stated otherwise.

[17] Dura yield: 0.2–0.4 MT/ha = 59–119 gal/ha= $254-$512/ha CPO; Tenera yield: 2.8 MT/ha= 831 gal/ha= $1,994/ha CPO (Bishop and Drobia, 2011).

Existing Demand and Growth Potential. Despite having the highest per capita rice consumption in Africa (127 kg), locally produced rice cannot compete with the tariff-free imported rice (predominately Asian) in the big urban markets (Government of Liberia, Ministry of Agriculture, and World Food Programme, 2010). The score of 6 for existing demand and growth potential reflects the high home and market demand for rice (regardless of how or where it is produced or whether it is lowland, upland, or imported), rather than the growth potential for upland rice, which only provides farmers with low gross margins due to the cheap imported rice that keeps prices low (estimated $115/ha; USAID, 2012a). Farmers in Liberia must reduce their production costs and produce rice more efficiently in order to meet urban market demands in Liberia and compete with imported rice. (Score 6)

Potential to Increase Income. The potential to increase income is low because most of the increases in production would be used for home consumption to reduce the "hunger period"—the period during which all the self-produced rice has been consumed and the households fall back on cassava to feed themselves. Currently, average yields per hectare are between 500 and 800 kilograms. Family labor availability restricts the possibility to extend the cultivation area in order to produce more rice. Additionally, low market prices due to cheap imports do not make rice a profitable enterprise for farmers. (Score 2)

Labor Requirement. The labor requirement for upland rice production in shifting cultivation is high and has labor requirement peaks.[18] These labor peaks occur when much work has to be done in a short time, e.g., to be ready for sowing when the first rains arrive, and the harvesting period where the grains have to be harvested before they drop. The possibilities for mechanization are virtually nil. No animal traction exists for soil tillage or transporting produce. Mechanization could help to increase the area under cultivation, although it will most likely increase the production costs, hence yielding smaller gross margins. (Score 2)

Capital Required. The capital required to engage in upland rice farming is relatively low compared with other crops. Major capital costs include hand tools that can make the fieldwork more efficient, and improved seeds (such as Nerica-14) that have a higher yield. Many farmers have very limited access to tools like hoes, axes, and shovels. Nerica-14 seed price is $1.25/kilogram and the recommended seed rate is 50–60 kilogram/hectare. Subsistence farmers do not buy improved seeds because they cannot afford them at planting time. Seeds are instead retained from the previous harvest. (Score 8)

Time Until Impact. To improve the yields for upland rice, better soil nutrient management is necessary. One way of improving soil nutrients is through the use of green manure, which is created by using nitrogen-fixing crops in the crop rotation. However, these effects must first be demonstrated in order to convince the farmers to apply these methods. These soil nutrition improvement measures are only effective after a full cycle of crop rotation and in the following cycle. Introducing the fast maturing (90–110 days) Nerica-14, a relatively high-yielding variety, would result in a shorter impact time. The benefits of Nerica-14, as demonstrated in the FFS, will need repetition and consistent performance to convince farmers that this variety will increase their yield. The introduction and dissemination of Nerica-14 seed is relatively slow because subsistence farmers cannot afford it, though farmers do exchange seeds amongst each other. In consideration of the above issues, the total score for time until impact is moderate. (Score 6)

Upland Rice Overall Total Score: 38; Ranking: 8

[18] This involves selection of site, brushing, felling of trees, burning, clearing, sowing of seeds (scratching/dibbling), construction of fence, weeding, bird scaring, and harvesting. Estimations vary from 186–250 days/hectare.

6.3 RICE – LOWLAND

Suitability for the Target Population. The same argument that was made for upland rice can be made for lowland rice production for this category. Not much lowland rice production is currently practiced in the PROSPER communities, which suggests that serious constraints prevent local farmers and entrepreneurs from establishing rice farms in the lowlands. The amount of labor required to develop the lowland rice into plots is large and suggests that it is only possible with outside assistance. Furthermore, the numerous examples of lowland rice fields lying idle suggest that the continuous cropping of these lowlands season after season is difficult. In order to develop lowlands for rice production, many farmers would need to be mobilized to help with the heavy work, for which they often receive a meal. To accommodate as many farmers as possible, the plots awarded or allocated for farming are rather small and do not yield enough to sustain the family. Therefore, upland rice cultivation will often continue to fulfill the food requirements. Individual land tenure rights for these farmers are not clear in these lowland rice production schemes. This could impact the maintenance of small dykes and other water-controlling structures in the future. (Score 8)

Potential for Value Addition. The potential for value addition is relatively small. When the lowland rice plots are large and great enough surpluses can be produced on a large scale, the milling and parboiling of the rice would add value to the product. This would be a viable enterprise because of the scale and concentrated volume. (Score 4)

Existing Demand and Growth Potential. Demand and growth potential for rice in Liberia is high given the high rate of rice consumption per capita. However, the gross margins are about $500/hectare with the use of conventional fertilizer (USAID, 2012a). In the FED pilot program, farmers receive a 50 percent subsidy on the fertilizer. Recent experiments with Urea Deep Placement (UDP- fertilizer) under FED show promising results, although the upfront costs are significant. Lowlands and swamps have no competition with other agricultural crops that grow at higher altitudes. Therefore, the large tracts of swampland are regarded as ideal for high-yielding rice production, which will improve Liberia's food security and make Liberians less vulnerable to food price increases. It is the policy of the Ministry of Agriculture (MOA) to convert as many lowlands into rice producing areas as possible. Lowland rice opens the possibility of mechanized farming, which can reduce production costs and make it possible for farmers to cultivate larger areas. (Score 8)

Potential to Increase Income. Lowland rice has the potential to increase income when rice production moves from the uplands (gross margin = $115/ha) to the lowlands (gross margin = $500/ha; which could be doubled with two harvest cycles), although the latter requires substantial (donor-funded) land clearing and preparation investments (USAID, 2012a). Although lowland rice production has potentially higher yields (1,500–2,000 kg/ha and could be increased further with fertilizer applications [FDP urea and phosphates]) up to 4,500 kg/ha), the small plot size and the labor requirement are major obstacles to increasing family income. The introduction (and financing) of two-wheel rototillers (motorized rotary cultivators) in completely de-stumped lowlands could increase the efficiency of labor and reduce the number of persons required to prepare the land for rice cultivation. A large portion of this yield will most likely be consumed by the family to cover their domestic needs; the rest can be sold for cash. With a per capita consumption of 128 kilograms/year and an average household size of about six persons, 845 kilograms of paddy rice is needed to feed the family.[19] The rest of the yield must be sold on the market to pay for the rototiller and the fertilizers, seeds and tools for the next season. (Score 2)

Labor Requirement. The labor requirement for lowland rice is high. Although soil preparation (the plowing of the vegetation and seedbed preparation) is time consuming, it could be mechanized with the

[19] An 853-kilogram paddy results in 768 kilograms of de-husked rice for consumption.

use of the above-mentioned rototillers. Line planting of the seedlings and timely weeding are labor-intensive activities as well. (Score 1)

Capital Required. Lowland rice requires a large capital investment upfront. Rehabilitation of abandoned old infrastructure is generally less expensive, yet external financing is necessary to construct the essential infrastructure, e.g., dykes, drainage channels, and other water control structures. These new structures also need regular maintenance to safeguard the investment. The capital cost required is therefore quite high. (Score 4)

Time Until Impact. Initial land-clearing activities and preparations for planting require some time, but once the fields are ready, two crop cycles can be grown. With a sufficient water supply and the presence of mechanized or well-organized manual labor, two harvests should be possible. The time until impact is therefore rather short. (Score 8)

Reduced Threats to Biodiversity. It could be argued that lowland rice cultivation offers a contribution to a reduced threat to biodiversity of (community) forests. This argument submits that lowland rice farming leaves the forest largely intact and constitutes a permanent system of agriculture production. Lowland farming generally enjoys superior soil fertility due to the decomposing organic matter carried by water runoff from higher areas. Increased production with two yields per year will require chemical fertilizers in order to combat the nutrient deficiencies caused by the first harvest. The role of wetlands in conjunction with the (community) forest is not valued because its role in the larger landscape ecosystem is not widely recognized and often ignored. The unique habitat these wetlands offer and the role these wetlands play in the watershed systems are often not recognized. Through the lens of biodiversity threat mitigation, lowland farming could potentially increase income without causing deforestation. Furthermore, when successful, community members will not clear forest to expand production. However, in a larger landscape in which the lowland swamp areas are part of the overall ecosystem of which the community forest is a part (sometimes adjacent to it, as around the Big Gio forest), lowland rice development might contribute to an indirect decrease in the level of biodiversity in the community forest. (Score 4)

Lowland Rice Total Score 39; Overall Ranking 7

6.4 CASSAVA

Suitability for Target Population. Cassava is the second most important staple crop in the PROSPER sites (after rice). It is produced in all PROSPER sites, although there are slight differences between the communities. For example, cassava is grown in greater quantities in District 4 and Barcoline than in the Tappita and upper Nimba communities. Cassava is the crop of choice when the rice harvest has been consumed and the next rice harvest is still weeks away, but the marketability of fresh cassava is rather limited as raw harvested cassava spoils within three to four days.

The two major products derived from cassava are fresh cassava root tubers and gari.[20] Both gari and fresh cassava are consumed by households in the PROSPER sites. Some products are sold on the local market. Gari is processed from the tubers and has a longer shelf life. Cassava leaves are also a very important part of the Liberian diet. As a food security crop, cassava is an important hardy crop, though the tuber does not provide any nutritive qualities beyond starch. Moreover, cassava is a "theft-proof" crop since it requires manual effort to remove from the soil, compared with plantains, for example, which can be removed with little effort. Due to cassava's familiarity within the general population and its importance to food security, cassava is a suitable crop for the PROSPER communities. (Score 10)

[20] To make gari, cassava tubers are peeled, washed, and grated. The grated cassava is placed in a porous bag and pressed for two days to get the water and starch out. It is then sieved (or sifted) and dried by heating in a large shallow bowl. The resulting dry granular gari can be stored for long periods. It may be pounded or milled to make it into fine flour.

Potential for Value Addition. Fresh cassava spoils soon after the tubers are extracted from the soil.[21] Profit margins for gari, a more stable product, are low when the cassava is ground by hand.

Mechanized processing of cassava into gari could be a profitable activity. The reliability of the grinding operation is important to provide the customers with a steady supply of gari. The mechanized production of gari could stimulate and increase the demand for cassava and thus turn cassava into a cash crop. The conversion of cassava into gari not only adds value to the product, but also opens distant markets because of gari's longer shelf life. A recent study by ZOA suggests that some gari processing facilities find it difficult to set a price that can make the business profitable or break even due to low supply of product (Kruiper, 2013). (Score 6)

Cassava leaves and tubers.

Source: IITA

Existing Demand and Growth Potential. The demand for cassava is limited. Rice remains the dominant staple, especially in urban areas. Cassava is a food security crop and provides food for rural farmers when the rice stock has been depleted. Cassava can be stored in the ground for three to six months and can be harvested as needed. Cassava is consumed in the household in the form of fufu, GB, or domboh, which are various ways to prepare cassava for a meal. Fresh cassava that can be sold in the larger urban markets will be produced closer to these areas to minimize the risk of spoilage by decreasing transportation times. The PROSPER areas, with the exception of Barcoline, are too far away from major urban cassava markets to supply these markets with fresh cassava. Processed cassava (gari or cassava flour) is the only form in which cassava will reach the urban market from the PROSPER communities. The size of the market for gari is difficult to estimate. Food processing and manufacturing (beer, biscuits, etc.) in Liberia could boost the market for cassava in the future. The gross margins for cassava vary but are generally low because of the high labor demand. Farmers would need to expand their farms and work in large volumes to see any significant profit. Mechanization in the current shifting cultivation system will be difficult because of the numerous tree stumps left on the fields. To make mechanization possible, the production of cassava will have to take place on land that is permanently under agricultural production and where chemical fertilizers are used to maintain soil fertility. (Score 4)

Potential to Increase Income. As discussed earlier, cassava can only become an income-earning crop when it can be preserved and processed. Growing higher yielding cassava will slightly increase the gross margins because it will be possible to harvest more cassava tubers with the same labor burden. It is difficult to obtain a good picture on current cassava yields in the PROSPER sites. The Liberia Institute of Statistics and Geo-Information Services (LISGIS) estimates the average yields in Liberia at 6 metric tons/hectare (mt/ha). The aforementioned ZOA study estimates that the most common yield is around 5.3 mt/ha. However, the study expresses the possibility that farmers are overstating their yields. The study also shows that the price offered by processors for fresh cassava was between 200 and 400 Liberian dollars (LD) per 65-kilogram bag. With the yield of farmers estimated to be between 81.5 bags/ha (5,300 kg/ha) and 103 bags/ha (6,743 kg/ha), the returns for 200 LD per bag is between 16,300 and 20,600 LD/ha ($214–$271).[22] For a bag price of 400 LD, the returns are between 32,600 and 41,200 LD/ha ($428–$542/ha). The ZOA study also demonstrates that yield gains can be made by switching from the

[21] Research and breeding programs have been initiated to create cassava varieties that have a much longer shelf life. Once developed, they will vastly increase the marketability of cassava tubers.

[22] At an exchange rate of 76 LD/US$1.

local Gbofani and Bassa Girl varieties to the newly developed, high-yielding Caricass varieties.[23] However, the best-tasting gari is made from the local varieties and not the Caricass.[24] The potential to increase income can only be achieved when: (a) there is an increase of cultivated area per farmer; (b) higher-yielding varieties are adopted that would not require extra labor (although it might take time to adopt due to taste preferences); (c) farmers have produced enough to cover their own food security requirements; and (d) there are processing facilities available to produce gari or flour. The remoteness of the PROSPER sites adds to the costs, with the exception of Barcoline. Considering all of these conditional factors, the potential to increase income is rather limited. (Score 2)

Labor Requirement. The labor requirement is high because most of the cassava is produced in shifting cultivation. High rainfall and acidic soils that are very poor in nutrients and organic matter make shifting cultivation the only option to provide nutrients to the plant. Cassava can grow in very poor soil and is drought-resistant. It can produce much more when grown in richer, more fertile soil and when organic or chemical fertilizer is applied. Yields of between 25–35 metric tons are possible. Improved agricultural practices like planting on ridges or mounds, correct spacing, and planting in lines will increase the yield; however, these practices require extra labor. Soil improvement measures such as intercropping with nitrogen-fixing plants (e.g., cowpeas and groundnuts), while beneficial to the cassava crop, require inputs (e.g., seeds) and extra labor. The benefits are only measurable over time while farming the same plot. The benefits of green manure and better agricultural practices have not yet been recognized to outweigh the extra labor effort. The only source of labor available is family labor. This limited resource restricts the area a family can cultivate. (Score 2)

Capital Required. The capital requirement for cassava cultivation is low. Cassava is propagated from stem cuttings. The stem parts used for propagation must be 25 centimeters long. One plant can provide planting material for many new plants. Farmers provide planting materials for a new field from their own existing cassava crop. Little capital is needed to replace tools that wear out over the months of intensive use in land preparation. As discussed above, successful expansion of cassava production is closely linked with the potential for processing it. This requires initial capital to purchase machinery and business skills to put money aside for maintenance, repairs, and the potential replacement of machinery. (Score 6)

Time until Impact. The cassava production cycle is between six and 12 months. The introduction process for improved varieties is relatively slow because the farmers who grow the crop predominantly for food security need to be convinced that the new varieties yield more than what they currently produce and are resistant to the cassava mosaic virus.[25] As discussed earlier, the possibility of processing cassava is an integral part of marketing the potential of increased cassava production. Without increased processing opportunities or capacity, an increase in cassava production will not be possible. The ZOA study suggests that farmers' responses to demand from processing facilities is rather good. However, most farmers will only sell cassava to processing facilities if they have exceeded their own capacity for home processing. (Score 8)

Reduced Threats to Biodiversity. Cassava is currently cultivated in a predominantly shifting cultivation agriculture production system. However, increased yields per area and better marginal returns on labor achieved through better varieties and improved crop husbandry could reduce the amount of hectares required for this crop, hence less emphasis on the shifting cultivation cycle. Nevertheless, higher yields and the availability of labor and processing capacity could also stimulate entrepreneurial farmers who see

[23] Caricass I, II, and III.

[24] As per verbal conversation with FFS members in Zolowee and also noted in Kruiper (2013).

[25] The cassava mosaic virus affects the leaves of the cassava plant, not allowing them to absorb sufficient sunlight, and indirectly hampering the growth of the root.

the opportunity to expand acreage and increase the pressure on forest land to be cleared for this income opportunity. (Score 3)

Cassava Total Score 41; Overall Ranking 6

6.5 PLANTAIN

Plantain (*Musa acuminata* and *Musa balbisiana*) is an important cash crop whose main consumers live in urban areas, with the largest market in Monrovia. It is eaten boiled, roasted, or fried in palm oil. Plantain is cultivated for home consumption but is mainly cash crop. Plantain bunches are offered on the roadside or on various weekly markets. They mature throughout the year and so provide income possibilities all year round. In some places (such as Tappita), a critical mass exists for truck owners or traders to to fill an entire truck with plantain for transport to the Red Light market in Monrovia.

Plantain is often intercropped with rice. The plantain is left growing after rice production and usually receives little attention. The planting material is obtained from vegetative shoots ("suckers").

Suitability for Target Population. Plantain is relatively easy to grow, requires relatively little labor, and, due to its year-round fruit production, offers sustained income throughout the year. Individual smallholders might find it difficult (and expensive) to transport bunches to the market, and roadside sales are less reliable. Knowledge about plantain cultivation is very basic, and diseases that cause plants to collapse are a pervasive problem. Though plantains are quite hardy, they have a shelf life of about seven days, after which time the fruit becomes overripe. There is a significant risk for transport spoilage, especially in the rainy season when travel becomes unreliable and traders/buyers might not show up on time because the roads are blocked. (Score 8)

Motor bike transport of plantain from the weekly market in Zualay (Zor) to Sanniquellie, November 2012.

Photo: USAID PROSPER

Potential for Value Addition. The potential for value addition is low. Plantain is prepared almost exclusively by women and is sold roasted or fried as a snack. Although plantain can be sliced, dried, and ground into flour, no large market for this product exists. Currently most, if not all, plantain is sold green. (Score 2)

Existing Demand and Growth Potential. The market demand in the larger urban areas seems to be quite stable, although no numbers are available to support this observation.[26] Since plantain can be produced throughout the year, prices are quite flat despite some disturbances in the supply lines due to impassible roads or collapsed bridges. This causes farm gate or rural market prices to go down and end market prices to go up as the transporter/trader will increase prices because of increased risk. During the field market survey, the team witnessed more expensive motorbike transport replacing truck transport because road conditions had made truck transportation impossible. The growth potential would have to be generated by an increased domestic urban demand.
(Score 6)

Potential to Increase Income. Plantain is produced as a cash crop and is sold in larger urban markets through various channels. Traders buy from local producers, aggregate the "heads" (bunches), send the heads in pick-up trucks or taxis to larger urban areas, where the consignment is received by traders/marketers with whom a trusting relationship has been formed. These connections are often family

[26] The total production in Liberia is estimated to be 46,000 tons and the area under plantain about 21,000 ha (FAOSTAT, 2013).

members who originate from the same clan or town. The transporter will let the receiving party know when and where he will arrive. The receiving partner pays the taxi or pickup driver for the transport. All heads of plantain are marked with unique initials carved on the stems. In all, many people are involved in the transport of the plantain from farm to end market. The potential to increase income for farmers would have to come from increased production of bunches whereby the extra bunches produced were worth the extra labor. An increase in urban demand would create more work and income for transporters. If roads improved, more cost-efficient transport would be able to take larger loads for lower costs and potentially would reduce the market for motorbike operators. The potential for plantain to increase income is rated as medium. (Score 6)

Labor Requirement. The labor requirement for plantain production is relatively low. Besides expansion planting, which requires splitting a shoot from the mother plant for planting elsewhere, the plantain plant needs very little care. However, with improved crop husbandry (e.g., the right spacing, mulching, and weeding), higher production is possible. Although these improved crop husbandry measures require extra labor, the overall labor requirements for plantain remains low. (Score 8)

Capital Required. Farmers can use their own shoots to expand existing plantain farms. Those who have no plantain, or a very small number of plants, have to rely on shoots from other farmers. The price for suckers is around $0.57 per plant. Planting a hectare with recommended spacing of three meters between the rows and two meters within the rows would require 1,667 plants (675/acre). A 25m^2 plot would require 104 plants, with a total cost of $60. Plants start producing after nine to 12 months depending on the soil fertility and water availability, so a second crop is possible. After a second harvest, the plants should be chopped up to destroy the habitat for harmful insects, and the land should be left to lie fallow to break the life cycle of nematodes, which can destroy plants. Because most of the shoots can be produced from existing plantain plants, slow expansion of a plantain farm, often intercropped with upland rice, requires little capital. (Score 10)

Time Until Impact. Expansion of plantain production by farmers can result in sale of plantain on the market within a period of nine to 12 months. (Score 6)

Reduced Threats to Biodiversity. Higher yields per cultivated area would decrease the need to expand planting over greater plots, thus diminishing threats to biodiversity. Although plantain is often cultivated and maintained on the same land for longer than rice and cassava (sometimes up to five years), the farmland necessary for plantain cultivation still remains part of the shifting cultivation farming system. Plantain often grows together with rice or cassava in the early stages of its development. The plantain market in Monrovia is strong, so farmers will respond to the demand. Successful farmers that can increase production may look for opportunities to apply their skills to an enlarged area to earn more money and, in so doing, may increase the incidence of deforestation. (Score 3)

Plantain Total Score 49; Overall Ranking 3

6.6 HOT PEPPER

Suitability for Target Population. The hot peppers cultivated in Liberia are of the *Capsicum frutescens* or *chinense* species, both of which are found in West Africa and are known for their spicy flavor. Many of the varieties found in the region were introduced by repatriating slaves in the last century. Hot pepper is a key ingredient in Liberian cuisine, and many Liberians consume it daily. Large amounts are consumed in the urban areas. Spoilage of fresh, perishable hot peppers due to transport distances and challenges occurs frequently, reducing potential gains. Traders often offer a farm gate price that reflects risk mitigation for their business. Off-season production could fetch higher market prices, but it requires extra labor. Most PROSPER communities already have some engagement in the production of hot peppers, which will enable the program to build upon this experience. (Score 10)

Women traders removing spoiled peppers at the Tappita market, November 2012.

Photo: USAID PROSPER

Potential for Value Addition. The potential for value addition is significant when the peppers can be dried quickly and safely in a solar dryer. Solar dryers reduce spoilage and permit peppers to be held until prices are higher. Drying also can mitigate the risks of bad roads or collapsed bridges that can cause long delays during certain periods of the year. (Score 4)

Existing Demand and Growth Potential. Demand for hot peppers is steady throughout, although the supply is not. Price fluctuations range from 900 to 4,000 LD per bag of fresh hot peppers (Gerstle, 2006). When Monrovia wholesale prices are high, hot peppers from neighboring Guinea are introduced into Monrovia markets. The importing from Guinea suggests that proper timing or production presents potential for growth. In addition, the growing trend of urbanization in Liberia suggests that the urban markets demand will increase every year. (Score 6)

Potential to Increase Income. According to the study on hot peppers carried out in 2006 by the Community Peace Building and Development Program, hot pepper production could offer potential returns of up to 300% (Gerstle, 2006). Hot pepper is in demand all year long. The greatest opportunities are in off-season production and sale of peppers, when prices are at their highest. Assisting communities to develop their capacity and the needed resources to follow a "dry and hold" strategy during the peak season could increase their incomes if producers are willing and able to wait. Given the market saturation in the peak production period, a related constraint is the waste of hot pepper. Farmers and traders focus on the sale of fresh peppers, only opting to dry peppers when they start to spoil. As a result, large volumes of peppers are wasted. (Score 6)

Labor Requirement. The labor requirement is relatively high, especially when hot peppers are produced in the dry season. Hand watering crops is time-consuming when cultivating on higher grounds near a water source. The drying of hot peppers also adds to the labor burden, although drying in a solar dryer can reduce the amount of labor. The costs for the use of the solar dryer have to be less than the cost of drying in the open on a mat with the additional risk of rain showers. To grow a successful crop of hot peppers, it raising seedlings in a nursery is recommended. The construction and maintenance of a nursery, on the other hand, requires more labor. (Score 4)

Capital Required. Capital costs to start hot pepper cultivation are relatively low. The plant can produce for about 18 months. Therefore, productive plant replacement is not necessary every 12 months as is the case with strictly annual plants. Construction of a nursery can be accomplished with local materials, but requires time and effort. With the exception of tool replacement, few capital inputs are required. The construction of a solar dryer, which can also be used for other products like *Griffonia* or cocoa beans, can cost up to $600 in materials (plastic sheeting) plus other material costs (e.g., bamboo) and construction labor and can be used collectively. (Score 4)

Time Until Impact. The time from intervention to seeing measurable results can be relatively short. Hot pepper has a short cultivation cycle of three to four months. It also has a high, year-round market demand and production and can be sold all year. Construction time of a solar dryer is short. However, the set up and organization of a group with a leadership structure that will manage the use and maintenance of the solar dryer requires time. (Score 8)

Reduced Threats to Biodiversity. Hot peppers are cultivated within the existing shifting cultivation cycle. Besides home consumption, peppers are a large cash crop catering to urban markets. An intervention in this value chain, e.g., support for the creation of drying facilities, probably would not have an impact on threat levels to biodiversity of the community forest. When drying prevents spoilage, more money can be

made from the same area of land under hot pepper cultivation. It does not seem likely that large commercial growers will enter a market for which they might clear young forest or allocate fallow forest agricultural land. (Score 3)

Hot Peppers Total Score 45; Overall Ranking 4

6.7 RUBBER REHABILITATION

Old overgrown rubber smallholder plantation near Diala (Tappita)

Photo: USAID PROSPER

Suitability for Target Population. Rubber cultivation is common in all PROSPER sites except Barcoline. Rubber is an important cash crop that has an extensive network of buyers. There are a few large rubber holdings in Liberia, of which Firestone and LAC are the largest currently in operation. Rubber is one of the most lucrative crops in Liberia, although the relatively high cost of entry into the cultivation of rubber and the uncertainty of land tenure create some obstacles. The six-to-seven year investment in time and effort upfront might be difficult to overcome for subsistence farmers whose needs are immediate. For farmers who do have secure access to land, rubber rehabilitation could be a viable and lucrative option. Rubber is very well-suited to Liberia's climate and soil. There is a lot of interest in rubber farming, but the uncertain land tenure issues make the risks too high for many in the community who have not secured land rights. Technical knowhow has diminished during the years of civil unrest, and access to good plant stock materials is difficult.

When looking at the suitability of rubber cultivation for the population in the PROSPER communities, it should be taken into account that there are quite a number of existing smallholder rubber plantations. Likewise, there are many smallholder cocoa stands, and to a lesser extent, small oil palm holdings. Most of these smallholder plantations were formed in the 1970s and 1980s and were quite successful initially. The introduction of these tree cash crops must have been popular among community members because there are many of them (cocoa and rubber). Many years of civil war, however, destroyed the rubber trees through destructive latex extraction. New rubber is being planted on upland rice fields that are cleared by shifting cultivation, and will be converted into permanent rubber farms after one or two years of upland rice production. This development reveals community interest in rubber production in light of a potential long-term income. Unfortunately, the plant material used for expansion is of inferior quality and will ultimately reduce the long-term economic benefits substantially. (Score 6)

Potential for Value Adding. The potential for value addition to latex production in PROSPER communities is nonexistent. Coagulated rubber is processed by the larger rubber companies into rubber sheets or blocks that are exported. (Score 1)

Existing Demand and Growth Potential. The rubber has attracted large-scale private producers and buyers to support its reemergence. Firestone, LAC, and Sime Darby are rehabilitating and expanding their operations. The expansion of these operations will create a larger infrastructure from which other rubber growers can benefit. Firestone buying stations are situated throughout Nimba County, while the LAC is buying rubber from smallholders in the eastern part of Grand Bassa. The current market price for rubber is relatively low because of a worldwide economic slowdown. The long-term forecasts, however, are showing increasing prices for a long time to come. Most rubber is used for the manufacturing of vehicle tires, and the forecasted growth of the number of cars on the roads in China and India provides a strong growth potential. (Score 10)

Potential to Increase Income. About seven and a half acres of rubber has the potential to earn $500 per month (gross margin) when tapped. However, the period between the planting of young rubber seedlings and the first tapping is about seven years. Intercropping of young rubber trees is essential for smallholders in order to obtain an income for the years while the rubber is maturing. The rehabilitation of nonproductive small old rubber holdings could provide a long-term income without the need to clear forestland for perennial agriculture production. Furthermore, when the rubber trees are in production, enough income can be produced from the rubber farm to buy imported rice and other food crops on the market rather than growing it. (Score 10)

Labor Requirement. Rehabilitating rubber is labor-intensive, especially when the previous vegetation (including the old trees) is not removed through agricultural burning. De-stumping (the removal of stumps and roots of the old trees) is too costly for smallholder rehabilitation. Therefore, the stumps are left to decay by themselves. Brushing and clearing the vegetation around the young trees, which must be done at least twice a year, requires labor, although herbicide solutions are available to reduce these costs. Tapping is still an important income generation activity for families living in or near rubber producing areas, and most of the maintenance work and the tapping cannot be mechanized. (Score 6)

Capital Required. The capital costs for rubber rehabilitation are high. Large amounts of money and labor are required for rubber cultivation and rehabilitation, which mainly involves the cutting of old trees, freeing up planting lines, and planting and brushing to keep the vegetation between the new trees under control. Although a large part of the required labor can be provided by a farmer's family, power saw operators still need to be hired to facilitate the felling of old rubber trees, the costs for which are substantial. Burning cut trees causes massive CO2 emission into the atmosphere, and for this reason, this practice is not advised. (The trees will decay by themselves.) Further, considerable power saw cutting would be required to open up clear lanes for planting. No income is predicted to be made from the old rubber wood (charcoal or rubber wood) because of the distance to the markets (charcoal) or processing facilities (rubber wood), therefore no costs can be offset by income derived from sales of any cut rubber tree. (Score 2)

Time Until Impact. The time required to initiate the activity, bring unproductive rubber smallholder lands back into production, and provide a self-sustainable long-term income source is approximately seven years. This amount of time is far beyond the lifespan of PROSPER—and most other development projects. These facts lead one to presume that rubber as a profitable crop, well-suited to the climate and soil, is only an opportunity for large foreign investors or local elites who have the means and power to secure land tenure in a way that the local smallholders who live in the PROSPER sites do not have. However, a case could be made that a rehabilitation program enacted now could show impacts after PROSPER's life span. An intervention that achieves the tangible results as planned from the outset will show that this approach to small rubber holdings can be successful and could be a model to replicate in other areas. (Score 2)

Reduced Threats to Biodiversity. Rubber rehabilitation could have a significant, positive impact on the threat to biodiversity in the community forest. Impoverished rubber smallholders have reverted to shifting cultivation to provide for their livelihood. Rejuvenated unproductive rubber smallholdings can provide significant long-term income for farmers, which could cause them to abandon shifting cultivation and devote their time to rehabilitated rubber farming exclusively. However, it is possible that independent farmers see rubber as a long-term income possibility and will intercrop wild, unselected old clones on land cleared by shifting cultivation for rice production. This trend has been observed in some PROSPER sites around the Big Gio.

The long-term effects will be that more farmers will move away from shifting cultivation to derive their income from permanent agriculture (cash crops as well as food crops). Rubber rehabilitation and farmers that convert fallow agriculture forestland to rubber should not be compared with rubber concessions, where all types of land, including fallow agriculture land and secondary forest, are converted into permanent monoculture agriculture. These concessions are a big threat to biodiversity, and threaten the livelihood options of many people in the area. (Score 6)

Rubber Total Score 43; Overall Ranking 5

6.8 COCOA REHABILITATION

Suitability for Target Population. In Liberia, cocoa is grown almost exclusively by smallholders that cultivate one hectare or less. Very few large growers exist, unlike the rubber and oil palm sector where larger and medium-sized holdings are more common. Cocoa in Liberia has the potential to increase incomes for rural communities, but there are many constraints to overcome. Old cocoa holdings exist in all PROSPER communities, although there are very few in Barcoline. Many of the smallholdings were not maintained during the years of civil unrest, so much cocoa cultivation knowledge has been lost. Marketing structures like the Liberian Produce Marketing Corporation (LPMC) have become defunct. Individual traders travel through the cocoa producing areas offering low prices for small quantities of unprocessed, low-quality cocoa beans. However, in the past years, marketing structures (cooperatives and associations) have been formed and nurseries established with high yielding state-of-the-art cocoa varieties (from Ivory Coast and Ghana) near some PROSPER sites. Familiarity with the crop and its marketing makes the cocoa tree a suitable cash crop for some of the PROSPER communities. (Score 6)

A cocoa farm in Marlay (Quilla Community) near the Big Gio Forest

Photo: USAID PROSPER

Potential for Value Addition. Fermenting the harvested cocoa beans for a few days followed by proper drying to achieve a moisture content of <8% adds value to the beans. However, this should be classified as *improved production standards* and not as value addition (which implies a separate product). Well-fermented and well-dried beans will receive a premium payment, as the fermentation process kills germs and leads to improved taste and aroma. Drying can be achieved more quickly and better in a low-cost solar dryer. Cocoa beans are exported from Liberia without any further processing. (Score 2)

Existing Demand and Growth Potential. Cocoa beans are produced exclusively for the export market. The long-term forecasts for both the volume and price of cocoa beans on the world market are very positive. Growing demand and consumption in India and China are the main drivers. Rehabilitation, replacement (rejuvenation), and enrichment planting of new, short-maturing, and high-yielding varieties, in combination with the development of marketing structures, will maximize the growth potential that exists for cocoa. The establishment of a private cocoa input supplier, Wienco Liberia Inc., further raises the potential for multifold increases of cocoa bean production. In 2009, four cocoa buyers in Liberia controlled the market. Due to the liberalization of the cocoa market in 2011, 11 cocoa traders are now actively buying cocoa from farmers in the country. (Score 10)

Potential to Increase Income. Many smallholder cocoa farmers have limited knowledge of growing a high-quality and high-yielding crop. Many of them inherited their cocoa stands but were never properly trained in cocoa production. Often good quality cocoa beans are mixed with poor grade cocoa beans in order to boost the volume. However, traders will pay for the lowest grade in the batch. The quality of cocoa beans can be easily enhanced by proper fermentation, which can command a much better price. With no inputs like fertilizers and agro-chemicals but with good management (brushing, removing diseased pots, and canopy management), a cocoa farmer can harvest 192 kilograms of cocoa beans and earn approximately $314/acre for well-fermented and dried product. Further, the volume of cocoa beans can be increased by applying fertilizers. With proper modern management practices, fertilizers, and disease control products, the production could easily increase to 640 kilograms of beans and $1,050/acre. When the cost for the inputs is deducted, this still yields a return of $736— a 134 percent increase. The potential for increasing income and productivity is high. (Score 10)

Labor Requirement. The labor requirement for cocoa production is relatively low. However, after being abandoned for 15 or more years, trees and underbrush have become overgrown, and farmers must spend considerable time and labor clearing the farm. The canopy must be pruned and opened up for the cocoa trees to flourish and any increase in production to show. Pruning, under-brushing, and enrichment planting can be done in stages and do not require the ridged timetable of annual crops. Once the smallholding is properly rehabilitated and enriched with high-yielding varieties, the work devoted to the crop will pay well and the overall labor required will be moderate to ensure that the cocoa stand is in good shape. A good price for quality and quantity cocoa beans produced will enable the smallholder to employ daily laborers in peak labor periods. (Score 8)

Capital Required. The rehabilitation of a cocoa smallholding unit does not require much capital. The main requirement is labor, technical assistance, and marketing organization support. The first stage, consisting of light pruning, under-brushing, and opening the canopy, can increase production from old trees 80–100 percent. In the second stage, more rigorous pruning, fertilizer application, and enrichment or replacement planting will be necessary to increase production to a higher commercial level. Capital is required for both of these measures. Inputs like fertilizer and fungicides can be obtained through an input supplier on credit. Seedlings from commercial cocoa nurseries will have to be paid for by the farmer. The current price is $1.75/seedling. Seedlings can be subsidized in an early stage to encourage and stimulate farmers to buy them with money earned from increased cocoa bean production and higher quality (fermented and dry) cocoa beans. Once the new trees used in enrichment planting have starting bearing pods (two years), no subsidies are expected to be necessary to convince farmers to invest in more trees with their own money. The farmer can choose the scale of rejuvenation project, and the number of trees will vary according to his/her willingness and capability to invest. (Score 8)

Time Until Impact. Cocoa tree crop rehabilitation can have an effect in a relatively short period of time. The first phase (described above) can potentially increase the current low production by 100 percent in one season, from 1½ to 3 bags per acre. With proper fermentation and drying, a premium price can be obtained. Second stage rehabilitation comprises rigorous staged pruning that will slow down the production, from which the trees will need time to recover. However, this can be compensated by applying fertilizer that increases the yields. It takes two to three years before pods will be produced as a result of enrichment or replacement planting. The overall time until impact is moderate. (Score 6)

Reduced Threats to Biodiversity. The rehabilitation of cocoa provides a livelihood opportunity with good economic perspectives that can reduce the threat to biodiversity. Most smallholder cocoa farmers are involved in shifting cultivation to provide for their livelihood. With external support, rehabilitation of old cocoa can provide quick income that can be used to rejuvenate and increase production even further on the same piece of land. This intensification of the production recreates a permanent agroforestry production system in which forest trees provide partial shade to old (and eventually also new) cocoa trees. Rehabilitation and intensification of cocoa smallholders can reduce the dependency on shifting cultivation

for livelihood income. There is a possibility that farmers who do not have an old cocoa plantation will plant improved cocoa seedlings that are now available as an in-between crop in a shifting cultivation system. This land will then become part of a permanent agriculture production system and will reduce the land available for shifting cultivation typically used for food crop production. The likelihood of this scenario is not very certain due to the land tenure situation that can put the high upfront cost at risk. Furthermore, the upfront investment in new seedlings and labor will have to be paid for by the farmer/investor from within the community. Most communities that do allocate land to farmers from outside the community do not allow "outsiders" to engage in tree farming. (Score 6)

Cocoa Total Score 56; Overall Ranking 1

6.9 COFFEE

Suitability for Target Population. Robusta coffee, consequent to its central African origin, is best adapted to less elevated hot and humid forests of tropical regions. The crop is preferably grown between 15°N and 12°S in flat areas and elevations between 300 and 800 meters. Robusta requires a short dry season to flower. Before the civil unrest, coffee was an important, although relatively small, export crop. However, the production and cultivation of coffee was abandoned during the civil unrest from 1990 to 2003. Coffee trees were neglected and even cut down. Coffee is a minor crop in Nimba County. Like cocoa, coffee farmers are typically smallholders with less than two hectares of coffee. Knowledge about coffee cultivation has disappeared for the most part, and the government has offered no support. Most efforts to revitalize the tree crop sector have been geared toward cocoa, oil palm, and rubber. No coffee nurseries offer new coffee plant material for farmers, and no input suppliers provide agrochemicals and fertilizer specific for coffee cultivation. In addition, there is currently no extension message or methodology developed for Liberian farmers on how the rehabilitate the old coffee plants. The lack of interest from farmers and the lack of support services (specific coffee fertilizers, financing packages, or private or government extension services) make coffee cultivation much less suitable for the target population than alternative crops like cocoa. (Score 4)

Potential for Value Addition. There is no potential for value addition locally. Locally grown coffee is harvested, sun-dried, and milled (where the husk is removed). Since most milling machines operated in the past by the LPMC are no longer functioning, the dried coffee berries are pounded in a mortar to remove the husk. The de-husked coffee beans are sold to local traders. In border areas, the product is also taken across the border and sold. The money received (in West African francs, or CFAs) is used to buy commodities that are sold on local markets in Liberia. Liberian traders transport the dried coffee beans to Monrovia where they are aggregated and packaged in 50-kilogram bags for export. There are currently five exporters that export coffee. The possibilities for value adding are low. (Score 2)

Existing Demand and Growth Potential. The demand for Liberian coffee is low because of its low quality. Moreover, the world market demand over the last 10 years had trended toward Arabica coffee. The varieties grown in Liberia are Robusta (*Coffea canephora*) and Liberica (*Coffea liberica*). Robusta production in Liberia faces stiff competition from countries like Brazil that have mechanized Robusta production and produce that variety in large quantities for a very low price. The Robusta and Liberica varieties are used in industrial and low-end coffee blends. Robusta is well-adapted to lower elevations, is quite hardy and disease-resistant, and produces higher yields than Arabica coffees, although the world market price is much lower. Many low-end coffee brands in the U.S. and Europe have switched over to 100% Arabica coffee to attract buyers who perceive it to be superior. The climate conditions in Liberia are not suitable for the cultivation of Arabica coffee, which requires cooler temperatures more often found on higher altitudes. A local market is Liberia is virtually non-existent except for some expatriate supermarkets. The existing demand and growth potential for this commodity is low. (Score 4)

Potential to Increase Income. The income potential for coffee cultivation is low. The infrastructure for the coffee market is also weak, which leads to low profits for farmers. Coffee is a labor-intensive crop, and there are no government advisory or agro-input supplier services. The rehabilitation of coffee, which is composed of rigorous pruning and clearing, can increase coffee bean production. However, there is a low potential to increase income due to the absence of inputs to boost production like fertilizers and agrochemicals, the labor-intensive nature of coffee cultivation, and the low farm gate prices paid for coffee. Furthermore, the farm gate price paid by the buyer is based on the lowest quality coffee beans (with high moisture content) and does not offer an incentive for good quality coffee (well-dried, evenly ripened berries). The low production levels and few spread out producers result in high purchasing costs for the buyers, which results in low farm gate prices. (Score 6)

Labor Requirement. The labor requirement for coffee production is high. Besides the regular pruning and brushing, which is comparable to cocoa cultivation, the harvesting of the coffee berries is labor-intensive. The harvesting period stretches from November into March. Picking only ripe berries followed by drying and de-husking will produce good quality coffee. However, this requires several rounds of selective picking. (Score 4)

Capital Required. The capital requirement for rehabilitation of old coffee farms is relatively low. Besides tools, the investments required are mainly time and effort. New, improved plant material has not been developed in Liberia for farmers to use for replacement planting or to increase their tree density per acre. Farmers that would like to use their own selected sprouted berries will have to cultivate the young trees for five years before they will start bearing fruits. (Score 8)

Time until Impact. The impact time for coffee rehabilitation activities is from two to five years. Unlike cocoa, immediate pruning is necessary, which can improve production in the first year. The absence of "tailor-made" coffee fertilizer and the non-availability of pest control products will lengthen the rehabilitation time. Brushing and pruning will increase the production only marginally. Furthermore, the absence of new improved coffee lines, multiplication sites, and nurseries make it difficult to increase production per acre through gap planting and replacement planting. (Score 5)

Reduced Threats to Biodiversity. Coffee rehabilitation could reduce threats to biodiversity in community forests. Shade-grown coffee fits very well in an agroforestry production system. As mentioned for other perennial cash crops, there is a chance that if the world market price for Robusta coffee rose sharply and prices for coffee were exceptionally high compared with other perennial crops like cocoa, farmers would thin out secondary forest to plant coffee, or would plant coffee on older fallow forestland. As discussed earlier, this could happen for any crop, annual or perennial, for which demand and price are high for a sustained period. (Score 6)

Coffee Total Score 39; Overall Ranking 7

7.0 SELECTION

Based on analysis provided above, hot peppers, plantain, oil palm, and cocoa ranked the highest for potential PROSPER investment. The first three crops can be classified as food cash crops while the latter is an exclusive cash export crop. Market infrastructure is in place in all PROSPER communities, but to a slightly lesser extent in Grand Bassa.

COCOA

Cocoa has been cultivated in Liberia with great success, almost exclusively by smallholders with less than two hectares—of which there are many in the PROSPER communities in Nimba County. The holdings in Grand Bassa County are much smaller. Support for cocoa rehabilitation is currently undertaken by the World Bank and U.S. Department of Agriculture through the LIFE I–III projects (implemented by ACDI/VOCA). Currently ACDI/VOCA is implementing LIFE III in Lofa County and parts of Nimba County (not in PROSPER sites). The introduction of a large input and credit supplier, Wienco Liberia, is a new development in the cocoa sector. Furthermore, the increase in number of licensed cocoa buyers from four (2009) to 11 (2013) shows the strong potential for growth in this sector. Since November 13, 2012, Liberia has been an aspirant member of the International Cocoa Organization. Full membership will bring an end to the automatic price deduction of Liberian cocoa (downgrading). The ratification of the membership agreement is currently pending at the Liberian Ministry of Foreign Affairs. In all, cocoa rehabilitation is supported by a strong, re-emerging private supply and marketing sector, of which the smallholder farmers in PROSPER supported community forests areas can greatly benefit.

Though vastly overshadowed by rubber, cocoa is Liberia's second most important agricultural export crop. Official exports have amounted to 2,000–3,000 tons/year in recent years, but total production is estimated at about 10,000 tons from about 30,000 hectares, with most of the production exported through neighboring countries.[27] Liberia has a good comparative advantage for the production of cocoa based on agro-climatic conditions (comparable to Ivory Coast). However, the crop never developed into a major industry in Liberia, essentially because of the government's neglect and mismanagement of the sector. Cocoa can have a significant impact on broad-based income growth and on the reduction of threats to biodiversity in community forests in the PROSPER sites. The cultivation of the crop is not labor-intensive, although harvesting and fermentation requires substantial labor. This labor, however, is spread over a number of months. Cocoa does not require heavy up-front investments in processing and offers a major opportunity for forest-based agriculture communities to diversify their productive base away from a dependence on shifting cultivation. Cocoa will benefit from favorable international prices in the medium-term, which can sustain smallholders' interest in the rehabilitation and rejuvenation of existing smallholder plantations if the pass-through of international prices to farmers is improved and better access to technology/services is provided.

OIL PALM

Oil palm re-vitalization will enable smallholders to increase production of Tenera oil, derived from hybrid trees. Labor remains the key driver to profitability of palm oil production. Manual local oil extraction methods by mortar or pit are very labor-intensive and therefore expensive. Support for processing oil would reduce the labor per unit produced and would improve producer margins in both Dura and Tenera.

[27] When Liberian cocoa is taken to a neighboring country and exported from there, downgrading does not apply.

Regional markets offer strong demand for interior smallholder palm oil production. Smallholders in the PROSPER sites in Nimba can sell into higher price neighboring counties (Grand Gedeh) and into Guinea. Increased oil palm production will provide income opportunities in processing and the transport sector. Further, PROSPER can build on the experiences gained in the USAID SHOPS project over the past few years.

HOT PEPPERS

The cultivation of hot peppers offers great opportunities when production can be moved to periods of high prices. Simple, low-cost drip irrigation, experimented with very successfully by the SHOPS project in an oil palm nursery, could be an alternative to small gas-powered water pumps. Further, drying facilities to dry peppers quickly if needed would prevent post-harvest losses. The informal marketing system is well-developed. The production of hot peppers is still part of the shifting cultivation production system, which regenerates soil fertility over time in the forest fallow period. Intensification of the production on the same piece of land would require an external source of nutrients for the plant, requiring cash up front for fertilizers, which might be unfeasible given the non-existence of credit facilities.

PLANTAIN

Plantain production and expansion is very popular because of the relative low cost involved. Self-produced suckers can be used to expand the cultivated area. Very little technical recommendations are available to increase the production of plantain. There is no research or government program supporting the sector with improved husbandry recommendations or improved plant materials. Although the crop scores high in the overall ranking, it is not clear how PROSPER could contribute to further improvement of the crop production. One of the highest costs in plantain production is the transport of the plantain bunches from the production site to the place where it is sold. Improvement of general infrastructure, which is beyond the scope of PROSPER, can reduce these costs.

8.0 CONCLUSIONS

The objective of this assessment was to serve as an instrument to determine which value chain(s) to support and develop in PROSPER communities. The Liberian context provided multiple challenges in gathering required information. Lack of household-level data (yields, quantified data on family consumption versus what they sold, etc.) and communication challenges required the assessment team to make conclusions under less-than-ideal circumstances.

Nevertheless, the assessment garnered a few key conclusions. Shifting cultivation is a threat to biodiversity in forest areas, yet in many communities, the barriers to enter alternative crop production are high. Poor feeder roads mean that farmers cannot get their crops to markets in a timely and cost-effective manner. Exorbitant transportation costs cut into profits for traders and farmers alike, while poor electricity and communication services mean that farmers lack access to crucial information (such as market prices). In addition, they do not have access to external inputs that would increase their yields. Lack of knowledge and sources on crop and land use management mean that farmers are not using the latest farming techniques, further limiting their yields.

Despite these challenges, there are key potential markets in which smallholder farmers can participate. As rural-to-urban migration increases throughout Liberia, there will be a rise in the demand for food products in urban areas coupled with a decrease in the number of food producers in rural areas. This will increase market opportunities for the smallholders while continued government investment in infrastructure will reduce the costs of getting products to the urban markets. Investments from other donor-funded activities have provided tangible results to farmers in other areas that, when leveraged, can play an important role in demonstrating successful change to PROSPER beneficiaries.

Finally, after careful analysis, cocoa, hot pepper, oil palm, and plantain emerged as the top four value chains worth consideration. Each proved to have a good balance of labor and capital requirements and high potential for biodiversity conservation, while also being suitable for the target population. These crops also have a strong domestic market and, in the case of cocoa, strong export market potential. Previous and current investments by other donors in oil palm and cocoa have strengthened key aspects of these value chains, allowing PROSPER beneficiaries to take advantage of these improvements. Upon still closer review of program resources and the amount of time remaining, the four value chains were narrowed down to **cocoa** and **oil palm**. For PROSPER communities, the involvement in tree crop production is favorable to staple crop production, particularly rice, which competes with low-priced imports. The historical investment in cocoa means that farmers have the opportunity to rehabilitate existing land without threatening the biodiversity of community forests. While expanding oil palm farming has limitations (especially the high capital costs for new seedlings), processing of oil palm fruits and kernels has proven to have high potential for increasing household income.

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ANNEX 2: REFERENCES

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