

ASSESSING POTENTIAL CARBON REVENUES FROM REDUCED FOREST COVER LOSS IN LIBERIA

Jessica Donovan^{*}, Keith Lawrence⁺, Christopher Neyor[‡], Eduard Niesten⁺ & Eric Werker[§]

Working Paper

Abstract

We conducted an analysis that explores the merits of a low-carbon development strategy for Liberia. This chapter describes both our cost-benefit analysis initiative and a plausible policy process for Liberia. We proposed a simple approach that models the costs and benefits of land placed under different uses. Policy scenarios then determine the amount of land under each land use and the implications for costs, benefits, and carbon emissions. A “low-carbon development strategy” for Liberia would include a number of cost beneficial policies, the most obvious being a transition to more efficient agriculture. Other beneficial policies include accelerating the establishment of Protected Areas; ensuring that tree crop plantations are located on degraded land rather than forest areas; and introducing energy-efficient stoves for charcoal and fuel wood.

^{*} Conservation International, Monrovia, Liberia.

⁺ Conservation International, Washington D.C.

[‡] Ministry of State, Republic of Liberia, Monrovia, Liberia.

[§] Harvard Business School, Boston, Massachusetts.

After fourteen years of conflict that led to a collapsed economy, destroyed infrastructure and displaced hundreds of thousands of people, Liberia is rapidly restructuring its government institutions and developing a platform for strong and sustainable economic development. Following a 2003 peace agreement, economic growth quickly rebounded to an estimated 9.5 percent in 2007 and 7.1 percent in 2008 (CIA 2010). However, continued recovery must overcome difficult challenges, with over half of all Liberians living in poverty, high unemployment, few functioning schools and hospitals, limited potable water, and a lack of electricity infrastructure outside of Monrovia.

One consequence of the civil conflict was relatively low deforestation rates, as much of the population was forced to leave the countryside and migrate to the capital and other major cities. Exports of timber and agricultural products, like every other industry in the country, drastically slowed (although they picked up substantially towards the end of the civil war under the regime of Charles Taylor)¹. The net result is that Liberia currently hosts nearly forty percent of all remaining forests within the Upper Guinean Forests, a region stretching from Guinea to Togo (Myers et al, 2000). This is a natural asset that Liberia can choose to manage in various different ways. Depending on how international markets for carbon evolve, one option is to implement policies that reduce deforestation rates and to sell the carbon credits that these policies generate, providing a much-needed source of revenue for the nation.

Global efforts to limit global warming by reducing the quantity of carbon emitted into the atmosphere are likely to yield significant market opportunities. Reducing emissions through policies to avoid deforestation or regenerate forest in developing countries like Liberia may generate carbon credits much more cost-effectively than through emission reductions in industrialized countries. These credits may be sold through bilateral agreements such as that

recently signed between Norway and Guyana;² through voluntary transactions between private parties; or through a market framework such as the Reduced Emissions from Deforestation and Degradation (REDD+) mechanism proposed within global negotiations currently taking place under the United Nations Framework Convention on Climate Change (UNFCCC). Under REDD+ transactions, the amount of compensation would be linked to performance based on monitored and verified reductions in carbon emissions relative to a business-as-usual baseline.

Today, several driving factors place Liberia's forests at risk. The predominant form of cultivation, slash and burn agriculture, threatens new areas of forest each year. This source of pressure will intensify as war-displaced populations leave the cities and return to rural areas and establish farms for local production. Expansion of the road network will open previously untouched tracts near or within forest areas and further contribute to deforestation rates. Illegal pit sawing, mining activities, and the collection of fuel wood and charcoal are eating away at Liberia's forests. Without adequate planning, expansion of plantations and concessions for rubber, oil palm, timber and other products will also accelerate deforestation.

The agriculture and timber sectors make significant contributions to Liberia's economy as do development programs such as road building. However, the associated forest loss also causes a range of negative impacts that impose real costs on the people of Liberia and globally. Deforestation leads to soil erosion and impoverishment, reduction in the quantity and quality of freshwater supplies, habitat loss and accompanying declines in availability of wild foods, increased risk of fires, and more. Forest loss also produces carbon emissions that contribute to global climate change. Understanding the tradeoffs between policy options—in terms of opportunity costs, land requirements, the distribution of benefits and impacts on local

communities—is essential to making policy choices, including any possible move towards a low-carbon economy.

Positive steps towards a low-carbon economy are already visible. Liberia has initiated a forest sector reform process to evaluate these tradeoffs and rationalize forest use. The resulting National Forest Management Strategy centers on the “3C approach,” seeking an optimal allocation of the nation’s forest resources between Commercial use, Conservation and Communities. This strategy positions the forestry sector to create jobs, drive economic growth, and generate revenues from the global market for carbon credits. Guidelines in the new forest reform law provide the legal framework for sustainable forest management and establish oversight for an industry that once helped fuel the country’s conflict.

To pursue a low-carbon economy, Liberia will have to implement activities that limit deforestation within its current development strategy, even though these activities will generate costs in addition to benefits. Liberian policymakers must carefully consider the decision to depart from a trajectory of aggressive forest exploitation and conversion to commercial plantations and agriculture. A coalition of civil society groups have been seeking support for a deal with a major bilateral donor that restricts activities linked to deforestation and compensates Liberia for the opportunity cost of these steps. Due to importance of these decisions for the country’s future, the Liberian Cabinet decided that a formal cost-benefit analysis would assist them in weighing the merits of a ‘low-carbon’ policy.

To inform policy deliberations, Conservation International and the Government of Liberia (the Government) conducted an analysis that explores the merits of a low-carbon development strategy for Liberia. The Government assessed the costs involved, the potential value of carbon credits that could be generated, and potential sources of funding. The study

focused on deforestation and degradation, rather than other sources of carbon emissions such as energy and transportation.

Although formal cost-benefit analysis has not historically been part of the lawmaking process in Liberia, the country's policymakers are prudent and often risk-averse, and will demand further studies before committing to a change in policy direction. In the past, the Government has used quantitative analysis to evaluate policies and agreements governing its natural resource sector, including, the largest investments in Liberia, the iron ore and tree crop sectors. Through quantitative analysis, the Government has sought to identify the most practicable tax instruments to maximize revenue while continuing to attract investors.

Estimating Costs and Benefits

To ensure broad acceptance of the results, we engaged relevant audiences in Liberia early on to agree on a methodological approach that was rigorous enough to yield meaningful conclusions but straightforward enough to permit easy communication of results. We proposed a simple approach that models the costs and benefits of land placed under different uses. Policy scenarios then determine the amount of land under each land use and the implications for costs, benefits, and carbon emissions. Before proceeding with the analysis, this approach was vetted through a carbon working group in Liberia that convened key government agencies as well as civil society representatives. This group is made up of a broad spectrum of interested stakeholders in climate change mitigation and REDD+ issues; it was initially formed prior to COP 13 in Bali to help coordinate Liberia's participation. It is co-chaired by the Forestry Development Authority (FDA) and the Environmental Protection Agency (EPA) and includes members such as the Ministry of Gender, Ministry of Agriculture, University of Liberia, Conservation International, Fauna and Flora International, International Union for Conservation

of Nature (IUCN), and civil society groups in Liberia. Since then the group, now renamed the REDD technical working group, has been providing technical guidance to government agencies in relation to REDD+ and other climate change mitigation opportunities. This has included reviewing the prospects for carbon trading and developing the national document for the Forest Carbon Partnership Facility. The group agreed on a three-step approach to identify potential policies to reduce emissions from deforestation and forest degradation, and to perform cost-benefit analyses of these policies.

Step 1: Identify Candidate Policies with Potential to Reduce Carbon Emissions

The analysis team consulted policymakers in a wide range of sectors during a series of visits to Liberia, including representatives from forestry, agriculture, planning, lands, mines and energy, infrastructure, public works, finance, the governance commission, internal affairs and the Liberia Institute of Statistics and Geo-Information Services (LISGIS), as well as representatives from the private sector, international organizations, civil society and academia. We sought to elicit suggestions for possible low-carbon alternatives to the business-as-usual policy scenario. These proposals were complemented by a literature review and ideas drawn from best practices in other countries to generate a set of candidate policies to assess. Alternative policies that were evaluated included only those deemed plausible for implementation in Liberia, at some scale, with a clear and quantifiable reduction in deforestation and degradation—or increase in forest regrowth.

Step 2: Economic Modeling of the Costs, Benefits, and Carbon Impacts of Each Proposed Policy

Economic costs—including opportunity costs and, when possible, employment impacts—and benefits were estimated for each individual potential carbon emission reduction measure with assumptions developed from published sources (e.g. Barbosa Filho and Yamada, 2002;

Duflo, Kremer, and Robinson, 2008; Openshaw, 1974; Persson, 1975; Pinard and Putz, 1996; Pretty, 1999; Ullah et al, 2009), and particular attention to projecting the costs per tons of carbon emissions potentially avoided. Different modeling techniques were required for each proposed measure, depending on the nature of the policy (for example, whether it changes the area under a given land use or changes the practices of the land use) and the availability of different types of data sources. Other types of benefits, such as biodiversity gains or impacts on water supply, were excluded and noted qualitatively. We did not discount future values (hence we ignored the effect of any differences between the timing of the costs and the timing of the carbon savings), but capped all analyses to a twenty-five-year time horizon. In addition, we did not model beneficial multiplier effects from environmental sustainability or job creation.

Step 3: Assess the Potential for Carbon Revenues

As noted earlier, carbon transactions can take several forms—bilateral arrangements, voluntary deals, and, eventually, sales in a global market for carbon credits—which will determine the actual carbon revenue from Liberia's forests. Given prices seen in existing forest carbon projects (with an average around \$7 per ton of carbon dioxide in Madagascar; \$5 per ton in the bilateral agreement between Norway and Guyana), and the potential prices under a post-2012 REDD+ finance mechanism (which could be higher), Liberia may expect to obtain between \$5 and \$15 per ton of carbon dioxide. Our analysis compared the costs of emission-reduction measures to potential revenues assuming a price of \$5 per ton of carbon dioxide, in order to provide a conservative assessment of those policies that would create a net benefit for Liberia.

Perhaps the most challenging methodological issue was the definition of an appropriate baseline or business-as-usual scenario. First, the long period of recent civil conflict in Liberia does not permit simple extrapolation of existing trends as there have not been any well-defined

trends in the Liberian economy since the 1970's (Werker and Beganovic, 2011). Second, ambitious existing policy frameworks with respect to forestry, agriculture, mining, and road development, for example, might have well-defined goals but gaps between policy goals and implementation capacity mean that these frameworks do not necessarily represent a likely business-as-usual scenario without qualification. However, defining something else as business-as-usual would contradict stated government policy, leaving the analysis in somewhat of a bind. This ultimately was resolved through careful use of language and terminology, and a general agreement that many key features of likely scenarios remain in flux. We based our projections on the best available data, including trends observed in geographically and economically similar countries.

Results

The results of the analysis (Lawrence, Niesten, and Werker, 2009) suggest that several low-carbon policy options could be economically beneficial for Liberia. Together, these could comprise the potential foundations of a “low-carbon development strategy” for Liberia. This strategy would include the elements summarized below.

1. Moving to a more efficient agricultural system can be an extremely cost-effective way to generate carbon credits. By replacing shifting cultivation with either conservation agriculture or irrigated lowland rice cultivation, or by subsidizing fertilizer inputs, Liberia can reduce the amount of forest lost to slash-and-burn practices each year. Under these systems there would be enough land available to both produce Liberia's food needs and assign large areas to regenerate the natural forest cover. Although these policies require significant set-up costs, they would be profitable, and sometimes even self-financing, for farmers on an ongoing basis, even without carbon credits. Carbon finance could certainly

help to fund the set-up costs; at a price of \$5 per ton of carbon dioxide, these policies would all be profitable for Liberia. However, the challenges in changing the dominant mode of agriculture should not be understated: land tenure is often insecure; access to capital, knowledge, and appropriate land is often absent; and mindsets are difficult to change.

2. There is already legislation in place to create 1.5 million hectares of protected areas. The Government of Liberia included this commitment in the redrafting of forestry laws, demonstrating its commitment to sound forest management practices under the 3C approach of harmonizing Commercial, Conservation and Community uses. The commitment to the proposed protected area network is outlined within the Forestry Reform Law of 2006. Accelerating the establishment of these areas would further reduce carbon emissions, as well as protecting the cultural and natural assets they contain. Carbon revenues could help fund the set-up costs involved; at \$5 per ton of carbon dioxide, this acceleration would be profitable for Liberia.
3. Ensuring that tree crop plantations are located on degraded land rather than forest areas can generate significant carbon credits at virtually zero cost. Essentially, all that would be required is a policy decision not to allow foreign-invested plantations to be located on primary or secondary forests; there is more than enough degraded land for this purpose, as the significant current tree crop base represents less than one-tenth of degraded land. The zero-cost assumption assumes that plantations are equally beneficial to the Liberian economy on degraded land as on forests, and that other economic activities that might have occurred on the degraded land are not displaced.

4. Timber Sales Contracts (TSCs) are small concessions that permit total clearing and conversion. Reducing the number of TSCs issued, and instead placing these areas into carbon concessions, would save large amounts of carbon at an estimated cost of \$3.75 per ton of carbon dioxide, due to the intense nature of the logging of these areas. The agricultural land opened by clearing under TSCs would not be needed if the above-mentioned agricultural policies are also implemented.
5. Introducing energy-efficient stoves for charcoal and fuel wood would reduce pressure on the forests. This policy would be profitable for Liberia if \$5 per ton of carbon dioxide were received for them.

Together, this twenty-five-year low-carbon development strategy would provide substantial benefits for Liberia:

- Carbon revenues of \$58.7 million per year, assuming a price of \$5 per ton is received, and an ambitious but nonetheless gradual adoption of modern agricultural techniques (revenues could increase to three times this amount if prices of carbon credits continue to rise);
- More efficient, higher-yielding agriculture;
- Increased protection of natural and cultural heritage within protected areas;
- A reduction of 11.7 million tons of CO₂ emissions per year, equivalent to around one half of Liberia's annual deforestation; and
- Status as a regional leader in climate change mitigation, creating green jobs.

Set-up costs, management costs and lost timber revenues are estimated to average around \$22 million per year, plus an additional \$5 million per year for national coordinating and monitoring institutions (which could also coordinate climate-change adaptation policy). However, these

costs would not be spread evenly over the twenty-five years. Costs would be significantly higher in the early years as programs are initiated and set-up costs are incurred. Liberia could look for opportunities to partner with organizations prepared to fund these set-up costs.

Other policies could also be attractive, depending on factors such as the price of carbon that is achieved. Replacing some commercial timber with carbon concessions could be financially beneficial if the price of carbon credits rise relative to timber, or if Liberian forests are found to contain less timber than is currently estimated. This result also depends on the financial performance of Forest Management Contracts (FMCs — large concessions for sustainable commercial timber harvest) and whether the profits generated stay within Liberia. Under our baseline assumptions,³ a carbon credit price of at least \$13.50 per ton of carbon dioxide would be required before this policy becomes beneficial to Liberia. If the FMCs are less productive than currently anticipated, then it would be beneficial to Liberia to reduce the targeted area of FMCs at lower prices, perhaps as little as \$7.25 per ton of carbon dioxide. These same considerations also influence the decision over whether community forest areas should be managed for sustainable forestry or as carbon concessions. Table A summarizes the key results by policy.

To realize these carbon revenues, Liberia could choose to participate in different types of carbon finance arrangements. This includes signing a bilateral deal similar to the agreement between Norway and Guyana, engaging in the current voluntary carbon markets and the Clean Development Mechanism (CDM), or participating in a global carbon market.

The low-carbon economic analysis yielded several policy approaches that could reduce Liberia's deforestation rate and create opportunities to generate credits from Liberia's vast forest estates. These proposed policies would be challenging to implement for a number of reasons.

Changes in agricultural practices require better definition of property rights, capacity building amongst farmers and extension agents, coordination across communities and land owners, and drastic reshaping of subsistence farmer perspectives. Securing broad based buy-in for reorienting the forestry sector faces political and practical hurdles. Finally, generating carbon revenue requires sophisticated national and legal policy and regulatory support, and enhanced (or outsourced) governance capacity.

The benefits of a low-carbon economy extend beyond revenue generation. Implementing a low-carbon development strategy and producing carbon credits can provide new opportunities for entrepreneurs and create green jobs that help address unemployment. Successful carbon transactions also offer distributional benefits. Since carbon revenue depends on performance,

Table A: Key Results by Policy, Including Potential Carbon Revenues

Policy	Average CO2 saved per yr over 25 yrs (million tons)	Cost of carbon saved (\$/tCO₂)	@\$5/ton: Carbon revenues per year (\$M)	@\$5/ton: Net benefit / cost per year (\$M)
100,000ha of plantations are located on degraded land rather than forest areas	2.1	Very low	10.6	10.6
Fertilizer subsidies to increase efficiency of shifting agriculture	1.8	<2	8.8	7.1
Lowland rice promoted in place of shifting agriculture	1.6	<2	8.2	6.3
Conservation agriculture promoted in place of shifting agriculture	1.7	<2	8.6	6.1
Accelerated creation of Protected Area Network	0.2 ¹	<2	0.8	0.5
Increased efficiency of charcoal production & use	1.1	2.67 - 3.20	5.7	2.1
No further TSCs	3.2	3.75	16.0	4.0
<i>Sub-total for potential low-carbon development strategy</i>	<i>11.7</i>		<i>58.7</i>	<i>36.7</i>
Restrict FMCs to 1.6 million ha	1.8	7.25 - 13.50	9.2	-4.1 to -15.6

¹ 0.8 for 5 years, then zero

community decisions and actions will be critical in determining the level of revenues received. Communities must derive tangible benefits from these deals. Thus, appropriately structured carbon deals will advance Liberia's poverty reduction strategy, which emphasizes equitable distribution of benefits as an essential element of poverty reduction.

Effective implementation of a low-carbon economic strategy requires strengthened governance structures at all levels, from local communities to national bodies. Indeed, preparing for REDD+ carbon market opportunities can catalyze improved governance structures that will help reduce the potential for conflict in rural areas and can subsequently be applied to other needs, such as climate change adaptation and protecting watershed services provided by forests.

From Cost-Benefit Analysis to Policy

The cost-benefit study on its own is still a long way from constituting a set of concrete Liberian policy proposals. Moreover, as described in the subsequent section, putting forward a low-carbon economic development plan is not something the Government could do in isolation because it stands on the premise that developed countries will finance carbon sequestration efforts. With that in mind, we sought to embed the study in a larger Liberian-run initiative.

As a first step, the results of the study were presented at a workshop in Monrovia attended by many members of the sustainable development community in Liberia. Such workshops form an important part of the process by which policies are presented and legitimized in the Liberian context. The Energy and Climate Change Adviser to President Johnson Sirleaf convened the workshop and invited high-level decision makers from a variety of ministries and agencies, as well as from the donor community and civil society. The workshop proceeded in the following two parts. First, the President's Energy and Climate Czar proposed the creation of a

National Climate Change Steering Committee (NCCSC), which would be supported by a Climate Change Secretariat and housed in the Office of the President, to coordinate national climate change policy. Second, the technical authors of the cost-benefit analysis presented the findings of the study.

This two-part process reflected a deliberate strategy. Although external technical authors could research the areas in which Liberian development could be made less carbon intensive and quantify the tradeoffs involved, they would be less suitable for developing and balancing the actual policies. For the latter, a high-capacity yet streamlined body within the government would need to take the initiative, coordinating engagement across the various ministries and agencies that oversee economic activity in Liberia. Thus, the cost-benefit analysis itself was only intended as the first step in an iterative process between a small climate change team in the Office of the President and the various actors who would need to actually formulate an externally funded low-carbon development plan. Cost-benefit analysis was generally well received, with minimal controversy, aided by the technocratic and non-political nature of the findings. But this does not imply that the findings will be quickly adopted. The ultimate take-up of the policies will no doubt follow a more political process.

Once the proposed Climate Change Secretariat is set up, its technicians can take the lead in investigating how, and if, each carbon-saving measure examined in the cost-benefit analysis can be implemented in Liberia. Coordinating with governmental ministries and agencies, development partners, and civil society organizations, the Secretariat will create a comprehensive proposal. The proposal would spell out a series of specific interventions, as well as implementation costs, timelines, and the amount of carbon emissions avoided. The Secretariat

may need to cultivate buy-in from other government actors to pursue these policies. This would be conditional on there being sufficient financing to see them through.

The Secretariat would next submit the proposal for a low-carbon development strategy to its advisory body, the NCCSC, and other domestic stakeholders. Once validated, it can be “shopped around” by the Government to potential carbon buyers. Buyers will most likely include the Government of Norway, a World Bank facility, or another bilateral partner if present trends continue. Taking into account credit constraints in the Liberian public and private sectors, the proposal will include a combination of traditional up-front development funding for activities like agricultural extension as well as performance-linked incentives tied to observed emission reductions based on an appropriate monitoring, reporting, and verification (MRV) system.

At the time of this writing, the proposal to establish the NCCSC and its Climate Change Secretariat had just been approved by the Liberian Cabinet. Initial groundwork to flesh out the potential components in a national low-carbon economic development strategy has been undertaken. With organization of and capacity building in the Climate Change Secretariat now underway, the broader task of costing out the strategy and integrating it into national policy can now begin. It promises to be an exciting journey.

Implementation Risks

We have discussed the complexities of progressing from the technical cost-benefit report that describes low-carbon options to specific government policies. As in any political process, there are inherent risks both in moving the cost-benefit study to endorse and implement these national policies.

First, there is the risk that the study would not draw the necessary understanding and response from the relevant government functionaries. In a post-conflict country like Liberia where senior policymakers are preoccupied principally with short-term results, adopting a long-term policy position at the expense of short-term gains is unappealing no matter the value of long-term benefits. For instance, employment is an urgent priority. Timber extraction and forest conversion to oil palm plantations are seen as two of the most promising avenues for job creation, though in direct conflict with low-carbon ambitions. This is where funding commitments from the donor community (Annex I parties in UNFCCC jargon) can make an important difference.

However, securing donor commitment also introduces uncertainties. The funding risks are of two types. The first type of risk involves funding for the Secretariat and other national institutions that are required to make the most efficient use of Liberian forest cover. Senior policy makers in developing countries are leery of the slow pace that typically characterizes significant commitments and disbursements by donors. They are also apprehensive about the possibility that new money will not be committed or released until after considerable time and resources have been spent shifting to low-carbon policies. This interplay poses a risk to the transition from cost-benefit study to policy, in a chicken-and-egg situation where policymakers are reluctant to commit scarce time and budget until they see donor commitments, and donors do not want to commit funds until they see policy change.

The second risk with donor funds concerns the very creation of a market for REDD+ carbon credits more generally. Of all the modes of carbon emission mitigation, REDD+ in tropical countries may be the most difficult to demonstrate that a reduction in emissions has indeed occurred. As a result, tropical REDD+ credits are among the least likely to become part of

compliance markets anytime soon—even though they may be among the cheapest credits to produce, assuming they could be measured accurately. Donors recognized this dilemma and in the discussions in Copenhagen in December 2009, six nations pledged \$3.5 billion to jumpstart REDD+ projects (Moralse and Penny 2009). This is by far the largest potential market for REDD+ carbon credits today yet there is still no certainty that it will be realized in such a quantity and institutional form that may feed into a national program in Liberia.

Once the funding and market challenges have been overcome, and proper low-carbon policies are in place, there will be risks associated with implementation. Among these is the risk that human capacity and available technology are inadequate for ensuring effective implementation, for instance with respect to monitoring and verification provisions that meet international standards. In addition, since any eventual policy is likely to rely on incentives to individual actors through a market-like approach, there remains a risk that the analysis in the cost-benefit study does not accurately reflect the decisions people may take in the future. At the end of the day, policies can only set the incentives, and it will be farmers, communities, and firms that will determine how to use or not use the forest. The price of timber, cocoa, and the unemployment rate in urban Liberia will all affect that equilibrium. Political risk may discourage private carbon concessionaires from making long-term investments. This means that the amount of carbon revenue that actually materializes may not meet expectations.

In ongoing climate change negotiations, the UNFCCC has been working to address these cross-cutting risks in a new legally binding climate change treaty. The outcome of these negotiations will have a critical impact on prospects for addressing climate change, on the fate of forests throughout the developing world, and on economic opportunities for highly forested countries like Liberia. Given that Liberia has signaled a willingness to entertain the possibility of

a low-carbon development strategy that protects forests, we strongly hope that the emerging climate change treaty includes provisions that accommodate trade in carbon credits generated through REDD+ activities. Although overall progress on such a treaty has been extremely disappointing with no resolution appearing imminent at the time of writing, there have been positive developments on the acceptance and inclusion of REDD+ specifically. In the meantime, a bilateral deal appears to be the most promising route to Liberia receiving revenues from generating carbon credits.

Conclusion

This chapter describes both our cost-benefit analysis initiative and a plausible policy process for Liberia. A “low-carbon development strategy” for Liberia would include a number of cost beneficial policies, the most obvious being a transition to more efficient agriculture. Other beneficial policies include accelerating the establishment of Protected Areas; ensuring that tree crop plantations are located on degraded land rather than forest areas; and introducing energy-efficient stoves for charcoal and fuel wood. The net benefit of changes to forestry policies are less clear: reducing the number of Timber Sales Contracts would be cost beneficial but replacing commercial timber with carbon concessions is more marginal.

It can be difficult to communicate the concept of generating revenue through *not* emitting carbon dioxide. It is hard to understand how to produce an emissions reduction, and harder still to evaluate, and communicate to a lay audience, the costs and benefits of a national policy to engage in this market, especially when that market is yet to be created! These challenges are multiplied when working in a capacity-constrained environment like post-conflict Liberia. We believe a committed effort to achieve this would be worth it though, for our results highlight the

tremendous potential for this emerging market to contribute to Liberia's development and suggest a path to move it forward.

Notes

¹ See International Tropical Timber Council, *Achieving the ITTO Objective 2000 and Sustainable Forest Management in Liberia* (2005).

² See Memorandum of Understanding Between the Government of the Cooperative Republic of Guyana and the Government of the Kingdom of Norway Regarding Cooperation on Issues Related to the Fight Against Climate Change, the Protection of Biodiversity and the Enhancement of Sustainable Development, Guy.-Nor. (November 9, 2009).

³ Our baseline assumptions for the forestry sector are 8 m³ of timber achieved per harvested hectare on a sustainable basis with export prices of \$230/m³.

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