The Munden Project

REDD AND FOREST CARBON:

Market-Based Critique and Recommendations

March 7th, 2011

Please send all comments, feedback and inquiries to
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Foreword

The following analysis is intended as a market-based critique of REDD's tacit design for forest carbon markets. Before reading it, please note the following:

1. Although The Munden Project is a private company, our work is conducted under a grant from the Ford Foundation and requires that we adhere to a conflict of interest policy.

Under that policy, we refuse any for-profit work (from clients such as hedge funds, project developers, etc.) related to REDD, REDD+ or emissions trading, and we do not speculate, invest in or otherwise hold any position in carbon markets generally. This extends to our subsidiaries and our management.

This policy is not intended to suggest that carbon trading is bad. Rather, it is to ensure that we remain objective. If we had clients offering liquidity in a forest carbon market, the potential upside for our company would compromise objective analysis.

2. Given our (within REDD) somewhat unique experience in derivatives trading platforms and commodities markets, some of our conclusions will undoubtedly be employed by those opposing these markets to support their arguments.

In our view, doing so with the simple goal of criticizing the status quo is shortsighted. Whatever the shortcomings of REDD's current market design – and there are many – pointing out these shortcomings is only useful insofar as it informs us as to what the real solutions might look like.

Having entered this area as outsiders unfamiliar with the REDD debate, it is painfully obvious that there is a polarization of camps with respect to forest carbon and the role of private markets generally. Continuing this state of affairs does little to solve the very real problems that REDD is attempting to address.

Bearing this in mind, we direct the reader's attention to the final section of this document. Therein, we make some broad recommendations for an improved approach to filling REDD's investment gap. We also make passing reference to a couple of solutions that we are working on right now. These are still in the developmental stage, but we would be very interested in sharing the details of those solutions with certain parties.

Email addresses appropriate for each solution have been provided in the footnotes and we encourage all motivated parties to contact us. Our goal is not simply to criticize efforts to invest in fighting deforestation, but to improve them.

Thank you.

INITIAL ASSUMPTIONS

We have examined REDD from a market perspective, using our experience in derivatives trading and systems architecture to examine its mechanisms for financing forest preservation through capital invested in forest carbon markets.

Taking the perspective of a software developer presented with a new product concept, we start with the following questions: what is the system intended to achieve? Why is that outcome worth the investment of time, money and effort required not just to produce, but more importantly, to maintain and operate the system? And, most importantly, what impact is that system likely to have?

With respect to intent, the United Nations describes REDD in the following terms[1]:

> *REDD is a mechanism to create an incentive for developing countries to protect, better manage and wisely use their forest resources, contributing to the global fight against climate change. REDD strategies aim to make forests more valuable standing than they would be cut down, by creating a financial value for the carbon stored in trees. Once this carbon is assessed and quantified, the final phase of REDD involves developed countries paying developing countries carbon offsets for their standing forests[2].*

The amount of money that needs to be transferred from developed to developing countries is largely accepted as being large, in excess of $20 billion annually[3].

As developed countries have neither the budget capacity nor the political appetite required to maintain that funding level, it is assumed that private capital will be required. The existence of carbon trading platforms like EU-ETS makes for the logical assumption that REDD could attract this capital by offering the quantified carbon in a commodity form, making forest carbon fungible (and therefore tradable) within a derivatives-style system akin to those used for commodities futures and options.

It is very important to emphasize that, even though REDD is a thoroughly architected effort in many other respects, most of these market mechanisms have developed organically and lack a specific design. We find it more productive to think of REDD's private market structure as being based on two assumptions:

1. **REDD needs to attract private capital.** REDD's success depends upon the engagement of private capital, as non-private sources are either unable or unwilling to match the required investment thresholds to combat deforestation.

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[1] Our analysis also examined REDD+ initiatives like the World Bank's Forest Carbon Partnership Facility and Forest Investment Program. For the sake of brevity, we have not included our specific thoughts on each of those programs here.

That said, as noted in the Forest Investment Program's design documents (http://www.climateinvestmentfunds.org/cif/node/111), "*The FIP should draw upon the IPCC and the IPCC Good Practice Guidance for agreed definitions and terms related to forests and climate change while recognizing the evolving vocabulary within the UNFCCC process.*" Focusing on IPCC standards with respect to asset creation is therefore advisable and effective.

[2] Downloaded on March 2nd, 2011 from http://www.un-redd.org/AboutUNREDDProgramme/FAQs/tabid/586/Default.aspx

[3] European Commission, 'Communication on Deforestation', October 2007, eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0645:FIN:EN:PDF

We have not examined that premise, but simply assumed that large amounts of capital will be required to protect forests, regardless of the source. The more important question is to examine how that capital will be leveraged to protect forests, which brings us to our second assumption:

2. **Forest carbon markets are the right mechanism for generating private participation.** By quantifying forests as a commodity (forest carbon) and allowing private investors to trade that commodity using a derivatives-style framework (markets), the belief is that REDD will direct large capital flows towards avoiding or reducing deforestation and degradation of tropical forests.

Given that forest carbon derivatives are the "how" in REDD, we now turn to the "why". What outcomes are these markets supposed to achieve? According to the UN, their purpose is defined as:

> *[...] tipping the economic balance in favour of sustainable management of forests so that their formidable economic, environmental and social goods and services benefit countries, communities, biodiversity and forest users while also contributing to important reductions in greenhouse gas emissions*[4]*.*

This is a very unique objective, inasmuch as most benefits generated by derivatives trading are unintentional "happy accidents". REDD presents a very different – and laudable – paradigm. Not only is it supposed to provide a good outcome for the environment, but furthermore, it is intended as a development mechanism.

Some of the poorest, most remote countries and communities on the planet need to receive significant benefits from the trading mechanism, otherwise REDD fails to achieve its objectives. At the same time, the resulting avoidance of deforestation and forest degradation needs to be verifiably supported, such that the general environmental objective of reducing greenhouse gas emissions is achieved.

Taken together, we now see basic market hypothesis for REDD which can be used to focus our analysis. At a global level, forest carbon trading's role in REDD can be viewed as a simple equation:

This analysis asks, does summing the terms in this equation seem likely to produce the expected outcomes for each of the major stakeholders? In a word, the answer is "no", for four reasons:

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[4] Ibid.

Poor Transaction Structure. Transactions in REDD are structured as over-the-counter (OTC) arrangements, a fact that impedes REDD's developmental goals and leads to a serious misallocation of resources.

Commodities and Monopsony Power. Commodities markets are already unfavorable to producers and privilege intermediaries, largely because of the inherent nature of commodities themselves. Moreover, REDD's global reach and scale suggest that intermediaries will obtain monopsony positions relative to projects. Both would imply that forest carbon will work against, not for, REDD's stated development objectives.

Poorly Defined Assets. From a trading point of view, the process which forest creates carbon is ill defined to the point of being unacceptably risky. It contains a vague, poorly defined and scientifically unreliable process for creating forest carbon.

Unsolvable Clearing Problems. As a consequence, pushing these commodities through the derivatives trading framework will prove impossible. This will either cause the trading system to not be created in the first place, or (as seems more likely) will result in the creation of a substandard, risky and ultimately destructive forest carbon market.

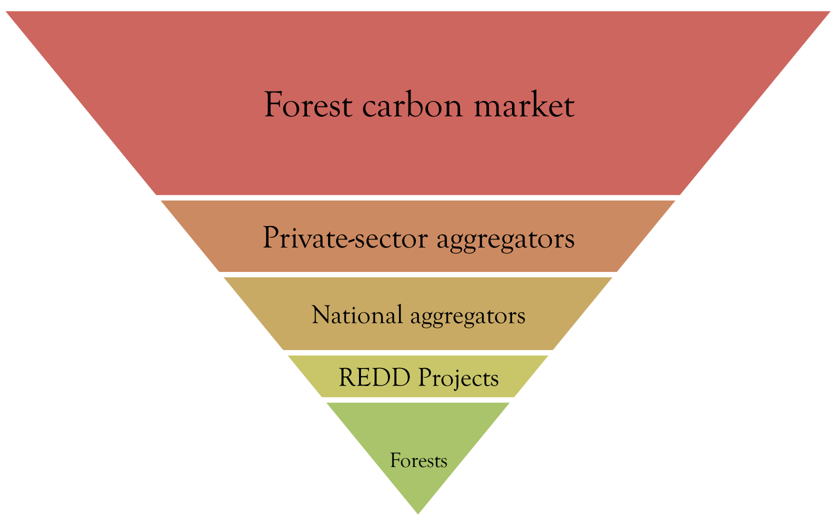
PART ONE:
OTC AND COMMODITIES

Forest carbon is a commodity. It is sourced – and may even be traded – "over the counter" (OTC), meaning outside of an exchange trading process. It is then aggregated and traded by intermediaries, following a process described later in this document.

The first transaction, where a project sells its carbon to an intermediary, is referred to as the "primary" market. Secondary markets are where the intermediary places that carbon with other parties – end users of credits, governments, speculators, private investors and the like.

The primary-secondary structure is not a choice. It is anthropologically inherent to REDD's design because the people generating the asset are neither qualified nor inclined to trade their assets on a market. This is a good thing. Much as we would prefer that farmers focus on growing food instead of trading commodities futures, those on the ground in REDD projects do not need the added distraction supplied by derivatives market speculation.

When trying to imagine the size and scale associated with its participants, the best way to think of REDD's market structure is as an inverted pyramid. Its fulcrum is the forest and the communities that live in those forests, but the scale of resources associated with that level is much smaller than that generated within the higher-order levels (such as the forest carbon market).



This layout might seem alarming, but functions perfectly well in many different scenarios. For example, it matches a classic market structure that exists in the massive market for government-issued debt, which has proven remarkably resilient in the face of the current financial crisis. In fact, the existence of a large secondary market has kept the primary markets in many high-debt countries like Japan and the United

States from collapsing. Without them, both countries would be experiencing life-altering societal problems, à la Germany under the Weimar Republic or the United States from 1930 to 1934.

The question is not, therefore, whether this type of market structure works in the abstract. It is whether this type of structure is appropriate for REDD. We believe that it is not only unsuitable operationally – in that it implies significantly higher costs for projects – but furthermore, that is highly likely to work at cross purposes with REDD's stated objectives.

MISMATCHED COUNTERPARTIES

Whether aggregated at a subnational, national or multinational level, the fact is that REDD is a project-driven market.

Implementation is dependent upon a series of negotiations between project developers and various aggregating entities. When this dynamic is instituted at the scale required to impact deforestation, the process for sourcing forest carbon will begin to resemble other large-scale commodities with OTC primary markets.

Despite their reputation, OTC contracts are not inherently harmful. Quite the contrary! They can provide real value in markets where standard, easily available products do not fit the investment or risk management needs of the buyer.

For example, futures traded on exchanges have defined expiration dates, contract sizes, commodity definitions, and so on. A person or organization wishing to hedge a risk that was similar but not exactly the same as an existing futures contract could either trade the future and assume the residual risk, or find a financial counterparty that will ensure the exact risk for a price. OTC transactions cater to the latter scenario.

The problem is that there is no need for OTC flexibility in forest carbon. The end asset is largely the same regardless of its source, which makes bilateral, OTC-style contracts completely unnecessary.

Why does this matter? Because OTC contract negotiations have their own peculiar dynamic, one that creates other types of risks, both for the individual parties and for the market as a whole:

> **Default.** OTC contracts are bilateral, so that the counterparties are subject to market risk as well as default risk from their counterparty. This is more dangerous in REDD, where forest projects in OTC deals are completely dependent upon a single, controlling counterparty and may be completely ruined by a default. Also, because projects have very little interaction with each other, multilateral default protections do not exist.
>
> **Pricing Power.** Active participants may have significantly better knowledge of market conditions and contract terms than occasional participants. This most especially disadvantages forest communities and REDD project managers, for whom an OTC carbon "trade" is a once-in-a-lifetime decision. The result will be that REDD projects will receive lower prices for their carbon, forcing them to cut operational costs.

Complexity. Derivatives contracts are complex legal documents and firms with more experience are also more skillful in structuring them to their advantage. This is compounded by the difficulty of creating support systems for these businesses – due to the complexity of the requirements, the pricing and risk management systems that support these markets frequently do not completely match the actual contract terms. Again, this will represent a major disadvantage for REDD projects, who will be forced to either muddle through these issues or engage expensive outside help.

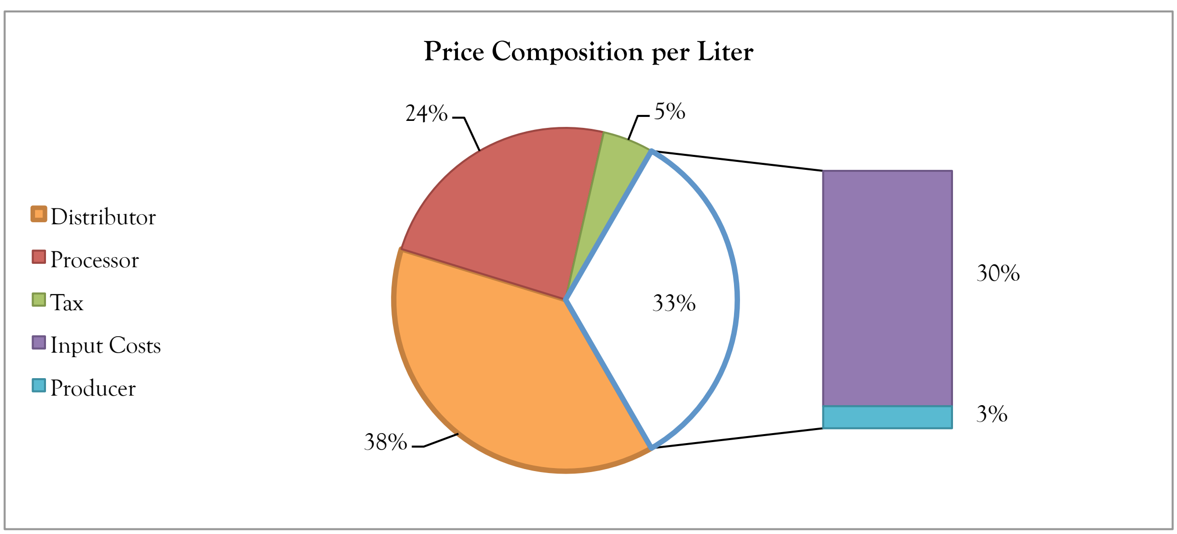
Oversight. This asymmetry of information applies to regulators in these markets as well. They cannot observe systemic risks building until those risks have already had a negative impact, and regulatory actions must be prescriptive rather than preventive.

Individually, each of these problems would be manageable, but taken together, they represent a very steep hill for REDD projects to climb. For those interested in REDD's overall impact, that steep hill becomes even more daunting when one stops to consider just how commodities and market access might behave in a large forest carbon market.

COMMODITIES AND THE RISK OF MONOPSONY STRUCTURE

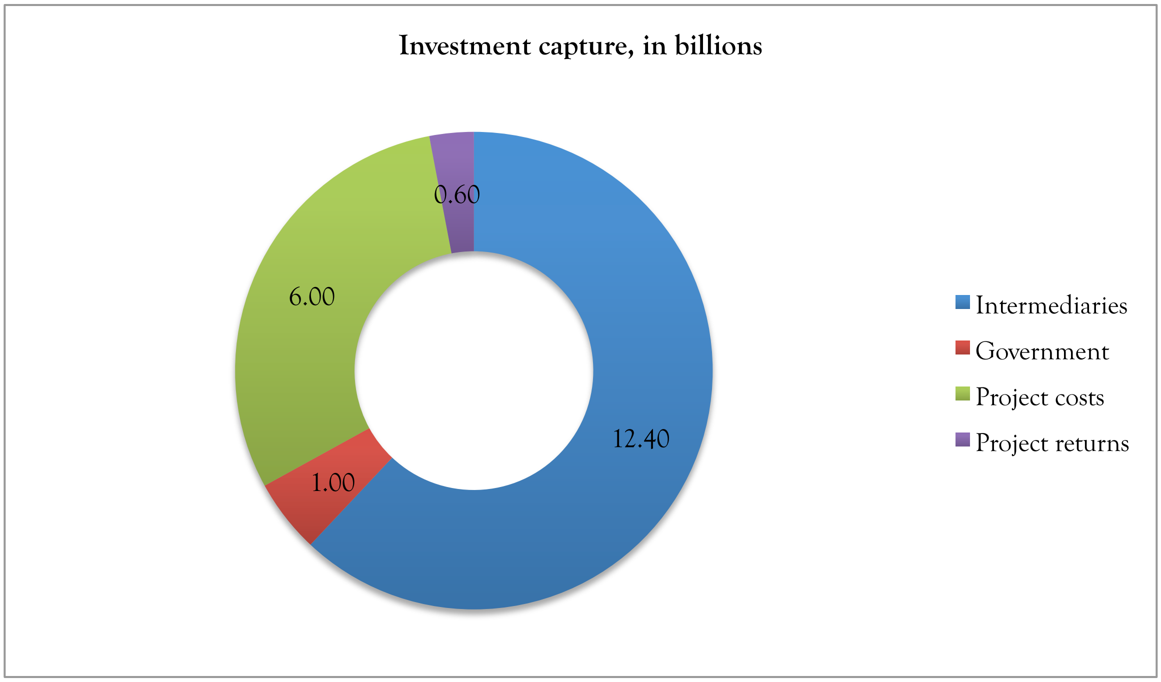
Commodities are not unique. By definition, they can be sourced from many different places. This is what makes them desirable to their consumers, and in many cases, commodities markets function quite well following this process.

The problem for REDD is that the commodity-based approach is at loggerheads with the development benefits REDD is expected to generate. Experience within numerous commodities markets shows a generalized pattern whereby commodity producers receive an extremely limited percentage of the final commodity cost. The typical pattern looks like the following data, derived from the EU milk market[5]:



[5] Lambert, C. "Les modalités de formation des prix alimentaires : du producteur au consommateur". Journal officiel de la République française, avis et rapports du Conseil économique, social et environnemental , n° 2009-11

Were REDD to follow this pattern, a putative $20 billion invested would yield the following results:



Admittedly, this represents a pattern seen in a highly mature market, but it illustrates the pattern we would expect REDD to follow. Indeed, this was confirmed for us in numerous interviews and conversations with numerous project developers in South America and Asia. Speaking with them, it became readily apparent that the process of counting carbon was a dominant cost factor in project development.

Although those responsible for the projects were quite skittish about being quoted directly on this point (for fear of losing market access, which suggests the makings of the monopsony dynamic we discuss later in this section), some empirical evidence supports this view:

> *In this study, Project Description Document (PDD) development by technical service providers by [companies here] and project validation to CCBA Standards by [companies here] were mentioned to cost an average of US$153,200 (n. projects = 5, min = US$46,000, max = US$350,000) 4 . Several of the projects have taken well over a year to complete their PDD's and others are still ongoing two years after starting. A field manager expressed clear sentiments about this process: 'it is sometimes in a consultant's interest to make things as complicated as possible[6]'.*

[6] Hajek, F., et al. (2011): Regime-building for REDD+: Evidence from a cluster of local initiatives in south-eastern Peru. Environ. Sci. Policy.

NOTE: We removed the names because we think this problem is representative of the system as a whole, as opposed to the practices of any single company or organization.

In contemplating REDD, it is important to imagine how this will look if a large-scale forest carbon market is successfully launched.

Logic dictates that the scale and resources required to source forest carbon credits will be so large that only a very few global intermediaries will be capable of providing it. Furthermore, these very same entities – or their parent companies – might also provide the connection between a project and the market. This is referred to as a monopsony[7], and recent examples from American agriculture provide us with some sense as to how that structure behaves at the scale imagined for REDD.

After a wave of mergers left the meat market with a classic monopsony structure standing between hog farmers and the market, United States farmers suffered tremendous losses. In 2003, Iowa Senator Charles Grassley – a generally *laissez-faire* Republican who refers to President Obama as a "socialist"[8] – had this lament about spot (that is, primary) meat markets:

> *Monopsony is to buying as monopoly is to selling. When family farmers have limited options to market their commodities, they face potential monopsonistic conditions. For decades, the Government has aggressively protected America's consumers through the Sherman and Clayton Acts from monopolistic activities. Unfortunately, the concept of monopsonies has not seemingly drawn as much attention.*
>
> *[...]*
>
> *It should be easy to understand that as the actual spot market thins out, if packers choose not to participate in the spot market everyday, packers potentially will be able to manipulate the spot market price and influence the worth of marketing contracts. I feel strongly that we need to be on the lookout for this type of manipulation of the marketplace.*[9]

And indeed, in 2010 the American market had arrived at just such a point (emphasis added):

> *The domestic market for slaughter beef is dominated by four firms controlling more than 81% of total beef production in the United States. [...] The authors believe it is reasonable to estimate no fewer than 80% of all beef sold for slaughter are sold either under contracts made more than 14 days before the livestock are delivered, or by producers who feed their cattle in yards and settings leaving no alternative but to accept the offered price, if a price is offered at all*[10].

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[7] Technically an "oligopsony", but the broad-brush use of "monopsony" by competition lawyers seems to have crept into most sectors and we preserve that here for clarity.

[8] "Grassley: Budget freeze to stop 'socialism'," Washington Times, March 24th, 2009.

[9] "Monopsony Issues in Agriculture: Buying Power of Processors in our Nation's Agricultural Markets." Hearing before the Committee on the Judiciary of the United States Senate, 108th Congress, First Session. October 30th, 2003.

[10] Domina, D and Taylor, CR. "Restoring Economic Health to Beef Markets." Report prepared for the Joint U.S. Department of Justice and U.S. Department of Agriculture/GIPSA Public Workshop on Competition Issues in the Livestock Industry, August 27, 2010, Ft. Collins CO.

Assuming that forest carbon requires a quantification process similar to the one used today, there is no reason to expect that the market for REDD forest carbon will behave any differently. The expertise, travel requirements and operational scale required to follow IPCC-like standards almost certainly requires a multinational organization, one that is well-capitalized and capable of managing many clients at once.

Will these organizations be numerous? Unlikely. Will they be domiciled in developing countries? It seems improbable. These skills and scale cost money to deploy, and that – far more than avarice or inefficiency – explains why REDD projects are likely to spend so much on MRV.

We therefore conclude that REDD is unlikely to generate expected impact at the producer level. That is, the bulk of benefits from forest carbon will not go to REDD projects, the communities that live within them or the countries where they are located, and those projects that are able to operate will come under intense pressure to cut costs due to monopsony buying power.

This has important implications for REDD beyond its impact on forest countries, projects and communities. If we assume that $20 billion will be needed to fight deforestation, then we can already assume that a good bit of that money will end up precisely where it started, in developed countries with the kind of large multinational organizations capable of servicing the market.

Consequently, the secondary market required to support that primary-market figure will be at least an order of magnitude higher in notional value. And, if we assume that the producer impact matches our experience in other commodities and monopsony pricing has a similar impact, the final number is likely to be upwards of $500 billion.

At that level, forest carbon starts to require a very serious market solution required to exchange, clear and settle forest carbon contracts properly. This means attracting large amounts of capital, but without creating the kind of excessive bubbles that have marked some other derivatives markets.

This leads us to the second part of our examination, where we examine this problem from a trading point of view.

PART TWO:
ASSETS AND CLEARING

Post-trade clearing and settlement are some- times referred to as the plumbing of the financial system. This term may suggest that clearing and settlement systems are of secondary importance. In fact, however, they are more like the central nervous system of the financial system. Clearing and settlement systems provide vital linkages among components of the system, enabling them to work together smoothly. As such, clearing and settlement systems are critical for the performance of the economy[11].

- Michael H. Moskow
President, Federal Reserve Bank of Chicago

Making a trade is making a promise. Clearing's role is to make sure that promise is kept.

The classic trading model sees two counterparties agree to trade one object for another, then performing the actual exchange of objects later in time. Imagine, for example, that Counterparty A will pay an agreed-upon amount of money to Counterparty B in return for delivery of *n* bushels of corn at *x* date (referred to as the "date of settlement").

A and B's mutual promise raises some important questions:

- What exactly constitutes "corn" and "money"? This sounds like a silly question, but it is actually quite important to have clear definitions of each.
- Can each of the counterparties deliver on its commitments? Do they have the assets? For example, can Counterparty A be trusted to deliver the money promised at the date of settlement?
- What happens if one of the counterparties fails to perform? Let's imagine there's a drought and Counterparty B can only deliver 50% of the promised amount. How does the other counterparty get made whole?

Clearing is the process markets use to answer these questions. Its role is to increase confidence in the market and allow participants to trade without bearing the diligence burden of researching each of their counterparties – and it has gained increased prominence in the wake of the 2008 financial crisis[12].

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[11] Moskow, Michael H., 2006, "Public policy and central counterparty clearing," speech delivered at the European Central Bank and Federal Reserve Bank of Chicago joint conference, "Issues Related to Central Counterparty Clearing," Frankfurt, Germany, April 4.

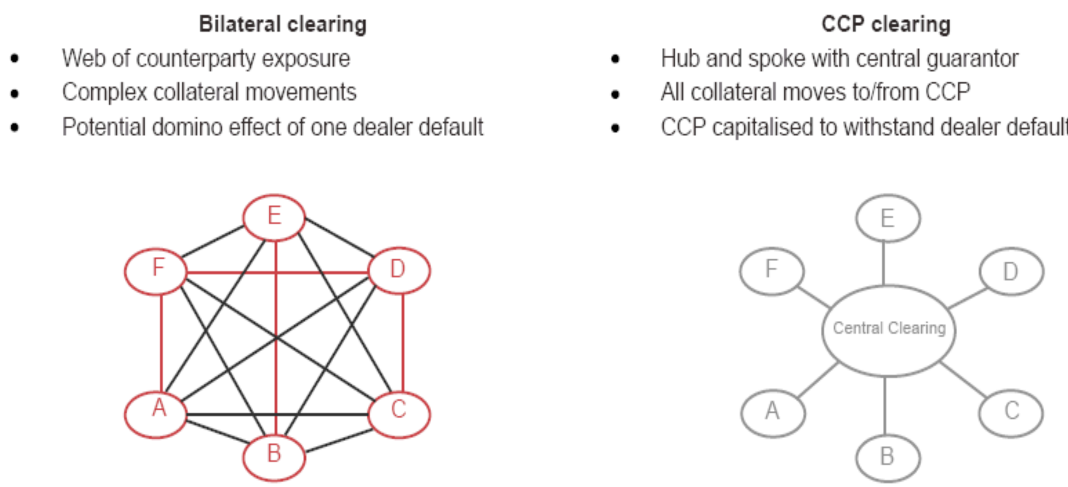
[12] Non-cleared derivatives (so-called "OTC" products, such as mortgage-backed securities and credit default swaps) were allowed to grow dramatically during the period from 1998 to 2007. When they failed dramatically during the financial crisis, it provoked a new wave of clearing-oriented regulation.

For example, Title VII of the United States' Dodd-Frank financial regulatory reform law mandates central clearing for liquid standardized contracts. The Munden Project's discussions with regulators in the European Union and our reading of EMP Werner Langen's draft report of February 2011 indicate that a similar clearing requirement will be included within their new regulations.

Two forms of clearing exist – bilateral clearing and central counterparty (CCP) clearing. Despite REDD's current structure as a bilaterally-oriented market, our view is that CCP clearing is a far superior standard by which to judge forest carbon.

In part, this is a reality imposed by changes in trading structure for larger asset classes. European Commission has stated that, "as for clearing, we want as many derivatives as possible to be cleared via central counterparties," and Europe's role as the largest carbon-market regulator seems likely to put it in the position of setting the trend for forest carbon where exchange mechanisms are concerned.

CCP clearing[13] is a process by which each participant in the market trades through a central guarantor. This central guarantor becomes the legal counterparty for each clearing member's trade. The difference between the bilateral[14] and CCP arrangements can be viewed as a network map[15]:



To analyze forest carbon as a traded asset, we need to answer the questions listed above from the perspective of a CCP. We begin by examining the first, and most fundamental question they would ask – what, exactly, is being traded?

Both will include many derivatives presently traded as OTC contracts. We believe that this will (and should) extend to carbon credits generally.

[13] For a good introduction to CCPs, see:

Bliss, R and Steigerwald, C. "Derivatives clearing and settlement: a comparison of central counterparties and alternative structures," Economic Perspectives, Federal Reserve Bank of Chicago, issue Q IV, pages 22-29. 2006.

[14] Bilateral clearing arrangements tend to be significantly complex, and generally only perform well in situations where the counterparties are of roughly similar size, are pursuing broadly similar return objectives and have access to similar information.

[15] "The future regulation of derivatives markets: is the EU on the right track?" 10th Report of the European Union Committee of the House of Lords. Retrieved on March 2nd, 2011 from http://www.publications.parliament.uk/pa/ld200910/ldselect/ldeucom/93/9307.htm

QUESTION ONE:
WHAT IS BEING TRADED?

In the example we gave at the beginning, Counterparty A traded money to Counterparty B in return for corn.

Determining what Counterparty A is trading – cash – is a well-understood problem and not particularly enlightening in a discussion of REDD or forest carbon. But Counterparty B is a different story. Corn and forest carbon are both commodities, and the former can instruct our view of the latter.

Defining "corn" requires examining the standards offered by the United States government and the exchange (in this case, CBOT) through which the corn is traded. First, CBOT rules dictate that only Yellow corn is permissible for delivery. Yellow corn is defined by the United States government as "*corn that is yellow-kerneled and contains not more than 5.0 percent of corn of other colors. Yellow kernels of corn with a slight tinge of red are considered Yellow corn.*[16]" This corn is then judged and adjusted for price according to the following chart:

Grade	Minimum test weight per bushel	Max heat damaged kernels	Max total damaged kernels	Max broken and foreign material	Price
#1	56.0	0.1 %	3.0 %	2.0 %	Contract + $0.015/bushel
#2	54.0	0.2 %	5.0 %	3.0 %	Contract
#3	52.0	0.5 %	7.0 %	4.0 %	Contract - $0.015/bushel

The differences between Grades 1, 2 and 3 are quite narrow, but there is a standardized price adjustment associated with each. This reflects the sensitivity – true across almost all financial markets – that traders have to even slight changes in the underlying asset's quality or amount. We will return to this problem and its bearing on forest carbon later in the document.

For the moment, the important thing to remember is that a clear standard that defines what is being traded within a given market is very important. With respect to REDD, it is obvious that a more complex definition will have to be employed. Quantifying an ecosystem is by nature more challenging than staring at ears of corn and judging the color of its kernels.

Introducing this kind of complexity is not a problem *per se*. Traders are used to a certain amount of intricacy. Consider, as an example, the CME Group's elegantly named Gulf Coast CBOB Gasoline A2 (Platts) Crack Spread Swap Futures market, where traders base their bets on a "floating price." This price is defined as:

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[16] USDA's United States Standards for Corn. Retrieved on March 2nd. 2011 from http://archive.gipsa.usda.gov/reference-library/standards/810corn.pdf

[E]qual to the arithmetic average of the high and low quotations from Platts Oilgram Price Report for U.S. Gulf Coast CBOB 87 gasoline (Colonial A grade: lowest RVP posted except A1 and A0) pipeline using the Supplemental 9.0 RVP Summer assessment minus the Light Sweet Crude Oil Futures first nearby contract month settlement price for each business day that both are determined during the contract month. For purposes of determining the Floating Price, the gasoline price will be converted each day to U.S. dollars and cents per barrel, rounded to the nearest 0.1 cent[17].

In a trading world dominated by quantitative approaches and information technology, the formula above, while complex, reduces to an algorithmic approach quite easily. It provides a good standard against which to compare REDD-generated assets.

Two important points distinguish the futures contract above from forest carbon. First, all of the underlying assets within this algorithm are eventually physical (specifically, crude oil). This is where physical commodities have an advantage over virtual ones.

A physical commodity market can guarantee and verify quality while absorbing supply from variable standards, such as two different types of oil taken from two different derricks. This is because there is a chain of users stretching from tankers to refineries to agent resellers, and each link in that chain will test and re-test the asset's real quality. Obviously, forest carbon has no such user chain capable of providing a similar test.

The second point is that forest carbon lacks a clearly defined process that is reliable in producing similar outcomes across different scenarios. This is a complex topic that requires substantial explanation, but its implications for trading are quite important.

A COMPLEX ASSET WITH UNCERTAIN STANDARDS

All assets require a standard definition in order to be traded. The rice futures traded on Japan's Dojima exchange in the 1700s adhered to this definition just as much[18] as the rice futures traded on the Tokyo Commodities Exchange today.

Defining the asset being traded is important for a properly functioning financial market[19]. With forest carbon, our examination revealed several major problems with the current system.

The first problem is that there is no clearly defined process for forest carbon accounting. Two "equally valid" approaches exist: a gain-loss method and a stock-difference method. From a financial point of view, the existence of two approaches is already unusual, especially where a non-physical asset is concerned. Still,

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[17] Downloaded on March 2nd, 2011 from the specifications found at: http://www.cmegroup.com/trading/energy/refined-products/gulf-coast-cbob-gasoline-a2-platts-crack-spread-swap_contract_specifications.html#prodType=undefined

[18] Schaede, U. "Forwards and futures in Tokugawa-period Japan: A new perspective on the Dojima rice market," Journal of Banking & Finance, Elsevier, vol. 13(4-5), pages 487-513, September, 1989.

[19] Much of our time was spent examining the processes outlined in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, particularly Chapter 4 ("Forest Land").

it would be possible to adjust to this over time, in much the same way as equities markets tolerate multiple accounting methods using by corporations.

The problem is that there seems to be significant uncertainty as to which of these two methods is likely to be sustained, or whether they will both be replaced by a significantly different approach, as seen in statements like this one from the UNDP:

> *In general, the accounting approach chosen must reflect both purpose and acceptability to policy-makers, with decisions also likely to rely on the availability and form of existing forest data within a territory. As the profile of the forestry sector rises up the climate agenda, new accounting approaches are being proposed (see Cowie et al., 2007). A consensus on which accounting approach to adopt into the future has yet to be reached and inventory and activity-based accounting remain the dominant accounting approaches[20].*

Uncertainty is a permanent feature of markets, but it has a deep impact on market participants' behavior. If the accounting methods that generate the credits are uncertain, and if they are allowed to vary by territory as this quote implies, the market may produce three possible reactions. Each of them would be equally unproductive for REDD's stated objectives:

1. This uncertainty will be considered a significant risk, and used as justification to significantly discount the price of carbon. That discounting diminishes the amount being invested in forests.

2. If the forest carbon market is large enough, participants will choose the most complex methodology and rig it in order to produce artificially high numbers of credits. Given remote project locations and lack of external verifiability, this seems highly likely to succeed.

3. The easiest accounting method will be chosen, regardless of scientific accuracy, in a bid to reduce start-up costs. Once this is in place, regulators will come under tremendous pressure to maintain the status quo, in much the same way as financial regulatory authorities worried about credit-default swaps or subprime mortgage-backed securities did during the years before the financial crisis.

This would already be worrisome enough, but the problems do not stop here. The accounting methods also appear to tolerate major differences in composition. Under IPCC standards, the amount of credits available for any given hectare would be a function of five different carbon pools: living above-ground biomass, living below-ground biomass, dead organic matter in wood, dead organic matter in litter and soil organic matter.

We were disturbed to read that in any accounting scenario:

> *[D]ecisions on which carbon pools should be included are largely dependent on the availability of existing data, costs of measurement and the level of conservativeness required.[21]*

[20] "Forest Carbon Accounting: Overviews and Principles", downloaded on March 2nd, 2011 from http://www.undp.org/climatechange/carbon-finance/CDM/resources.shtml

[21] Ibid.

In other words, simply saying that an accurate accounting costs too much is sufficient to justify a change in standards. It is not difficult to imagine the implications of that approach!

The accounting standards are therefore unacceptable from a financial market point of view, to the point where we assume some major problems would be fixed before the initiation of large-scale carbon trading through mechanisms such as California's AB32 platform. And indeed, our conversations with many stakeholders suggested that these accounting matters might be cleared up in subsequent arrangements between REDD participants. We view this as unlikely, but for the sake of argument, let us assume that the accounting problems were to be cleared up in the future.

Unfortunately, doing so would only peel back one layer of the onion, revealing a much more troubling issue: the process by which forest carbon is counted under an emissions-reduction scenario.

This requires the establishment of a baseline, and then mapping current activity relative to that baseline. Development of a baseline might happen at a national, subnational or project level, but the general procedure is described as follows (emphasis added):

> *In order to set emission reduction targets, a baseline scenario must be developed. [...] Creation of a baseline scenario relies on a detailed understanding of the drivers of land use change. The drivers of deforestation, however, are complex and knowledge is still incomplete. A review by Giest and Lambin (2001) identify three aggregate proximate causes – agricultural expansion, wood extraction and expansion of infrastructure – and five broad categories of underlying driving forces: demographic, economic, technological, policy / institutional, and cultural / socio-political factors. They further identify a group of pre-disposing environmental factors, biophysical drivers and social trigger events that influence the rate of deforestation within a territory. The baseline must consider all of these complex and interlinked causes, forces and pre-disposing factors that vary greatly between countries, regions and over time. Substantial technical difficulties and uncertainties therefore arise when baselines are established*[22].

These substantial technical difficulties and uncertainties already exist under the current scenario, where well-meaning scientists generally engage in the calculation process and have little upside in those calculations' results. Absent a functioning carbon market, there is little incentive to systematically exploit these loopholes.

But if REDD is successful, and manages to attract large-scale private capital into forest carbon markets, that will change very quickly. An opaque set of variable standards will create a tremendous incentive to create (or destroy) supply as it suits the participants in the market. We can hardly imagine that regulatory structures in developing countries will prove capable of preventing this problem, especially in some of the remotest areas on the planet.

Moreover, the outcomes from baselines are unpredictable (emphasis added):

> *We compared outcomes of seven proposed baseline approaches as a function of country circumstances, using a retrospective analysis of FAO-FRA data on forest carbon emissions from deforestation. Depending upon the*

[22] Ibid.

baseline approach used, the total credited emissions avoided ranged over two orders of magnitude for the same quantity of actual emissions reductions[23].

One final note: we also found the process of explaining the IPCC's methods to market participants to be a very difficult task. Our examination showed that they were almost impossible to summarize in a comprehensive way that would be acceptable to financial market participants, largely due to their length and scientific content.

As a result, we can expect that traders and funds participating in a forest carbon market would be wholly unaware of the underlying asset being traded – reinforcing the importance of the CCP as a final guarantor of sensible financial standards for the asset being traded.

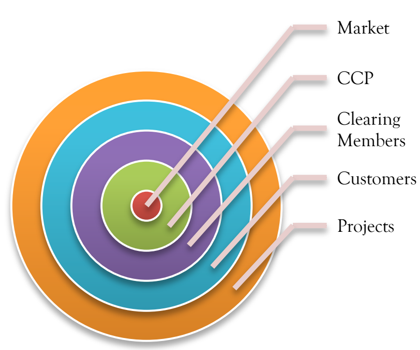
QUESTION TWO:
DO THEY HAVE THE ASSETS?

We can now loop back to our Counterparties A and B. Let's assume that the CCP has clear asset standards and we feel reasonably confident that each of them has the required asset to trade (again, this seems very unlikely with forest carbon as currently defined, but fortunately, A and B are just trading cash for corn). What comes next is the process by which we ensure that A will produce the cash and B will produce the corn at the required settlement date.

The CCP ensures this through a series of buffers, and we can think of the CCP as a central layer of protection that guards access to the market.

To access its center – the exchange – participants must pass through the appropriate intermediary layers. The CCP has standards for its clearing members, the clearing members have standards for their customers, the customers have standards for their clients, and so on. Generally, these standards test for capital and risk in various forms, although in the case of commodities, there are also considerations made to determine whether the counterparties have access to the physical asset.

So far, nothing about REDD suggests that this structure would (or should) be modified. The result would be a market access paradigm that looks like this:



[23] Griscom B, Shoch D, Stanley B, Cortez R, Virgilio N: Sensitivity of amount and distribution of tropical forest carbon credits depending on baseline rules. Environ Sci Policy 2009, 12:897-911.

A forest carbon market would therefore require that one or more CCPs grant market access to a select number of clearing members.

Those clearing members would have various customers (ranging from end users to smaller speculators), and some of those customers would, in turn, have actual contact with the projects to source the carbon credits being generated. We can also assume that a competent intermediary – such as UNFCCC – would continue promulgate standards as to the sourcing of forest carbon from projects.

Again, none of this is any different than what we would expect in other CCP-cleared derivatives markets. Where REDD takes a turn for the worse is the point at which the specific considerations imposed by a well-operated CCP are considered.

When a CCP clears trades in a given contract, it does so with the understanding that clearing members will not fully capitalize their trades. That is, a purchase of $100 million worth of a commodity does not require that the exchange be given $100 million in cash at the time of trade. Instead, almost all trades are margined. Each participant in a market commits a certain amount of cash – the margin – in order to trade.

This raises a key question. How much money should that margin be?

Generally, the answer is less than 15% of the contract's value. Sometimes, depending upon the product, it may be significantly less – as little as 1-2%. In practice, we see that the margin depends on the contract being traded and tends to reflect the stability of the environment from which the underlying asset was sourced.

For example, consider this list of major exchange-cleared contracts:

Exchange	**Contract**	**Margin**[24]	**As % of Contract**
Eurex	German Bund (FGBL)	€ 2,120.00	2.12%
CME	Corn (C)	$ 1,500.00	4.16%
Korea Exchange	KOSPI 200 (future)	N/A	9.00%
Bovespa	Arabica coffee (ICF)	R$ 7,611.77	13.01%

Notice that both the asset type and the country environment tend to impact the margin. Agricultural commodities are assets dependent on physical factors and considered to be less predictable. They will tend to have a higher margin requirements than financial assets. This is why, despite being sourced in a low-risk

[24] Based on initial margins for long positions in front-month contracts with market prices taken from close on March 4th, 2011. Margins are for clearing members and downloaded from the following sources on March 4th, 2011:

CME - http://www.cmegroup.com/wrappedpages/clearing/pbrates/performancebond.html
Eurex - http://www.eurexchange.com/clearing/risk/parameters_en.html
Korea Exchange (set as percentage) - http://eng.krx.co.kr/por_eng/m3/m3_7/m3_7_3/JHPENG03007_03.jsp
Bovespa - http://www.bmfbovespa.com.br/Sumario2TopoPequeno.aspx?menu=6&sitemap=11&Idioma=en-us

environment, US corn (CME) has a higher margin requirement than German debt (Eurex) and, even though Brazil and South Korea have roughly similar risk environments, the Brazilian Arabica future requires more capital than the Korean KOSPI contract.

So, we can expect that forest carbon would have higher margin requirements, but still close to 15%. This provides an important benchmark for predicting how a CCP might judge forest carbon as an asset. To put that benchmark into full context, we need to consider what happens when – as is inevitable – someone defaults on a forest carbon trade.

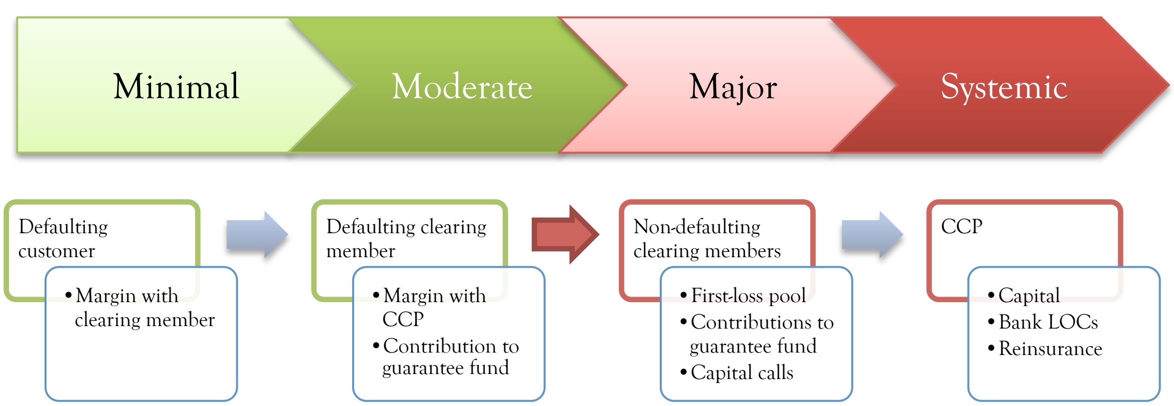
QUESTION THREE:
WHAT HAPPENS IF THERE'S A DEFAULT?

Since REDD will be presenting a new market, we can easily assert that there will be greater than normal default rates among market participants. We therefore need to consider default behavior from the CCP's point of view.

When a default happens, the losses are covered by a series of capital pools. The first pools to be tapped are the ones at the outer edges of the concentric circle above. So, for REDD, finding capital would follow the progression of Projects → Customers → Clearing Members → CCP.

This means that, eventually, all trades are guaranteed by capital committed by the CCP's non-defaulting members and, eventually, the funds, lines of credit and insurance policies of CCP itself. The deeper into the circle the default goes, the worse it is for the market.

Therefore, CCPs tend to view the world in terms of cascading risk, from marginal to systemic, as shown here:



The CCP has a <u>very</u> strong preference for keeping defaults within the Minimal and Moderate risk pools – that is, it wants to keep defaults covered by money from defaulting customers or the defaulting clearing member. Since almost all of this money is in the form of margins, making sure the calculations that set these margins are of absolutely paramount importance.

The quantitative theory behind this is explained by the following (emphasis added):

> *Margin requirements are not designed to fully collateralise a clearing house's exposures to its clearing members in all market conditions. Rather, clearing houses seek to strike a balance between the risk reduction benefits of greater collateralisation and the opportunity costs that greater collateralisation imposes on their members. Faced with this trade-off, most clearing houses have tended to set margins at levels intended to cover from 95 to 99% of potential losses from movements in market prices over a one-day time horizon*[25].

Quantifying these potential losses is often done through a confidence interval. One particularly popular method is called "value at risk", or VAR[26]. Within this method, there is a term referred to as "alpha" that represents a confidence level relative to expected large losses.

How does this alpha value work in action? Where does it come from? The answer is price behavior, exemplified in the Australian Securities Exchange's process for setting margin. Note the extreme weight accorded to price behavior (emphasis added):

> *Although the basis used for determining initial margins will vary depending upon the pricing characteristics of the contract concerned, ASX Clear (Futures) will typically make its calculations based on the level of protection it requires for a large single day price move. [...] Generally, 'benchmark' initial margin levels are based on long term historical data and are set so as to cover ASX Clear (Futures) from daily price movements with a confidence factor of 99%.*
>
> *In addition to this benchmark calculation, a number of other factors are also taken into consideration, some of which include:*
>
> - *Recent price volatility*
> - *Market liquidity*
> - *Historical and implied volatility divergence.*
> - *The extent of divergence between the futures and the underlying market price*
> - *The potential for any market participant to unduly influence the market price*
>
> *Upon analysis of these factors an appropriate initial margin figure is then determined. This figure is then carefully monitored and will be revised should market conditions change*[27].

In short, the wing nut that determines almost all margin requirements for clearing is price. Without an accurate prediction of how price is moving – not up or down, but its volatility – the task of setting margins becomes very difficult for a CCP.

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[25] Bank of International Settlements. "Clearing Arrangements for Exchange-Traded Derivatives" CPSS Publications No. 23, March 1997.

[26] For reference, $Prob\left[\Delta\bar{P}(\Delta t, \Delta\tilde{x}) > VAR\right] = 1 - \alpha$ is one example of a VAR relationship.

[27] Australian Securities Exchange. "Calculations of Initial Margin". Downloaded on March 2nd, 2011 from http://www.asx.com.au/clearing/calculations-initial-margins.htm

Whatever one's feelings about Marshall curves and classical economics might be, one basic fact of market behavior is that the "supply" portion of supply and demand curves is an extremely important factor in determining price. As it sets margins, it is therefore vital that a CCP feel confident in predicting the following two supply-driven factors:

1. The amount of supply that a given clearing member (or its customers) is likely to put into the market

2. The aggregate amount of supply that will be available in the market to meet demand.

Unfortunately, the supply process for forest carbon comes nowhere close to an acceptably predictable level. When subjected to external verification and review, the values generated under IPCC Tier 1 vary wildly. To cite one example among many[28]:

Location	Brazil	Mexico	Indonesia	Republic of Congo	Republic of Guinea	Madagascar
Tier 1 default	150	65	175	155	155	155
Plot measurements	218	49	212	277	209	148
Error	45.33%	24.61%	21.14%	78.71%	34.84%	4.52%

When we queried certain stakeholders about this, we were told that this was a data problem. Tier 1 is the most implementable standard, but it relies on very vague data. Tier 3, we were told, would provide more accurate results.

However, when we examined Tier 3, what we found was the same vague pattern of flexible standards we saw within Tier 1:

> *Tier 3 approach for biomass carbon stock change estimation allows for a variety of methods, including process-based models. Implementation may differ from one country to another, due to differences in inventory methods, forest conditions and activity data. Transparent documentation of the validity and completeness of the data, assumptions, equations and models used is therefore a critical issue at Tier 3*[29].

Clearing an asset class where the margins of error in supply are consistently higher than standard VAR and margin requirements seems difficult at best. Not only does it make setting proper alpha values substantially more problematic for CCPs, but it also forces traders into a dramatically different comparison with other asset classes.

No well-operated CCP would dare touch an asset where supply can vary in such dramatic forms, particularly when the supply comes from countries that lack adequate governance capacity to combat fraud. Unless, of

[28] Waggoner P. Forest inventories: discrepancies and uncertainties. Discussion Paper 09–29. Resources for the Future, Washington, DC. 2009.

[29] 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

course, it was simply agreed that the scientific validation of carbon stocks would not matter, so long as the proper IPCC methodology is followed. But then there would be no point in engaging in all of the quantitative gymnastics required to source forest carbon under present standards.

A poorly operated CCP, on the other hand, might very well decide that clearing this style of forest carbon is worth the risk. But recent experience in financial markets illustrates just how imprudent – and potentially destructive – that decision would be.

PART THREE: CONCLUSIONS AND RECOMMENDATIONS

The preceding pages are a comprehensive, market-oriented critique of forest carbon, both as a mechanism for achieving REDD's stated goals and as proper asset class that is suitable for trading. We strongly believe that forest carbon is unacceptable from both perspectives.

But that opinion is useless in the absence of workable alternatives. The Munden Project is a company designed for systems development. We try to create and implement solutions adapted to complex problems, and not the other way around. That's why examining tropical deforestation was such an interesting experience for us – in geek speak, we would like to leave the problem domain in a better condition than we found it.

From our experience in other areas of complex systems development, we know two things:

1. **Criticism is a necessary part of making systems better.** Almost all initial systems designs have major flaws, and the difference between resilient systems and fragile ones is often how the critical process has been managed post-release. REDD is no different.

2. **Criticism is only productive when it entails responsibility.** Otherwise, the critique is nothing more than a complaint, which gets us nowhere. The best criticism:

- Highlights one or more significant flaws, not marginalia
- Suggests that these flaws will lead to problems under many scenarios
- Gets a fair hearing from those who can solve the problem
- Includes a framework for correcting the flaws
- Engages the critic as an ongoing participant in the solution

The preceding pages effectively address the first two bullets, and we hope that the third will follow as a result. This section recaps our critique, and then describes our recommendations for responding to the final two requirements, including a description of our own involvement.

FLAWS AND PROBLEMS

We have identified the following significant flaws with forest carbon as currently constructed:

1. The sourcing of forest carbon through OTC/bilateral style transactions is likely to create major problems related to default risk, pricing power, operational complexity and oversight. The result is likely to be a drain of resources, both in terms of money and time, away from the very serious problems REDD seeks to address.

2. Forest carbon is likely to behave as any commodities market would, which implies that producers will derive only marginal benefits from the market as a whole. Moreover, the unique logistical challenges posed by counting carbon to IPCC-like standards imply a very limited population of

providers willing to do this for projects. The resulting consolidation risks leading to a monopsonistic market structure, which will result in dramatically lower capital flows to forests.

3. As an asset, forest carbon is currently created using a vague, malleable and insufficiently repeatable set of processes. This makes the important process of clearing forest carbon impossible under any reasonably safe standards, which either implies that it will be cleared below those standards – or not at all.

The results of this are hard to predict specifically, but we feel confident in saying that the range of potential outcomes is highly skewed towards problematic effects that would see REDD fall well short of its objectives. At a systemic level, the following scenarios are of particular concern:

Scenario One. The commodity pricing structure does not create the benefit flows expected by governments, projects and communities, forcing them to abandon the concept. REDD – and more worryingly, the concept of engaging capital in the fight to protect forests – loses major credibility.

Scenario Two. Vague, opaque standards for counting carbon lead to significant price shocks as carbon is revalued – or worse, a perpetual cycle of loosening standards as participants learn to game the system. Developing country governments see their economies become linked to the forest carbon market, and in the wake of these shocks, are forced to prop up or bail out those markets in order to preserve stability.

Scenario Three. Bad incentives and conflicts of interest in verification and validation create a tragedy of the market's commons, where carbon price is depressed as issuers overwhelm buying capacity. If linked with existing platforms like EU-ETS, this is a real problem.

Scenario Four. The lack of clearing will cause deforestation by creating a bubble, in much the same way as subprime lending's bubble caused bankruptcies. In this scenario, the popping of the bubble would cause damage to forest countries and communities, forcing them to generate cash flow to compensate by leveraging their most readily available and marketable asset: forest timber.

We therefore assert that the current mechanism for engaging private capital under REDD – the so-called "market" approach – is highly likely to fail. Forest carbon trading is unworkable as currently constructed.

RECOMMENDATIONS

Does this mean that REDD must turn away from connecting forests to capital? Of course not. The truth is that there is no such thing as "the market" – there are many markets, with many possible designs and implementations. The preceding analysis considers but one of them.

Clearly, the sourcing, pricing and trading aspects of forest carbon markets are poorly designed, but our critique does not mean that investment in REDD is not possible. Instead, we simply believe that the pricing and trading aspects of forest carbon markets are poorly designed and that, as a result, REDD has an investment gap.

The real question is, what can we do to fill it? If forest carbon as currently constituted isn't the answer, what is?

Our current work involves leveraging the analysis we conducted of REDD and our knowledge of complex systems into a platform that will more efficiently and consistently connect capital with forest projects, driving both environmental outcomes and improving communities' livelihoods. That platform will be performance-based, and we believe that it will represent a significant advance in the process of allocating capital to engage communities in forest preservation[30].

We feel strongly that this will mark a major step forward, but at the same time, we recognize that this solution might not work for all parties and might not produce good outcomes in all scenarios. Moreover, despite some very compelling arguments against its specific implementation, the general rubric of "forest carbon" might be compelling enough to drive many parties to continue their investments in that sector.

We therefore have reason to share some broad-based recommendations for forest carbon markets:

☑ **Invest in tenure**

Our first recommendation is the most straightforward. In many cases we analyzed, a very simple question – does the project have the right to do this on this land? – was impossible to answer. If there is any involvement from private capital sources, we cannot envision a scenario where the answer to that question is not important.

As with other important portions of REDD, we are not land tenure experts. We do not, therefore, have a useful, specific solution to offer regarding tenure clarification. But we can state confidently that clarity about whether a given project has the right to exist and operate on the land it encompasses is a prerequisite for any form of investment.

Our sense is that current efforts to improve tenure are not adequately funded, and are occasionally seen as ancillary to the real problem of deforestation. We disagree. Programs and initiatives that support this clarification are vital and should be given a higher priority by funders.

☑ **Change the definition of forest carbon**

A major shift should be made in the process by which forest carbon is defined. Current participants are operating under the impression that counting forest carbon stocks and cycles will match the precision requirements imposed by a sensible market structure. As the foregoing analysis demonstrates, this is simply not true.

But this analysis is limited to a very specific, complex approach to generating forest carbon. If forest carbon proves to be such an attractive brand, we think the best bet is to move it – and move it dramatically – in the opposite direction from its current trend, away from microanalysis, and towards a broader, clearer definition.

[30] More information about this work can be requested by emailing us at forestflow@mundenproject.com. Again, The Munden Project's strict conflict of interest policy applies to this work, and we intend to manage this as an open source software project in collaboration with other stakeholders.

Agreement should be reached on a much more straightforward measurement of forest carbon, one that can be easily applied by projects with minimal – or ideally, no – reference to outside quantification experts.

This will create two immediate benefits. First, it will relieve projects and funders alike of a significant resource drain, one that does not appear to contribute to the on-the-ground success of REDD projects. Second, it will offer a clear process by which supply can be anticipated, thereby allowing for a sensible forest carbon exchange to be created.

This will not, however, eliminate the commodity related problems described in Part One of our analysis. For that, we have an associated recommendation.

- ☑ **Engage community-driven approaches, and do so more effectively**

Extensive evidence shows that giving communities greater rights to forests is effective from an environmental standpoint. For example, a global study recently completed by the National Academy of Sciences indicated that:

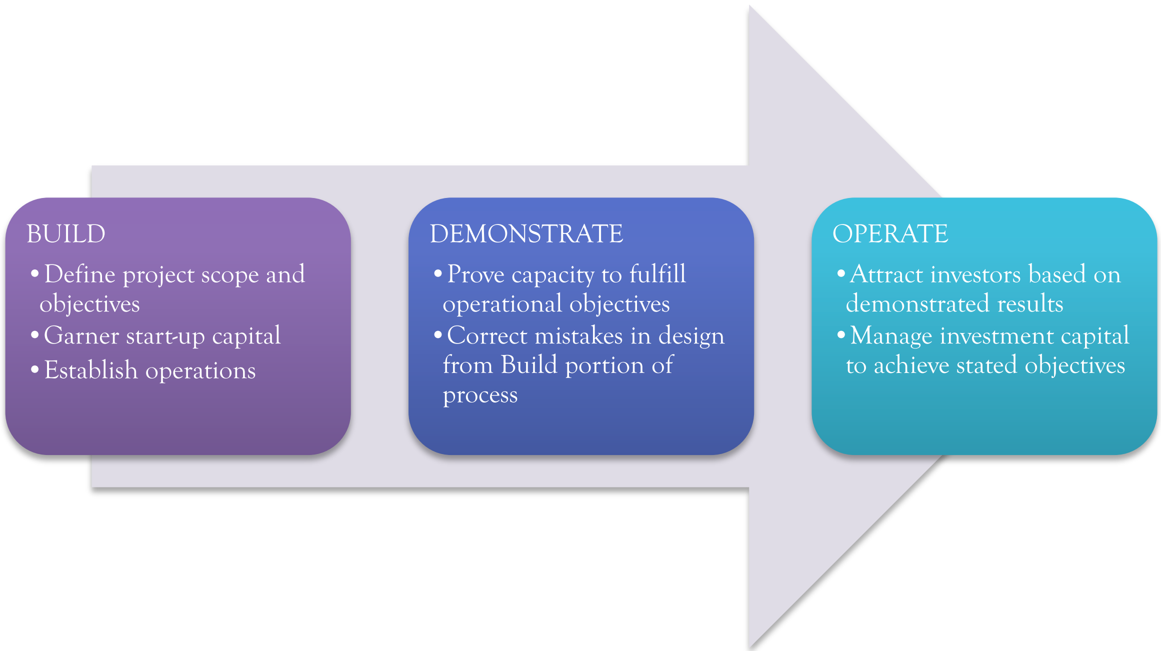
> *By using original data on 80 forest commons in 10 countries across Asia, Africa, and Latin America, we show that larger forest size and greater rule-making autonomy at the local level are associated with high carbon storage and livelihood benefits; differences in ownership of forest commons are associated with trade-offs between livelihood benefits and carbon storage. We argue that local communities restrict their consumption of forest products when they own forest commons, thereby increasing carbon storage. In showing rule-making autonomy and ownership as distinct and important institutional influences on forest outcomes, our results are directly relevant to international climate change mitigation initiatives such as Reduced Emissions from Deforestation and Forest Degradation (REDD) and avoided deforestation. Transfer of ownership over larger forest commons patches to local communities, coupled with payments for improved carbon storage can contribute to climate change mitigation without adversely affecting local livelihoods[31].*

The problem is that, because REDD has twin goals for development and environment, community-driven REDD projects might not be able to achieve the desired outcome through connection with private funding. Furthermore, most participants seem to believe that community-driven approaches are too small to match the scaling needs, either of large private investors or large public sources of capital.

We think that a different approach would elegantly manage both problems.

The first part of this approach relates to a reassessment of how projects are connected with funding sources. We have noticed that each project follows the following flight path:

[31] Chhatre, Ashwini, and Arun Agrawal. 2009. "Trade-Offs and Synergies between Carbon Storage and Livelihood Benefits from Forest Commons." Proceedings of the National Academy of Sciences, early edition, http://www.pnas.org/content/early/2009/10/05/0905308106.



In the context of community-driven projects, one can make two interesting observations about the Build-Demonstrate-Operate cycle described above.

The first is that, for community forestry approaches, Build has more or less the same scope no matter what the project is planning to operate as (carbon aggregator, NTFP harvests, development project, etc.). The only difference is that in the forest carbon scenario (at least, as currently constructed), they have to incur all these extra costs to do the baselining, biomass assessments and the like.

The second is a key question: "operate as what?" There are going to be a good many projects that are best funded from public or not-exactly-profit-driven sources. Others might very well be appropriate for investors, if bundled and offered at scale, sans project-by-project diligence issues.

From this, we have three recommendations for the effective engagement of communities:

1. Relieve projects of the carbon-counting burden during the earlier phases of the process. A simple (and steep) discounting of the amount of carbon likely to be generated by a given project, based on available data from existing projects, would provide cost-free operating capital to the project during the Build phase.

   This means that the generalized operational objectives that are a part of Build could be met more quickly and effectively, enabling communities, projects and funders to see results earlier in the process.

2. Use the Build and Demonstrate phases to clarify what the project will be doing on the basis of operational expertise as opposed to *a priori* guesses. The linchpin of this strategy would be to establish testable standards for commercial activity that may be of interest to investors and if the

projects cannot meet those standards, target them for development funding sources instead of mismatching them with private investors.

For example, if a project believed that it could generate significant commercial revenue from processing non-timber forest products that a community already harvests, the initial capital received during the Build phase might be used as a form of "test loan" to build out some processing infrastructure. The community/project could then begin to establish a cash flow pattern that, in turn, would be used to analyze the project's promise as a lending candidate.

3. The final portion of the process has to do with scale. Given the adoption of 1 and 2, it would be both feasible and desirable to fuse various projects into a single portfolio of projects[32]. Doing so would confer significant advantages to both sides of the arrangement. Projects would no longer be wholly dependent upon single funding sources, and investors would no longer worry as much about placing a single, correct bet on a project.

The end result would be a significant improvement in projects' operational capacity, and a more appropriate, results-tested method for connecting them to appropriate capital sources. Given forest communities' demonstrated effectiveness in achieving good outcomes, this seems like a compelling model.

☑ **Generalize projects' operational functions and use technology to enable them**

The process of constructing and operating a REDD project is far too cumbersome, and furthermore, much of the operational burden falls on forestry or development experts who have neither the inclination nor the expertise to operate their projects from a financial standpoint. Under current standards, these projects are required to construct budgets over very long time horizons and manage their project capital wisely after receiving an investment.

Given this mismatch of skills to resources, it was not surprising that we encountered so many problems when talking with project operators.

First, the process of setting up the project itself seems to require a significant amount of resources – in part because the carbon definition is uselessly complex, as explained above – that would best be used elsewhere. Each time a project is created, its creators are obliged to reinvent the wheel by developing Tolstoyesque PDDs that are bespoke products for no apparent reason other than the lack of a generalized framework for creating projects.

Second, this overburdening of project developers leads to very significant mistakes in the project's operational assessments. Our experience in reviewing project documents revealed large, important projection and assumption errors, ones that set the projects up for almost certain failure.

For instance, many of the budget projections we saw failed to incorporate inflation. In a developing country, that single factor may impose the largest cost of any factor included in a project's financial

[32] We are also working with some community forestry groups to develop the portfolio concept. More information about this work can be requested by emailing us at cfportfolio@mundenproject.com. Again, The Munden Project's strict conflict of interest policy applies to this work, and we do not intend to be participant investors in any such effort.

projection. Not including it would be irresponsible – if one did not consider that the person responsible for doing so had too little training and mindshare to be expected to do it.

In a certain way, this is exactly as it should be. It makes little sense for REDD to develop into an approach that requires highly trained forestry experts to master accounting software and inflation projections. The key is to keep this dynamic sustainable.

Given that REDD funding is currently driven by a small number of capital sources, we wonder if they might not be able to coalesce around a simple, web-based solution to this problem. Developing an application that project developers can use to cost out their projects, operate them and report results makes a lot of sense.

We recognize that some considerations have to be made for the remoteness of locations in which certain projects are situated, but still, a very light Internet-based logic system would have the desirable effect of liberating project designers and participants from having to reinvent the wheel at inception.

Moreover, this system need not be imposed as a top-down approach. Software systems are adaptable enough to accommodate significant differences in management approaches, and we do not think that REDD would be any different in this respect. Furthermore, the nature of REDD's operational accounting and management procedures is simple enough that a high-cost solution would be completely unnecessary.

A straightforward, durable system could be built at an extremely low cost and maintained by a non-profit or series of non-profits charging a minimal commission on transactions (whether public or private) generated through the system.

ABOUT THE MUNDEN PROJECT

The Munden Project was founded in 2009 to develop solutions for addressing a new breed of complex, systemic issues.

Our strategic consulting unit (New York) services clients in finance, agriculture and issues related to climate change, while our software systems arm (Chicago) focuses on derivatives markets and credit systems. We are also launching a new EU consultancy based in Rome this year.

Our solutions are delivered to clients in two forms:

Strategic Analysis. Our consulting clients turn to us for unique perspective on how to quantify, manage or implement solutions to large, systemic problems.

Complex Software Systems. We create, test and implement software systems. Our systems are designed to solve complex data or computational problems that cannot be handled by existing approaches.

Our Expertise in Derivatives and Market Systems

Within our Systems arm, The Munden Project has a strong background in developing quantitative systems for a range of market clients. Our specific technical expertise includes the following areas:

- Commodities derivatives pricing algorithms
- Quantitative techniques for systemic risk modeling
- Simulation techniques for testing automated trading or investment strategies
- Migration of OTC derivatives into exchange-based clearing and/or trading
- Integration with exchange technologies (i.e. FIX, ClearPort)
- Netting, matching and compression systems

We have implemented a number of different financial systems for clients, from automated pricing techniques for interest-rate valuation to electronic trading environments used by hedge funds and derivatives exchanges. The latter includes the migration of OTC products to conform to new governance structures (such as Dodd-Frank and Basel III), a highly unique skill set that sets The Munden Project apart from other software firms.

The Munden Project also provides our perspective and opinions to regulators engaged in implementing derivatives reform. We do so at our own expense, out of a belief that sensible reform that creates more functional markets will accrue to the benefit of all participants in those markets.

For more information, please visit us at http://www.mundenproject.com.