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# Reducing greenhouse gas emissions by forest protection: The transaction costs of implementing REDD

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*"The reason that some activities are not the subject of contracts is exactly the same reason why some contracts are commonly unsatisfactory—it would cost too much to put the matter right."*[1]

*Abstract.* Understanding and minimizing the transaction costs of policy implementation are critical for reducing tropical forest losses. As the international community launches REDD, a global initiative to reduce greenhouse gas emissions from tropical deforestation, policymakers need to pay attention to the transactions costs associated with negotiating, monitoring and enforcing contracts between forest users, governments, and donors. The existing institutional design for REDD relies heavily on central government interventions in program countries. Analysing new data on forest conservation outcomes, we identify several problems with this centralized approach to forest protection. We describe options for a more diversified policy approach that could reduce the full set of transaction costs and thereby improve the efficiency of the market-based approach to conservation.

## I. Introduction

Fifty-one years ago, Ronald Coase articulated the problems with the implementation of government policies to reduce social costs, concluding that sometimes the transaction costs to "put the matter right" exceed the benefits. Such transaction costs help explain why past policy efforts

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[1] R. H. Coase, *The Problem of Social Cost,* Journal of Law and Economics 31-44 (1960).

have not led to global tropical-forest conservation.[2] We argue that more attention to transaction costs would benefit the institutional design of REDD, the new global program intended to combat tropical deforestation in developing countries.[3] Most of the proposed designs for REDD are similar in that they are market-based approaches that rely primarily on host-country government monitoring of contractual behaviour, which entail incentive-incompatibility problems. In addition to the monitoring costs of contractual compliance, negotiating and enforcement costs arise in contracts for forest preservation as they do in all market contracts.

The main objective of REDD is to provide positive economic incentives to people in developing countries to conserve forests and thereby reduce greenhouse gas emissions from one of its leading sources.[4] REDD appears to be a win-win solution: developing countries receive payments to preserve their forests, and donor countries receive carbon credits and praise for "doing something" about climate change.[5] Though REDD seeks to address the core underlying problem of tropical forest loss—the social costs of tropical deforestation and the consequent undervaluation of forest preservation by free markets—the architects of REDD face a range of transaction costs in structuring and implementing the program.

## II. How to Reverse Tropical Forest Loss?

To reverse the current trend of tropical deforestation is a daunting task, partly because we are still in the dark when it comes to making tropical forest conservation work in developing countries. Analysts and practitioners agree that there are no readily available and universal solutions to deforestation and forest degradation.[6] Despite international conservation efforts, no country in the modern era has been able to reverse a trend of area decrease in tropical primary forest.[7] Examining data from FAO's Forest Resources Assessment 2010, we analyzed changes in the spatial extent of primary forests in all countries with tropical forests during the 1990–2010 period. We found no country whose forest inventory data showed an increase in primary tropical

[2] K. Andersson and C. C. Gibson, *Decentralized Governance and Environmental Change: Local Institutional Moderation of Deforestation in Bolivia*, 26 Journal of Policy Analysis and Management 99-123 (2007); and D. Kaimowitz, *Forestry assistance and tropical deforestation: Why the public doesn't get what it pays for*, 2 International Forestry Review 225-231 (2000).

[3] REDD or "Reducing Emissions from Deforestation and Forest Degradation and the Role of Conservation, Sustainable Management of Forests and Enhancement of Forest Carbon Stocks in Developing Countries".

[4] Copenhagen Accord, UNFCCC (2009); and IPCC, Fourth Assessment Report (2007).

[5] L. E. O. C. Aragão and Y. E. Shimabukuro, *The Incidence of Fire in Amazonian Forests with Implications for REDD*, 328 Science 1275-1278 (2010); and K. Richards and K. Andersson, *The leaky sink: persistent obstacles to a forest carbon sequestration program based on individual projects*, 1 Climate Policy 41-54 (2001).

[6] E. Ostrom, M. A. Janssen, and J. M. Anderies, *Going beyond panaceas*, 104 Proceedings of the National Academy of Sciences, 15176-15178 (2007); H. Geist and E. F. Lambin, *Proximate Causes and Underlying Driving Forces of Tropical Deforestation*, 52 Bioscience 143-155 (2002); and A. Angelsen and D. Kaimowitz, *Rethinking the Causes of Deforestation: Lessons from Economic Models*, 14 The World Bank Research Observer 73-98 (1999).

[7] See Food and Agriculture Organization, Global Forest Resources Assessment, FAO (2010); and J.-P. Puyravaud, P. Davidar, and W. F. Laurance, *Cryptic Loss of India's Native Forests*, 329 Science 32 (2010).

forest areas. A handful of countries, including China, India, and Vietnam, reported net increases of total forest cover for the 2005–2010 period, but these figures reflect a trend driven by the establishment of forest plantations, not by regrowth or even stabilization of primary forests. In the case of Brazil, deforestation rates have decreased by about eighty per cent since the peak in 2004.[8] Most scholars now agree that this reduction is not primarily attributable to government action but rather to market-related factors, such as economic growth in urban areas (causing less migration to the frontier) and sluggish markets for some agricultural commodities.[9]

The challenges faced by national governments when seeking to conserve forests are illustrated by recent empirical work that seeks to tease out the effect of government action on deforestation. Using forest-cover data derived from satellite images, together with statistical methods, two research groups—Robalinho and associates[10] and Sanchez-Azofeira and associates[11]—investigated the effects of the Costa Rican government's payments for environmental services (PES) program. This program is often referred to as a forerunner to REDD programs because it pays land owners to maintain stable tree cover on their land. Evaluating the impact of this program, Robalinho et al. found that the program contributed to merely a one per cent decrease in annual deforestation rates,[12] while Sanchez-Azofeira et al. found no statistically significant effect of the program on forest conservation (looking at a slightly shorter time period).[13] Most of the payments went to land owners with forests that had little or no alternative uses, which means that the owners would have conserved the forest regardless of the program payments.

In addition to PES programs, an even more common strategy for conserving tropical forests is the creation of government protected areas, such as national parks and biosphere reserves. A recent study assesses the effect of Costa Rica's protected area system on forest conservation. Andam and associates found that about ten per cent of the protected forest areas would have been deforested had they not been part of the government conservation program.[14] A similar study found that the Brazilian government's creation of protected areas in the Amazon did reduce deforestation in these areas—but this reduction is, according to the authors, principally explained by indigenous territories' protected forest lands and not the government-run protected

[8] A. Regalado, *Brazil Says Rate of Deforestation in Amazon Continues to Plunge*, 329 Science 1270-1271 (2010).

[9] G. A. Sánchez-Azofeifa, R. C. Harriss, and D. L. Skole, *Deforestation in Costa Rica: A Quantitative Analysis Using Remote Sensing Imagery*, 33 Biotropica 378-384 (2007); and D. Nepstad, B. S. Soares-Filho, F. Merry, A. Lima, P. Moutinho, J. Carter, et al., *The End of Deforestation in the Brazilian Amazon*, 326 Science 1350-1351 (2009).

[10] J. Robalinho, A. Pfaff, G. A. Sánchez-Azofeifa, F. Alpízar, C. León, and C. M. Rodríguez, *Deforestation Impacts of Environmental Services Payments: Costa Rica's PSA Program 2000–2005*, Environment for Development Discussion Paper 08-24, Resources for the Future (2008).

[11] Sánchez-Azofeifa et al., supra note 9.

[12] Robalinho et al., supra note 10.

[13] Sánchez-Azofeifa et al., supra note 9.

[14] K. S. Andam, P. J. Ferraro, A. Pfaff, G. A. Sanchez-Azofeifa, and J. A. Robalino, *Measuring the effectiveness of protected area networks in reducing deforestation*, 105 Proceedings of the National Academy of Sciences 16089-16094 (2008).

areas.[15] What these studies show is that even under relatively favourable conditions for forest conservation—with strong political will from national governments and financial support from international organizations—it is extremely difficult to make forest conservation work in developing countries.

Meanwhile, in industrialized countries, natural forest cover has increased in some regions over the past thirty years; for example, in Indiana and in other states in the Mid-West and Northeast of the United States.[16] Symmetric to forest loss in tropical regions, the regrowth of natural forests is not primarily attributable to government programs, but to the reduced profitability of small-scale agriculture on marginal soils.[17]

These empirical results raise concerns over assigning central governments with the lead responsibility for implementing REDD programs. Even in the cases where government programs demonstrably reduced deforestation, as is the case of protected areas in Costa Rica, it remains an open question whether those interventions were cost-effective or whether the same outcomes could have been achieved at a lower cost.

The empirical findings also suggest that there are limits to what we can expect national governments to accomplish when it comes to altering established patterns of land use. It appears that land-use decisions are primarily a function of markets and local community institutions, and to a lesser extent formal government rules and programs.[18] To figure out how the forces of the market might be moderated through specific market-based proposals, such as REDD, we need a better understanding of the hidden costs—the transaction costs—associated with such interventions.

## III. The Transaction Costs of REDD

The core challenge for REDD is to find ways of compensating land owners—governments (national and sub-national), indigenous tribes, community groups, and individual landowners—for foregoing market opportunities associated with deforestation, and instead, con-

[15] B. Soares-Filho, P. Moutinho, D. Nepstad, A. Anderson, H. Rodrigues, R. Garcia, et al., *Role of Brazilian Amazon protected areas in climate change mitigation*, 107 Proceedings of the National Academy of Sciences 10821-10826 (2010).

[16] S. M. Manson and T. Evans, *Agent-based modeling of deforestation in southern Yucatan, Mexico, and reforestation in the Midwest United States*, 104 Proceedings of the National Academy of Sciences 20678-20683 (2007); and N. Ramankutty, E. Heller, and J. Rhemtulla, *Prevailing myths about agricultural abandonment and forest regrowth in the United States*, 100 Annals of the Association of American Geographers 502-512 (2010).

[17] T. P. Evans and H. Kelley, *Assessing the transition from deforestation to forest regrowth with an agent-based model of land cover change for south-central Indiana (USA)*, 39 Geoforum 819-832 (2008).

[18] E. Ostrom and H. Nagendra, *Insights on linking forests, trees, and people from the air, on the ground, and in the laboratory,* 103 Proceedings of the National Academy of Sciences 19224-19231 (2006); D. C. Morton, R. S. DeFries, Y. E. Shimabukuro, L. O. Anderson, E. Arai, F. del Bon Espirito-Santo, et al., *Cropland expansion changes deforestation dynamics in the southern Brazilian Amazon*, 103 Proceedings of the National Academy of Sciences 14637-14641 (2006); and Nepstad et al., supra note 9.

serve forests.[19] To come to grips with this challenge, markets for tropical-forest conservation need to address three substantive transaction costs: the negotiation of contracts with landowners, the monitoring and verification of outcomes, and the enforcement of contracts if the parties do not fulfill their obligations. These transaction costs are present in all contracts, but international contracting—especially when third parties are part of the contract—raise a different set of transaction costs than are present in most market contracts.

For international donors to reach an agreement with landowners to switch from deforestation to conservation requires certainty about who owns the land. This may sound very simple, but the reality is that in most developing countries there are often multiple owners and users who claim property rights to forest resources.[20] It can be extremely messy to sort out property rights to forests, especially when statutory laws and customary norms assign conflicting rights to users.[21] Although national governments often appear as the formal owner of forest resources—recent research estimates that seventy-five per cent of the world's forest estate is owned by national governments—the de facto forest owners are the local people who access, use, and sometimes protect the resource.[22]

This reality poses a dilemma for REDD policymakers: Who is the contracting party with whom to negotiate conservation? Is it the government, which in principle owns the forest resources? Or is it the people, who actually use and manage those resources? Limiting conservation inducements to de jure land owners may produce a race among the de facto right-holders to "mine the resource" before they are formally excluded from accessing and using the resource.[23] Such a race would lead to increased deforestation and widened social inequities.

For these reasons, it may be necessary to couple de jure land ownership with de facto management rights in order to arrive at a market contract that achieves the goal of conservation. Essentially, for markets to work, all the holders of the property rights to the resource need to be part of the contract. One example of a government initiative that seeks to sort out property rights along these lines is the Terra Legal Program, which Brazil initiated in 2009 to grant formal legal title to squatters on public land in the Amazon. While it is imperative to improve the tenure security

[19] A. Angelsen, *Policies for reduced deforestation and their impact on agricultural production*, 107 Proceedings of the National Academy of Sciences 19639-19644 (2010).

[20] G. Feder and D. Feeny, *Land Tenure and Property Rights: Theory and Implications for Development Policy*, 5 The World Bank Economic Review 135-153 (1991); and E. Mwangi and H. Markelova, *Collective Action and Property Rights for Poverty Reduction: A Review of Methods and Approaches*, 27 Development Policy Review 307-331 (2009).

[21] A. M. Larson, P. Cronkleton, D. Barry, and P. Pacheco, Tenure Rights and Beyond (Center for International Forestry Research, 2008); and A. White and A. Martin, Who Owns the World's Forests (Forest Trends and the Center for International Environmental Law, 2002).

[22] W. D. Sunderlin, J. Hatcher, and M. Liddle, From Exclusion to Ownership? Challenges and Opportunities in Advancing Forest Tenure Reform (Rights and Resources Initiative, 2008).

[23] L. Alden Wily and P.A. Dewees, *From Users to Custodians: Changing Relations between People and the State in Forest Management in Tanzania*, World Bank Policy Research Working Paper 2569 1-31 (2001).

for settlers in the Amazon (not the least in order for market-based conservation programs to be effective), achieving such improvements through a title-regularization process has proven to be challenging.[24] The experience of the Terra Legal program is that land regularization is a slow and very contentious process in which it can often be difficult for smallholders to have their claims heard and taken as seriously as those from larger and more powerful land owners.[25] For many countries, this first hurdle will be the most difficult to clear—"it may cost too much to put the matter right."[26]

If and when property rights are sorted out and contracts are negotiated for conservation payments, other transaction costs loom: who will monitor and verify the accomplishments? Donors and carbon-credit buyers, who are the most ardent advocates of REDD, will benefit from cheap credits, so they may not want very close inspection.[27] The sellers of the credits—the developing countries and the carbon-market brokers—also have weak incentives to monitor rigorously; they may be on board because of the financial reward, and looking too carefully on reported claims is not really in their interest either.[28] In short, there may be an incentive-incompatibility in contracts if it is not in the interest of the monitors of the outcomes of the contracts to reliably report performance.

Despite technological advances that allow for more reliable monitoring of changes in forest carbon, many uncertainties still remain. One of the sources of uncertainty is REDD's insistence on additionality—sellers of offset credits need to show that activities rewarded under REDD would not have happened without the program.[29] Such uncertainties invite strategic participants to tweak the numbers in their favour, which would create offset credits that do not represent real reductions in GHG emissions; and such cheating would be hard to detect even for third-party monitors.[30]

Finally, in addition to contracts designed to reduce the negotiation and monitoring costs, enforcement costs remain. They are especially problematic in most international transactions because of the inability to rely on a judiciary to arbitrate disputes. How do rich countries credibly commit to withholding payments to poor countries? At the national level, it may be politically costly to

[24] B. Brito and P. Barreto, Primeiro ano do Programa Terra Legal: avaliacao e recommendacoes (Instituto do Homen e Meio Ambiente da Amazonia, 2010).

[25] D. G. McGrath, S. P. Gama, A. Cardoso, O. Almeida, and J. H. Benatti, *Integrating Co-management and Land Tenure Policies for the Sustainable Management of the Lower Amazon Floodplain*, *in* Miguel Pinedo-Vasquez, Mauro L. Ruffino, Christine Padoch, and Eduardo S. Brondízio (eds), The Amazon Várzea, pp. 119-135 (2011).

[26] Coase, supra note 1.

[27] Richards and Andersson, supra note 5.

[28] W. F. Laurance and O. Venter, *Measuring Forest Changes*, 328 Science 568 (2010).

[29] A. Karsenty, *The Architecture of Proposed REDD Schemes After Bali: Facing Critical Choices*, 10 International Forestry Review 443-457 (2008).

[30] K. Andersson and K. Richards, *Implementing an international carbon sequestration program: Can the leaky sink be fixed?*, 1 Climate Policy 173-188 (2001); and Laurance and Venter, supra note 28.

enforce commitments when the non-compliers are poor people who may have failed to protect forests for very legitimate reasons: they need to buy food to stay alive.[31]

Many of these transaction costs are hard to quantify, but REDD architects need to take steps to minimize them in order to create a market for conservation. It is only when weighing the true social costs and benefits of relying on forestry for emission reductions that alternative options—such as reducing fossil-fuel emissions in industrialized countries, or geoengineering—may be compared.

## IV. Reducing the Transaction Costs of REDD

Solving common-pool resource problems is a difficult challenge even with substantial amounts of external funding.[32] Reducing emissions from deforestation will require more than indiscriminately paying governments or landholders money to conserve forests. More money to REDD will not necessarily mean less deforestation in developing countries. However, policy interventions to protect forests are likely to be more effective if they are developed with an understanding of how transaction costs can affect the outcomes of such interventions.

We identify two specific avenues for reducing transaction costs and thus improving contracting for conservation. First, before negotiating any contracts, property rights to forests need to be sorted out, and the approach taken by governments to regularize land and tree ownership will necessarily vary across countries and even within countries. A useful diagnostic tool for governments that seek to improve tenure security for forest users is a field-based forest inventory that includes the collection of data not only on forest vegetation (as mandated by the IPCC methodological guidelines[33]) but also by systematic documentation of forest users and the nature of their forest use, including the current status of property-rights claims.[34] In Tanzania, for example, a national forest inventory is underway that combines biophysical measurements with field interviews with forest users. The goal with the inventory is not only to quantify forest-related carbon pools, but also to identify specific regions where property-rights issues are particularly prevalent or conflictive. The primary usefulness of such a diagnostic tool is to guide the government decisions on where and how to intervene in order to help sort out property rights related to

[31] This is analogous to the market failures for home mortgages in many countries. If foreclosures are not politically feasible, the capital market for mortgages disappears. K. M. Chomitz, P. Buys, G. D. Luca, T. S. Thomas, and S. Wertz-Kanounnikoff, At Loggerheads? Agricultural Expansion, Poverty Reduction, and Environment in the Tropical Forests (2007).

[32] T. Dietz, E. Ostrom, and P. C. Stern, *The Struggle to Govern the Commons*, 302 Science 1907-1912 (2003); E. Ostrom, *A General Framework for Analyzing Sustainability of Social-Ecological Systems*, 325 Science 419-422 (2009); and K. Andersson and E. Ostrom, *Analyzing decentralized resource regimes from a polycentric perspective,* 41 Policy Sciences 71-93 (2008).

[33] Intergovernmental Panel on Climate Change, Good practice guidance for land use, land-use change, and forestry, IPCC (2004).

[34] E. Tomppo and K. Andersson, Technical Review of FAO's Approach and Methods for National Forest Monitoring and Assessment, FAO (2009).

forest access and use.[35] The data generated by such a diagnostic monitoring tool can also help decision-makers identify the "low hanging fruit" of deforestation reduction—to target areas where reductions would be the least expensive to achieve. One of the benefits of building a market for forest conservation is that once property rights are known, the holders of property rights will have an incentive to reveal their opportunity costs and buyers can start low and buy conservation preservation up to their budget. For this strategy to work, however, reliable data on variation in forest carbon as well as the human drivers of such variation are required, and such data are not available in most REDD countries at this point.

Another way in which the transaction costs of conservation may be reduced is through the development of multilevel governance responses to forest loss. In addition to *national governments*, other types of organization may have lower transaction costs related to the negotiation, monitoring, and enforcement of contracts.[36] For example, a local association of forest users may do a better job at patrolling, monitoring, and protecting forests over which they have vested user rights, than would a central government.[37] An independent research institute may be more impartial and often has better technical expertise in monitoring compliance with land-use regulations than do government agencies that may have economic and political stakes in the outcome.[38]

An often-overlooked option for multilevel governance is the modification of economic policies in industrialized countries.[39] Reforming these policies could complement the market for forest conservation. For example, if the United States decided to remove subsidies for ethanol production, this would increase the amount of corn acreage used for non-ethanol use as well as increase the acreage planted in soy, which in turn would reduce the incentive for Brazil to expand their soy frontier further into the Southern Amazonian forest.

## V. Concluding Remarks

All contracts must confront and try to minimize transaction costs. The most common set of transaction costs are negotiation, monitoring, and enforcement costs. Relative to two private parties entering into a domestic contract where they contract in the "shadow" of the domestic legal system, the transaction costs of public contracts increase because of third parties being part of the contract, which raises issues of incentive-incompatibility associated with the set of transaction costs that we have highlighted. International public contracts or third-party contracts

[35] Ibid.

[36] J. Phelps, E. L. Webb, and A. Agrawal, *Does REDD+ Threaten to Recentralize Forest Governance?*, 328 Science 312-313 (2010); and J. S. Oestreicher, K. Benessaiah, M. C. Ruiz-Jaen, S. Sloan, K. Turner, J. Pelletier, et al., *Avoiding deforestation in Panamanian protected areas: An analysis of protection effectiveness and implications for reducing emissions from deforestation and forest degradation*, 19 Global Environmental Change 279-291 (2009).

[37] Ostrom and Nagendra, supra note 18; and Ostrom, *A General Framework*, supra note 32.

[38] An example of a politically impartial monitor of deforestation is Brazil's Instituto Nacional de Pesquisas Espaciais (INPE).

[39] A. Long, Tropical Forest Mitigation Projects and Sustainable Development: Designing U.S. Law for a *Supportive Role,* 36 William Mitchell Law Review 968-991 (2010).

do not take place in the shadow of a domestic legal system that gives the participants recourse to the judicial system. At the very least, this raises enforcement costs. In the case of contracting to protect forests, uncertainty over property rights and the incentives of the international participants may also increase negotiation and monitoring costs. For REDD to succeed, parties to the program need to be aware of the set of transaction costs up front—prior to engaging with the program and setting up contracts for buying or selling emission-offset credits—so that they can either safeguard themselves from downstream opportunistic behaviour or decide that it is "too costly to put the matter right".[40]

[40] Coase, supra note 1.