Analysing REDD+

Challenges and choices

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Chapter 12

Site selection for forest carbon projects

Liwei Lin, Subhrendu K. Pattanayak, Erin O. Sills and
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- Countries with a higher biodiversity index and jurisdictions with more protected area are more likely to have forest carbon projects, corroborating proponents' assertions that they consider biodiversity co-benefits when selecting sites.
- Jurisdictions with higher deforestation rates and forest carbon densities in Brazil and Indonesia are more likely to have forest carbon projects, consistent with a focus on additionality. However, projects also tend to be located in more remote (and possibly less threatened) areas in Brazil.
- Villages inside project boundaries (in a sample of REDD+ projects studied by CIFOR) depend largely on agriculture, emphasising the challenge of reducing deforestation without undermining agriculture-based livelihoods.

12.1 Introduction

Projects are a key part of the REDD+ landscape. Over 200 projects are being implemented or developed in around 40 countries (Kshatriya *et al.* 2011). In 2010, REDD+ projects accounted for the largest share of transactions in the voluntary carbon market (Peters-Stanley *et al.* 2011). As the most concrete embodiment of the ongoing international policy discussions about REDD+, projects are a key reference point for understanding how REDD+ will unfold on the ground. They are also a valuable source of lessons for future REDD+ implementation, as discussed in Chapters 9, 10, 11 and 14 (tenure, proponent challenges, hopes and worries, and MRV in local projects) as well as other literature (e.g. Harvey *et al.* 2010b; Hajek *et al.* 2011).

Previous research assessing the distribution of REDD+ initiatives across countries found biases *against* Africa and *towards* countries with higher forest carbon stocks (Wertz-Kanounnikoff and Kongphan-Apirak 2009; Cerbu *et al*. 2011). In addition, Cerbu *et al*. (2011) found that higher biodiversity and governance indicators increase the probability of a country having REDD+ projects. But to date there has been no attempt to assess the subnational geography of REDD+ projects. This is more challenging due to the lack of consolidated information on the boundaries of REDD+ projects (unlike protected areas, for example) and because their precise boundaries are often in flux and/or confidential until they are presented for validation by a carbon offset standard.

In this chapter, we use data on the jurisdictions (countries, municipalities or districts, and villages) where projects are located to obtain insights into site selection. The location of projects is important because it shapes the possibilities for additionality and for learning from experience. First, however, we discuss sources of information on forest carbon projects and update information found in Sills *et al.* (2009) on who and what are involved in these projects.

12.2 Information sources on projects

This chapter draws on three sources of information about REDD+ projects (Figure 12.1). The first is a catalogue of global forest carbon projects developed under the Global Comparative Study (GCS) on REDD+ (see Appendix) (Kshatriya *et al.* 2011). This catalogue builds on and complements other efforts to track projects, as described in Box 12.1. The catalogue was compiled through internet searches (including the websites listed in Box 12.1), email correspondence and interviews with project proponents, a review of the grey literature on carbon offset projects, and expert input on individual countries. It includes projects in all stages of implementation, from initial planning to those that are selling verified carbon credits.

Second, with the assistance of CIFOR staff and associates in Brazil and Indonesia, we were able to obtain more detailed information on the proponents and jurisdictions (municipality or district) where projects are located in these countries. We also contacted many of the proponents – 33 (75%) of projects in Indonesia and 20 (56%) in Brazil – for information on

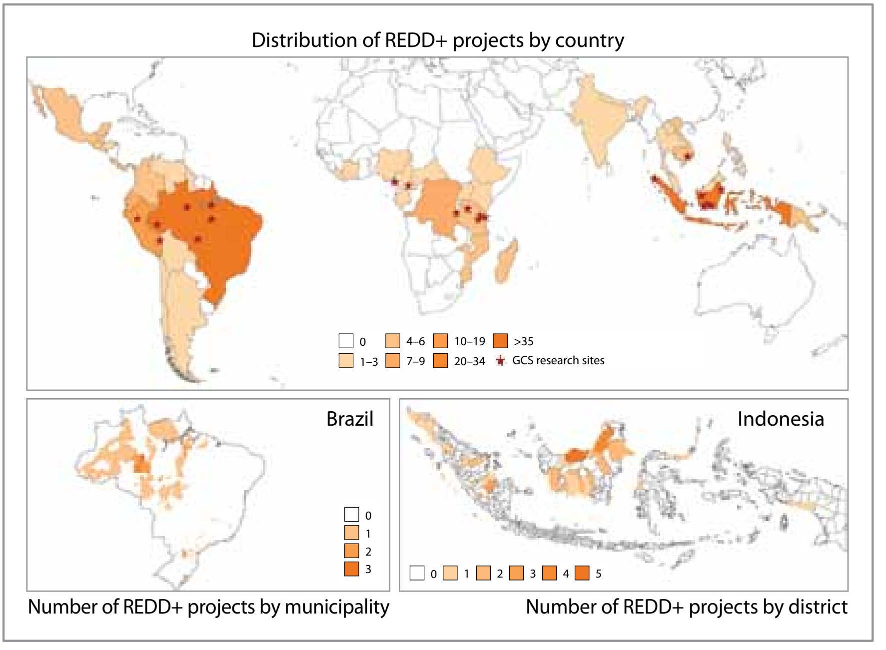

Figure 12.1 Distribution of REDD+ projects

their basic strategies. Our focus on Brazil and Indonesia is motivated by the fact that they generate more than half of global emissions from deforestation (Murray and Olander 2008), have the largest numbers of forest carbon projects (Kshatriya *et al.* 2011) and are among the top three countries in terms of total forest carbon stock (Saatchi *et al.* 2011).

Third, for 20 projects in the GCS (in six countries), we also have basic information on villages located both inside and adjacent to the projects, gathered as part of the sample selection process for the before-after-control-impact (BACI) evaluation method described in the Appendix. This information was gathered from key informants, secondary statistics and field visits.[1] The database includes 148 villages located within the boundaries of REDD+ projects and 170 villages located outside of the project boundaries but in the same region. While this does not represent a random sample of villages, it broadly characterises the types of villages in REDD+ projects.

12.3 Overview of forest carbon projects

We define REDD+ projects as interventions to increase, quantify and report forest carbon stocks relative to business as usual reference scenarios

1 This GCS research instrument and database are called the 'Village Appraisal Form'.

Box 12.1 Catalogues of REDD+ projects

Mrigesh Kshatriya and Liwei Lin

There are several platforms that catalogue and present information on REDD+ projects. In 2011, CIFOR launched a global catalogue of forest carbon projects with a map interface and links to further information on the projects, available at http://www.forestsclimatechange.org/redd-map. Other organisations that are tracking the development of REDD+ projects or forest carbon projects can be categorised into the following:

- Standard-setting organisations such as CCBA, VCS and Plan Vivo
- Environmental NGOs such as the Institute for Conservation and Sustainable Development of Amazonas (IDESAM), Global Canopy Programme, and Forest Trends (including Forest Carbon Portal and Carbon Catalog)
- Research organisations such as CIFOR and IGES (see below)
- Intergovernmental organisations such as UNFCCC Clean Development Mechanism (CDM) and World Bank Carbon Finance Unit.

In addition to the CIFOR catalogue, the following websites are good starting points for information on REDD+ projects:

The Climate, Community and Biodiversity Alliance (CCBA)
(http://www.climate-standards.org)
The CCBA is a consortium of environmental NGOs and IGOs that have developed standards for evaluating forest carbon projects. Of the 75 projects that have been, and are currently being, audited, 20 are in Africa, 17 in Asia, and 25 in Latin America, with the rest in the USA and Europe.

Verified Carbon Standard (VCS)
(http://www.vcsprojectdatabase.org)
The VCS was founded to provide quality assurance in the certification of projects in the voluntary carbon market. The website contains information on over 750 projects from forest conservation to the waste disposal sector, but only 22 that fall within the agriculture, forestry or land use category in developing countries.

Plan Vivo
(http://www.planvivo.org/projects/registeredprojects/)
Plan Vivo Foundation is a registered UK NGO that has created standards for designing and certifying community-based forest projects. The Plan Vivo project registry has 17 projects, 10 operating in Africa, 3 in Asia and 4 in Latin America.

Forest Carbon Portal
(http://www.forestcarbonportal.com)
Developed by Ecosystem Marketplace, a programme of the US-based NGO Forest Trends, Forest Carbon Portal has a searchable database of forest carbon offset projects around the world. The aim of this inventory is to link

forest carbon projects to carbon markets, and it is designed for a broad range of stakeholders. Of the 40 REDD+ projects on this platform, 11 are in Africa, 2 in Asia and 21 in Latin America, with the remainder in North America and Europe.

Carbon Catalog
(http://www.carboncatalog.org/)
Carbon Catalog is an independent directory of carbon credits, also recently acquired by Ecosystem Marketplace. It lists 136 carbon providers from nonprofit and commercial organisations, and includes 627 projects worldwide. Of the projects in the forestry sector, 27 are in Africa, 16 in Asia and 22 in Latin America.

The REDD Countries Database (RCD)
(http://www.theredddesk.org/countries)
The RCD – part of the REDD desk platform – is an independent database of activities on the ground, which has been developed by the Global Canopy Programme and the Forum on Readiness for REDD in collaboration with in country research organisations. Currently, the RCD includes information on 144 REDD+ initiatives (subnational projects and readiness activities) in seven countries.

Institute for Global Environmental Strategies (IGES)
(http://redd-database.iges.or.jp/redd/)
The IGES is an international research institute established under the Japanese government. The IGES REDD+ online database describes projects and country readiness activities. With a total of 29 projects, 3 are in Africa, 17 in Asia and 9 in Latin America.

in a geographically defined subnational area of a developing (non-Annex I) country. There is often ambiguity about whether the 'plus' in REDD+ includes af/reforestation (AR). In existing compliance markets, there is a distinct line between REDD projects (which intend to reduce deforestation or forest degradation) and AR projects (which create new forests). According to the rules laid out under the Kyoto protocol, only the latter are eligible to participate in the CDM. This line is blurred, however, with REDD+ projects. Many projects self-labelled as REDD+ include some component of tree planting, whether motivated by a desire to ensure the supply of wood products, or generate employment or market credits that can be linked to new trees in the landscape. We include afforestation projects that are planting trees only outside existing forests within the broader category of 'forest carbon' projects. We define 'REDD+ projects' as forest carbon projects that include at least some intervention in existing forest areas, be it avoiding deforestation, avoiding degradation, restoring forest or improving forest management.

This includes earlier avoided deforestation projects (catalogued in Caplow *et al.* 2011) launched prior to REDD+ but which have remained active since its advent.

12.3.1 Goals and activities

Focusing on Brazil and Indonesia, nearly all (48 out of 53) of the REDD+ project proponents whom we contacted cited reduced deforestation as one of their goals, and of these, over 40 also cited reduced degradation or restoration of forests (Table 12.1). Many proponents indicated that they were pursuing all of our listed goals: avoiding deforestation, avoiding degradation, restoring forest and afforestation (Figure 12.2). We asked the proponents whether they were accomplishing these goals through community forest management, monitoring and enforcement of forest laws and regulations, integrated conservation and development initiatives around protected areas (ICDP), and/or payments for ecosystem services (PES, as cash or in-kind rewards). A few proponents noted additional activities, like dissemination of new technologies such as improved cookstoves and reduced-impact logging. Table 12.1 and Figure 12.2 summarise the results, which confirm that most but not all proponents are planning conditional, performance-based payments in the spirit of payment for ecosystem services (PES). All of the Indonesian projects planning PES and nearly all (13) of the

Table 12.1 Number of REDD+ projects in Brazil and Indonesia by goals and activities

	Number of projects pursuing each goal/activity	
	Brazil	**Indonesia**
Goals		
Avoided deforestation (AD)	20	28
Avoided degradation (Adg)	14	23
Restoration (RS)	13	21
Activities		
Community forest management (CFM)	12	18
Monitoring and enforcement (Enforcement)	15	22
Integrated conservation and development projects (ICDP)	16	23
Payment for ecosystem services (PES)	14	20
Total REDD+ projects contacted	**20**	**33**

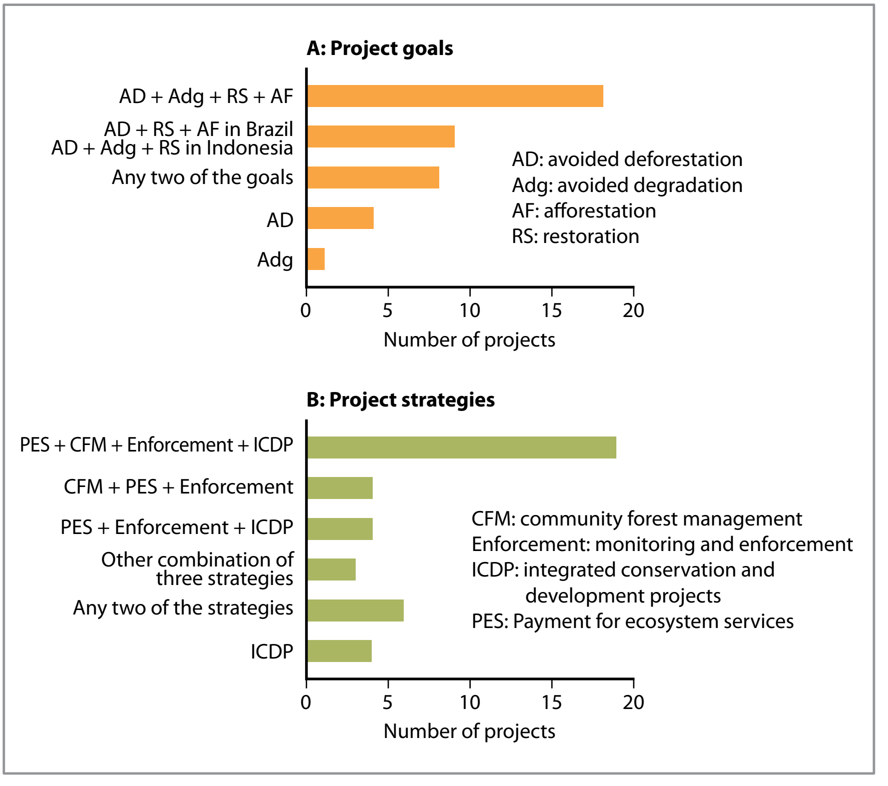

Figure 12.2 Number of projects in Brazil and Indonesia pursuing different combinations of goals and activities

Brazilian projects planning PES are also investing in improved monitoring and enforcement or ICDP-type interventions, consistent with the hybrid model discussed in Chapter 10.

This mix of strategies is also consistent with the range of deforestation pressures taken on by projects. In Indonesia, the proponents we contacted indicated in roughly equal numbers that they are focused primarily on “changing the behaviour of actors who are currently deforesting or degrading the forest in the specific local area of the project” or on “preventing or pre-empting anticipated future deforestation or degradation threats” (e.g. development of palm oil plantations by companies from outside the project area). In Brazil, proponents were slightly more likely to say that their projects focused on preventing future threats rather than changing the behaviour of current actors. Better enforcement may be the most commonly cited strategy in part because it is relevant to both types of threats, whereas community forest management, integrated conservation and development, and PES are typically implemented with local populations who have some tradition of using (and have traditional property rights to) the local forest. In project sites where outside actors (who do not have a tradition of or rights to forest use) are the main deforestation threat, it is more challenging to counter this threat with performance-based payments, integrated conservation and development, or community forest management. Another type of hybrid strategy employed by projects is to use these strategies to build local alliances and support for warding off external threats of deforestation (see Box 12.2).

12.3.2 Key players

Forest carbon projects are being implemented by governments, nongovernmental organisations and the private sector, resulting in significant variation in emphasis and effectiveness (Agrawal *et al.* 2011). The majority of forest carbon projects that we catalogued are being implemented by NGOs, typically with environmental or sustainable development missions (see Virgilio *et al.* 2010). The GCS sample illustrates this trend, with projects led by international environmental organisations such as Conservation International, The Nature Conservancy, Fauna and Flora International, and the Jane Goodall Institute; international development organisations such as CARE and SNV; and national environmental organisations such as Amazon Environmental Research Institute, Tanzania Forest Conservation Group and the Centre for Environment and Development (see list of CIFOR project sites in the Appendix on the GCS). Out of 107 forest carbon projects in Brazil and Indonesia, 65 (61%) are led by NGOs. Of these, 20 (30%) are led by NGOs based in the United States, with others from Europe (e.g. Germany, Switzerland and UK), Asia (e.g. Australia and Japan) and the host countries. In Brazil and Indonesia, there is a private sector proponent in 43% of projects. Examples from the GCS sample of projects include private consulting groups like Mazars Starling Resources in Indonesia and GFA Consulting Group in Cameroon. Finally, local governments are often partners in project implementation and are taking the lead role in jurisdictional projects (e.g. the Brazilian state of Acre and Indonesian province of Aceh).

Other key players in the project landscape include funders and standards organisations, along with the certifiers or auditors who verify compliance with those standards. As discussed in Chapter 7, funders include philanthropic donors, the private (for profit) sector, and governments through multilateral initiatives (UN-REDD Programme, Forest Carbon Partnership Facility, Forest Investment Program and Congo Basin Forest Fund) and bilateral aid. The most prominent donor of bilateral aid has been the Norwegian government through its International Climate and Forests Initiative, which has pledged over US $680 million for REDD+ (Tipper 2011), including both REDD+ projects and readiness activities. The next biggest bilateral donor to REDD+ is the United Kingdom (Climate Funds Update 2012).

Box 12.2 Integrating conservation tools in the *Bolsa Floresta* programme, Brazilian Amazon

Jan Börner and Sven Wunder

The Juma Sustainable Development Reserve (SDR Juma) REDD project started in 2007 as part of the *Bolsa Floresta* programme in the largest Brazilian state, Amazonas. *Bolsa Floresta* is an ambitious conservation programme covering over 1 million hectares in 15 of Amazonas State's protected areas. The SDR Juma lies relatively close to the rapidly expanding agricultural frontier of Apuí, in the southeastern corner of Amazonas. Its population consists mainly of traditional small-scale producers who, apart from staple crop production, rely heavily on forest product use and fishing for subsistence. Projected future deforestation is nonetheless high for Juma, as cattle production is expected to gradually encroach onto its southern and eastern boundaries.

The *Bolsa Floresta* programme engages primarily with the local population in the protected areas and intends to promote good forest stewardship through conditional conservation incentives and interventions aimed at improving quality of life. As such, it innovatively combines different conservation policies, including ICDPs and PES. First, direct PES under *Bolsa Floresta* is a well-disseminated and locally popular innovation in Amazonas, but represents only a small share of total programme spending. Second, *Bolsa Floresta* improves local health services and education, thus compensating for the general underprovision of public services in these remote protected areas. Third, local resident associations are being strengthened, including for example, in SDR Juma through improved river transport offered to residents through local associations. Fourth, *Bolsa Floresta* promotes alternative production strategies in the villages through ICDP-type interventions (e.g. small animal husbandry, on-farm processing for value-added products) in order to make production systems more intensive and sustainable.

The programme thus aims to address a well-known Achilles heel of the recently quite successful Brazilian strategy for reducing Amazon deforestation through establishment of protected areas and enforcement of other conservation regulations. Effective regulation hinges on frequent and expensive field presence and may have local livelihood costs. In response, *Bolsa Floresta* is designed to buffer local household-level income losses resulting from compliance with protected area rules (PES component), provide improved organisation and compensatory collective benefits (association and social components) and reduce local dependence on forest degrading activities (alternative income component). Hence, the programme implementer Sustainable Amazon Foundation (FAS) hopes to enhance conservation alliances with local residents through the integration of these components, and thus bolster the integrity of protected areas even if pressure from outside increases as the agricultural frontier gradually approaches. Evidence from older Amazon colonisation frontiers suggests that stable forest-agriculture mosaics can emerge from smallholder-dominated landscapes, thus avoiding the more common conversion to extensive pasturelands. *Bolsa Floresta* is an attempt to move in that direction, and time will tell the extent of its success.

The leading standards for REDD+ projects are the Climate, Community and Biodiversity Project Design Standards (CCB Standards) and the Verified Carbon Standard (VCS) (Diaz *et al.* 2011), discussed further in Chapters 14 and 17. Winrock's American Carbon Registry also has a standard for forest carbon projects, including a method for REDD+ based on avoiding planned deforestation, and is developing a standard for projects nested in jurisdictional REDD+ systems. California's Climate Action Reserve includes forest carbon projects in the US and is developing a protocol for REDD+ projects in Mexico. Plan Vivo has been used primarily for agroforestry and af/reforestation projects but has REDD+ projects in its certification pipeline. Other standards include CarbonFix for af/reforestation projects and the relatively new Global Conservation Standard for carbon stocks in protected areas (Merger *et al.* 2011). Both the organisations coordinating development of these standards and most of the auditors that certify compliance with the standards are from the same group of OECD countries as the donors. However, Brazil is a partial exception to this rule, with two national standards (Social Carbon managed by the Ecologica Institute and *Brasil Mata Viva* managed by *the Bolsa de Títulos e Ativos Ambientais do Brasil*), as well as Social and Environmental Principles and Criteria developed by Brazilian NGOs as guidelines for implementing REDD+ in the Brazilian Amazon.

12.4 Project location

12.4.1 Why location matters

In order to achieve additionality, it would be logical to locate projects where significant deforestation or forest degradation is expected. As suggested by the literature on PES in Costa Rica, an intervention cannot have much incremental impact on reducing deforestation where deforestation rates are already low (Sánchez-Azofeifa *et al.* 2007). However, this does not rule out the possibility that interventions could encourage forest regeneration and/or better management of forests (Daniels *et al.* 2010; Arriagada *et al.* 2012), especially in a setting like Costa Rica with relatively clear land tenure and good governance (Pagiola 2008). Extending this to REDD+, a necessary – but not sufficient – condition for reducing emissions from deforestation (RED) is the presence of a significant stock of forest carbon threatened by future deforestation, as indicated by recent deforestation trends and the presence of deforestation drivers (e.g. roads). If this condition is not met, then REDD+ interventions must achieve additionality through the D+ (avoided degradation or enhancement of forest carbon stocks).

Some have questioned "how many REDD+ projects would truly fall within … the agricultural frontier, where, in the absence of REDD+, most deforestation is likely to occur and thus the greatest additionality can be achieved. An examination of some cases in Mexico and Honduras, for example, reveals the highest deforestation in areas where governmental forestry and environmental agencies have least access due to social conflicts and where no REDD+ activities are being planned" (Louman *et al.* 2011:368). This highlights the tradeoff between locating projects where there is the most deforestation to be avoided and locating them where effective interventions can be implemented realistically. This depends not only on governance conditions, but also on the opportunity costs of forest conservation and the operating costs for projects. The analysis by Busch *et al.* (2012) suggests likely site selection for REDD+ projects in Indonesia based on a given carbon price and the distribution of opportunity costs. Agrawal and co-authors suggest that existing REDD+ projects have been tailored primarily to provide social and ecological co-benefits valued by early investors, while in the future, "the segment of the carbon market likely to expand the most may be the one in which social and ecological co-benefits receive lesser attention" (Agrawal *et al.* 2011:384). We therefore consider forest carbon stocks, deforestation rates and drivers, and indicators of governance, opportunity costs and co-benefits as potential determinants of optimal site selection. Understanding patterns in site selection to date is a first step towards meeting the challenges of identifying optimal sites for future projects, designing nested REDD+ systems that include projects, and generalising or transferring lessons from REDD+ projects.

12.4.2 Cross-country distribution

The two countries with the highest emissions from land use change are Brazil and Indonesia (Houghton 2009). As reported by Houghton (2009), different methods suggest somewhat different rankings of other countries, but in addition to Brazil and Indonesia, top emitters may include Democratic Republic of the Congo, Myanmar, Nigeria and Venezuela. The cross-country distribution of REDD+ projects can also be compared to the distribution of total forest carbon stocks, which have been estimated to be highest in Brazil, Colombia, Democratic Republic of the Congo, Indonesia and Peru (Saatchi *et al.* 2011). However, there is significant variation across studies (Gibbs *et al.* 2007).

As of November 2011, CIFOR's global catalogue listed forest carbon projects in 51 non-Annex I countries. Of these, nine countries only have projects engaged exclusively in AR, but there are 43 countries with at least one of the more than 200 REDD+ projects worldwide. This wide spread of projects across many countries is important for informing the development of a future REDD+ regime, which will have to be inclusive to avoid being undermined by international leakage (Murray and Olander 2008). However, while many countries have one or two projects, most are highly concentrated in just three countries: Brazil, Indonesia and Peru. We examine these cross-country patterns and their possible underlying causes.

In Indonesia, there are 51 forest carbon projects, of which seven appear to be exclusively engaged in AR. The other 44 (many in Kalimantan) involve some combination of reduced deforestation, reduced degradation, restoration, reforestation and forest management. We have catalogued 56 projects in Brazil, which can be divided into 20 that involve only AR, mostly located in the Atlantic coastal forest region, and 36 that involve some combination of strategies that could be labelled REDD+, mostly located in the Amazon. Peru has 41 forest carbon projects, including 22 that appear to be pursuing only AR. The concentration of projects in Brazil and Indonesia is consistent with their global importance as sources of GHG emissions from land use change (Murray and Olander 2008). However, as suggested by Phelps *et al.* (2010a) and Calmel *et al.* (2010), factors other than forest carbon clearly also play an important role in the selection of countries for REDD+ projects. Democratic Republic of the Congo, for example, has just 11 projects (four focused exclusively on AR), despite its importance in terms of both forest carbon emissions and stocks. Similarly, Colombia has a high forest carbon stock yet only 10 projects (five exclusively AR), and we have identified only one project each in Venezuela and Nigeria and none in Myanmar.

Lin (forthcoming) examines the distribution of REDD+ projects across tropical developing countries (a subset of the non-Annex I countries under the Kyoto Protocol). Of these 86 countries in Africa, Asia and Latin America, 48 have at least one forest carbon project. After controlling for land area, population, GDP, governance index and rate of forest loss, she finds that the probability of forest carbon projects in a country is positively related to the country's biodiversity (as measured by the Global Environment Facility Benefit Index for Biodiversity (Pandey *et al.* 2008)), the percent of the country in terrestrial protected areas (from the World Database on Protected Areas (IUCN and UNEP 2010)), and the experience of the country with remote sensing and the CDM (from Resources for the Future [RFF]'s Forest Carbon Index (Deveny *et al.* 2009)). This is consistent with the stated priority given to biodiversity in project documents, as reported by Cerbu *et al.* (2011). It may partly explain the large number of projects in Peru, which has a high biodiversity index (7th out of the 86 countries) in addition to a large forest carbon stock and supportive government policy.

12.4.3 Subnational geography

To assess subnational patterns in site selection, we identified the number of projects in each municipality in Brazil and district in Indonesia. This allowed us to evaluate whether projects have been targeted to jurisdictions with significant carbon emissions from deforestation that could potentially be reduced by project interventions. We obtained data on deforestation rates from Hansen *et al.* (2008), who map gross forest cover loss between

2000 and 2005; forest carbon from RFF's Forest Carbon Index (Deveny *et al.* 2009); and percent forest cover in 2000 from the global land cover database (EC 2003).

Figures 12.3 and 12.4 show box and whisker plots[2] for deforestation rates, forest carbon density, and forest cover comparing municipalities in Brazil and districts in Indonesia with and without REDD+ projects. We have subdivided each country into the forest frontier regions (the Brazilian Legal Amazon and Indonesia's Outer Islands, shown in light grey) and the more economically developed regions (Brazil outside of the Amazon and the island of Java, shown in dark grey). For the Legal Amazon and the Outer Islands, the box plots show that projects tend to be located in places with higher forest cover and higher forest carbon content, but not necessarily higher deforestation rates. This suggests that projects are targeted to places with large stocks of forest carbon, but which are not necessarily facing threats to those stocks. However, while the median forest cover and forest carbon density are higher for municipalities and districts with REDD+ projects, the inner-quartile ranges overlap. In other words, there is also great variability in all three measures of forest carbon, indicating that there are other factors driving site selection. Controlling for these factors could provide a clearer picture of how site selection relates to forest carbon.

In selecting sites for REDD+ projects, proponents are likely to also consider the costs or difficulty of reducing emissions and the potential for co-benefits (see list of proxy measures in Table 12.2). Many of the factors that encourage deforestation are also likely to increase the difficulty and cost of project implementation, e.g. high opportunity costs, high population density, unclear tenure and poor governance. Thus, factors such as road or population density could either increase the likelihood of projects by creating the potential for additionality, or decrease the likelihood by making it difficult to effectively reduce deforestation. We compile subnational data on population density from national census agencies, and on road density from the Digital Chart of the World (total meters of roads divided by the size of the administrative unit in square meters) (DMA 1992). RFF's Forest Carbon Index also includes a direct measure of opportunity cost (Naidoo and Iwamura 2007). Key co-benefits expected from REDD+ include biodiversity conservation and poverty alleviation. We proxy for potential biodiversity co-benefits with percent of land in protected areas (IUCN and UNEP 2010) and for potential poverty alleviation co-benefits with poverty indices (from national census agencies).

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2 Boxplots show the distribution of the dataset. The line inside the rectangle represents the median of the distribution. The upper and lower boundaries of the rectangle indicate the upper quartile (25%) and the lower quartile (25%), respectively. The two lines outside of the rectangle are lower extreme and upper extreme values.

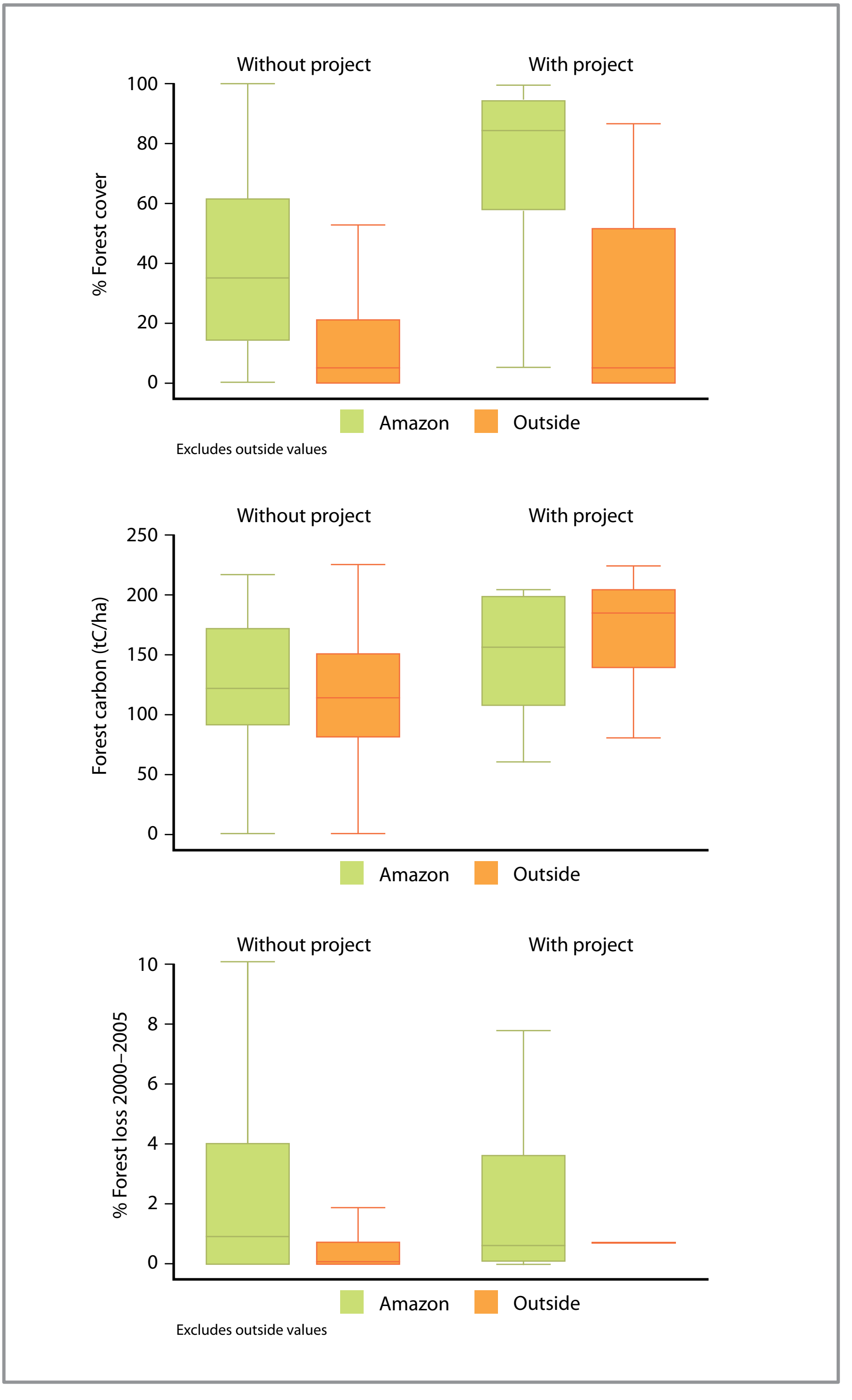

Figure 12.3 Comparison of municipalities with at least one REDD+ project to municipalities with no REDD+ projects, subdivided into municipalities in the Legal Amazon vs. the rest of Brazil ('outside')

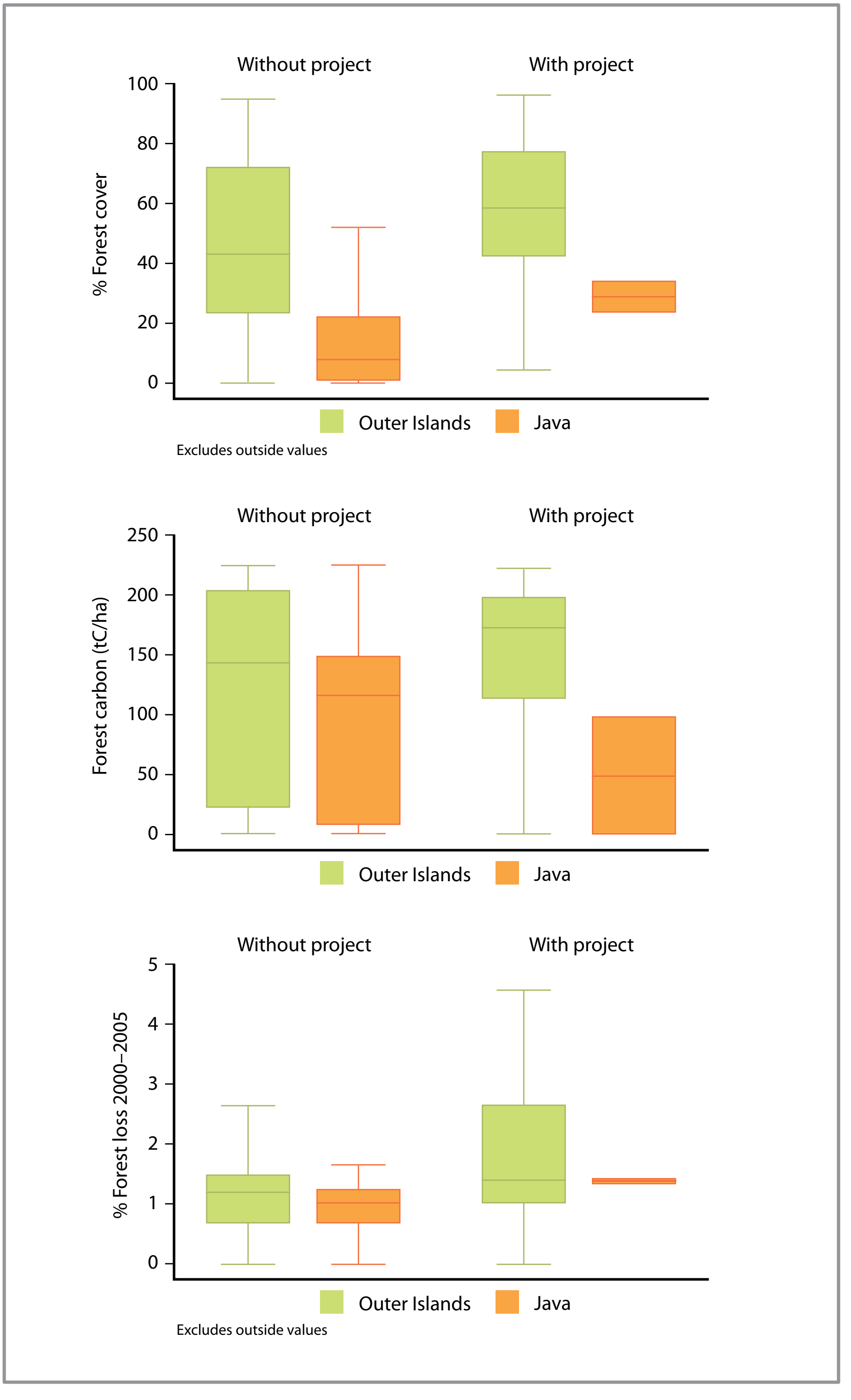

Figure 12.4 Comparison of districts with at least one REDD+ project to districts with no REDD+ projects, subdivided into districts on the Outer Islands (outside the provinces of Java) vs. Java

Table 12.2 Mean values of factors considered in site selection in municipalities or districts with and without REDD+ projects

	Brazil		Indonesia	
	With REDD+	Without REDD+	With REDD+	Without REDD+
Forest carbon (tC/ha)	145	117	153	116
Deforestation rate (% of forest cover)	2.4	0.9	2.3	1.3
Opportunity cost (US $/ha)	915	833	547	788
Land in protected areas (%)	28.2	8.3	25.9	11.8
Poverty (headcount ratio)	0.39	0.41	0.14	0.17
Population density (per km^2)	112	105	98.7	959
Road density (per km^2)	0.03	0.08	0.09	0.11
Area (km^2)	12 132	1262	10 191	3923
Observations	155	5414	48	392

Table 12.3 reports the results of a count regression model of the number of forest carbon projects in a Brazilian municipality or Indonesian district on these explanatory variables. The number of projects is positively and significantly related to both forest carbon density and the deforestation rate, controlling for other factors in this multivariate model. There is no statistically significant relationship with opportunity costs, but road density is negatively related to the number of projects in Brazil. Controlling for deforestation rate, projects are more likely to be placed in inaccessible areas, perhaps because of the expectation that it will be easier and less costly to reduce activities that involve deforestation or degradation in areas that are far from markets. Population density and poverty rates are only statistically significant in Brazil, with more projects expected in municipalities with higher population density but lower poverty (all else equal). Thus, the evidence is mixed on the role of expected poverty alleviation co-benefits in site selection. However, the coefficients on percent of land in protected areas are positively and strongly significant in both models, suggesting that proponents and donors are attracted by the potential biodiversity benefits of conserving forest near protected areas. This could be because both projects and protected areas are located in biodiversity-rich forests, or because proponents prefer to establish projects near protected areas, which signal biodiversity co-benefits to the market and perhaps also offer some advantages in monitoring and enforcement.

Table 12.3 Negative binomial models of the count of forest carbon projects in a Brazilian municipality or Indonesian district

	Brazil		Indonesia	
Variable	**Coefficient**	**Mean**	**Coefficient**	**Mean**
Forest carbon (in 100s of tC/ha)	0.970***	1.18	0.487**	1.21
Deforestation rate	0.087***	1.06	0.104**	1.46
Opportunity cost (in 1000s US $)	0.121	0.83	−0.191	0.76
% of land in protected area	0.586***	9.95	1.877***	13.38
Poverty rate (Poverty headcount ratio)	−1.162*	0.41	1.472	0.17
Population density (in 1000s per km^2)	0.411***	0.07	−1.581	0.87
Road density	−10.850***	0.08	−2.047	0.11
Area (in 10 000 km^2)	0.428***	0.18	0.568***	0.48
Constant	−4.061***		−3.181***	
Observations	4134		391	

Significant at 1% (***), 5% (**) or 10% (*) level.

Note: In the negative binomial model, an additional overdispersion parameter is estimated. As expected, this parameter is significantly different from zero in the models for both Brazil and Indonesia.

Many of the same factors are significant in different versions of the model. For example, we can estimate the model only for REDD+ (rather than all forest carbon) projects, including only municipalities or districts in the forest frontier (Amazon and Outer Islands) and considering only the probability of having at least one project (rather than the count of projects). Across the various possible combinations, the results that are most robust are positive associations with percentage of land in protected areas, deforestation rate and forest carbon.[3]

3 For example, in logistic regressions of the probability of at least one REDD+ project in a municipality in the Amazon or district in the Outer Islands of Indonesia (estimation results not reported here), most variables retain their sign and statistical significance. The only notable change in sign of a coefficient is on deforestation in the Brazilian Amazon: higher deforestation rates are associated with a lower probability of a REDD+ project, perhaps because those areas are considered lost causes and therefore do not attract projects.

Finally, we note that there are important factors omitted from this model due to lack of data. Based on interviews with REDD+ project proponents[4] during UNFCCC COP15 in December 2009, Lin *et al.* (2012) found that the top five factors in proponent decisions about where to locate REDD+ projects within countries are the deforestation rate, forest carbon content, biodiversity, interest of donors and governance. Our model confirms that the first three factors have been important in site selection for REDD+ projects, but we cannot test governance or the geographical interest of donors due to lack of data.

12.4.4 Local boundaries

For REDD+ projects in the GCS sample, we gain further insight on site selection by characterising villages located within project boundaries (which we label 'REDD+ villages') in comparison to villages in the same region but outside project boundaries. Again, we have larger samples for Brazil and Indonesia, so we report results for those countries separately, in addition to overall results for projects in all six countries where the GCS is conducting research at the project scale (Table 12.4).

This comparison suggests that villages are significantly more likely to be selected for REDD+ projects if forest conservation NGOs were active in the village in the past 5 years. This is consistent with the common perception of REDD+ as a new source of funds for existing forest conservation projects, raising potential additionality concerns (Ingram *et al.* 2009; Sills *et al.* 2009). However, it could also be interpreted as a sign that REDD+ projects are more likely to succeed, since they are building on previous efforts by forest conservation organisations. In Brazil, this is consistent with the pattern in social capital: there are on average more functional groups or organisations (e.g. farmers groups, credit groups and education committees) in REDD+ villages as compared to other villages in the region. However, the opposite is true in Indonesia and in the global sample: there are statistically fewer functional groups in REDD+ villages.

On average, REDD+ villages are more remote, as measured by distance from the nearest road used by four-wheel vehicles. This difference is statistically significant in the global sample and marginally significant in Brazil, but not in Indonesia. While estimated forest cover is not statistically different and we were not able to obtain good quality estimates of deforestation rates, the fact that REDD+ villages are systematically further from roads suggests that they are under relatively less deforestation pressure and have lower opportunity costs from avoided deforestation. This is consistent with the findings that Brazilian municipalities with higher road density are less likely to have REDD+ projects

4 The project proponents interviewed at COP15 were from NGOs (72%), the private sector (16%) and Official Development Assistance (12%).

Table 12.4 Characteristics of villages located within and outside REDD+ projects in the GCS sample

	Overall mean		P-value for difference in means	Mean for Brazil		P-value for Diff in Means.	Mean for Indonesia		P-value for difference in means
	REDD+	Outside		REDD+	Outside		REDD+	Outside	
Number of villages	148	170		49	51		64	45	
Number km to nearest road passable by 4-wheel vehicle	21	11	0.02**	13	8	0.16†	34	28	0.58
% forest	48%	49%	0.70	47%	50%	0.38	47%	46%	0.90
% where conservation NGO had been active	58%	34%	0.00***	69%	43%	0.00***	64%	11%	0.00*
Number of community groups	3.1	4.9	0.00***	2.1	1.4	0.02**	3.4	4.9	0.04**
% strong forest tenure	51%	61%	0.08*	78%	75%	0.73	16%	16%	0.99
Deforestation pressure from:									
Large–scale agriculture	24%	21%	0.51	29%	8%	0.01***	31%	44%	0.16†
Small-scale farmers	80%	85%	0.25	100%	100%	n.a.	58%	51%	0.49

Overall statistics include villages in Cameroon, Peru, Tanzania and Vietnam, as well as Brazil and Indonesia. Overall distribution of village characteristics is significantly different across REDD+ and other villages both in the overall sample and in Brazil and Indonesia. For each variable, differences in means may be significant at *** (99%), ** (95%), *(90%) or †(80%) level.

and have fewer forest carbon projects overall. That is, while many of these REDD+ projects are in regions under deforestation pressure (confirmed by the positive and statistically significant coefficients on deforestation in Table 12.2), it appears that proponents are choosing to work in more remote corners of these regions. This may be because REDD+ interventions are expected to be more competitive with development alternatives or because higher biodiversity co-benefits are expected further from market centres that generate demand for agricultural products. This latter explanation is corroborated by the proponent appraisal conducted by the GCS: 65% of REDD+ project proponents indicated that they considered biodiversity when deciding which villages to include, and half (3 out of 7) of the proponents who ranked site selection criteria indicated that biodiversity was the most important.

Small-scale farmers are a primary deforestation pressure in more than half of all villages (both inside and outside projects) in all countries. While in Brazil large-scale actors are more likely to be the primary source of deforestation in REDD+ villages than in villages outside those boundaries, the opposite is true in Indonesia. Thus, the profile of sites selected for REDD+ projects in Brazil is more remote locations, with active conservation NGOs, substantial local social capital, and deforestation pressures by large-scale actors from outside the region (e.g. see Box 12.2 describing the *Bolsa Floresta* project). This pattern is consistent with Brazilian project proponents' desire to create local alliances to forestall outside deforestation threats. In contrast, the site profile in Indonesia is locations with active conservation NGOs, but lower social capital, and lower threats by large-scale actors from outside the region. Such differences across these two countries merit further research and consideration as we seek to draw lessons from their projects.

Finally, there are some commonalities across all villages in our sample (not reported in Table 12.4). Most villages within these REDD+ projects are agricultural. In the majority (57%) of villages in REDD+ projects, agricultural crops are the primary income source of most households. In 63% of the villages, fewer than 20% of households earn the majority of their cash income from forests. Other income sources include animal husbandry (mostly cattle), fishing and mining. This dependence on agriculture suggests that there is deforestation by local agents that could potentially be reduced by project interventions. Further, it suggests that the key livelihood concern associated with these REDD+ projects is likely to be restrictions on agricultural practices such as shifting cultivation.

12.4.5 Caveats and recommendations for further analysis

Modelling the site selection process by jurisdiction (country, municipality or district, and community) allows us to compile data on a large number of projects, and thereby avoid potential biases from limiting our sample to projects willing to share maps of their boundaries. However, it clearly also introduces some measurement error because mean values for countries, municipalities or districts do not necessarily characterise specific project sites. The same analysis could be conducted with projects that are certified and therefore have publicly available maps, but findings may not be generalisable beyond certified projects. To some degree, the database on villages inside and adjacent to REDD+ projects in the GCS sample provides this more fine-grained information. The caveat on those data is that the villages were neither censused nor randomly sampled. However, field researchers attempted to identify similar villages inside and outside project boundaries, and thus the bias should have been towards zero difference.

In addition to compiling more precise information on project boundaries, a second area for future research should be to account for variation in governance at the subnational level. Likewise, the analysis could be improved with better data on biodiversity and potential livelihood co-benefits at the subnational level (in place of percentage in protected areas and official poverty statistics). Finally, more qualitative in-depth research on the decision making process of particular proponents and for particular projects could significantly enrich our understanding of project site selection and its implications.

12.5 Conclusions

If projects are to directly contribute to the diverse objectives of REDD+ (first and foremost, reduced emissions of forest carbon, but also social and environmental co-benefits), then they should be located in places where they can address significant emissions of forest carbon, threats to biodiversity and low income levels. Clearly the ability to meet these objectives depends on myriad factors, including the geographic expertise of the proponent and local governance conditions. However, it also fundamentally depends on the existence of biodiversity, poverty and forest carbon emissions.

Taking all tropical developing countries into consideration, higher deforestation rates are *not* associated with greater likelihood of REDD+ projects. Yet, the greatest number of projects by far are being developed in the two countries that dominate global forest carbon emissions: Brazil and Indonesia. In these countries, prioritisation of high forest carbon density and deforestation are evident at the subnational level, although there is also a preference for more remote (and therefore possibly less threatened) jurisdictions in Brazil and villages in the six country GCS sample. Specifically, municipalities in Brazil and districts in Indonesia have more projects if they have higher forest carbon density and higher deforestation rates. However, at the local level, REDD+ villages are systematically further from roads than non-REDD+ villages. And in Brazil, road density is negatively associated with the number of projects in municipalities, after controlling for other factors. Likewise, after controlling for these other factors, there is a weak statistical association between project location and poverty in Brazil, but not in Indonesia.

Overall there is a strong preference for locations with high potential biodiversity co-benefits. Countries with a high biodiversity index are more likely to have projects. Municipalities and districts with a higher proportion of their land in protected areas are more likely to have projects. And proponents report that biodiversity is an important consideration in site selection.

Finally, our sample of villages within and around REDD+ projects confirms that they are primarily agricultural and that small-scale farmers are viewed as one of the primary deforestation and degradation threats. Although there are exceptions, most villages are not highly dependent on forest products for household income. This suggests that a key challenge for REDD+ on the ground will be to slow local deforestation without undermining agricultural livelihoods or alienating local people who are key potential allies against the external deforestation threats that are also prominent in these locations.