IMPROVING REDD+ (REDUCING EMISSIONS FROM DEFORESTATION AND FOREST DEGRADATION) PROGRAMS

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A dissertation

submitted in partial fulfillment of the

requirements for the degree of

Doctor of Philosophy

University of Washington

2017

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Program Authorized to Offer Degree:
Public Policy and Management

University of Washington

Abstract

Improving REDD+ (Reducing Emissions from Deforestation and Forest Degradation) Programs

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Through an interdisciplinary set of studies, this dissertation seeks to contribute to the understanding of how REDD+ (Reducing Emissions from Deforestation and Forest Degradation) programs can better contribute to the improved human well-being, increased forest conservation, and reduced carbon emissions they seek to affect. To this end, I present three distinct papers that analyze elements of REDD+ programs. In Chapter 2, I use primary data collected through a survey of national REDD+ experts in 30 countries and secondary data aggregated from REDD+ forum websites, to study the patterns of national REDD+ policy diffusion. It is important to discern the mechanism of diffusion because if policies are being adopted after careful consideration of their successes in other locations and of how they might affect local contexts (learning), they are more likely to be successful in the long-term than if they are adopted purely to remain competitive for funding or to maintain a similar policy to peer-countries. I find evidence that the mechanism of diffusion at work is learning. In Chapter 3, I develop a unique index of the governance context for

land tenure security (GC-LTS) at the national scale and use geographic information systems to map this data globally. The GC-LTS index allows policy- and decision-makers to explicitly, quantitatively and spatially incorporate land tenure security considerations into evidence-based planning and analyses that previously could not account for elements of land tenure security. In Chapter 4, working at the local scale in central Mexico, I develop novel qualitative findings regarding local forest resource institutions as they relate to payments for ecosystem services (PES) projects and the project intermediaries who support their adoption. Using grounded-theory and a series of in-depth interviews, I work to develop testable hypotheses about the role of intermediaries in project implementation. This paper highlights the dynamic role that project intermediaries are playing in bolstering forest-resource institutions and providing accessible information to potential PES-project participants, as well as the potential for participants to learn through projects about the breadth of ecosystem services their forests provide.

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ACKNOWLEDGEMENTS

I wish to thank my advisor, Professor Alison Cullen, for her continued support and guidance from my very first day at the Evans School. I truly appreciate her patience. As I wandered through a variety of research topics, methods and degrees, she was always able to provide support and insightful feedback on my ideas.

I thank Professor Craig Thomas for his continued discerning and detailed feedback on my work from my papers in his courses through to my dissertation. Thanks to Professor Stanley Asah for his good-humored support and guidance as I developed my qualitative-skills and continued encouragement during my fieldwork in Mexico. To my entire committee, I am grateful for your careful consideration of my work and the support of my development as a researcher.

I am indebted to Professor Leigh Anderson, and the EPAR team, who have provided me with continued financial support and the opportunity to contribute to interesting research with real-world impacts throughout my doctoral degree.

I thank Dean Sandra Archibald for ushering me into the doctoral program from the MPA program when I wasn't quite certain of the right program to pursue.

Yuta Masuda gave me the great opportunity of working with the Land Tenure Security working group at The Nature Conservancy. This work gave me invaluable research and networking experiences and I am forever grateful for his support. I also thank our core team members Maggie Holland and Brian Robinson for their guidance. Thanks to all of the working group members for helping to hone my presentation skills and research ideas over the course of our meetings.

I am very grateful to all my amazingly hospitable research contacts in Puebla, Mexico for taking the time to contribute to my research. I am also grateful to the international policy experts from 30 countries who participated in my survey. A special thanks to Rebeca de Buen Kalman for her willingness to help me verify my coding framework.

I would not have been successful without my partner Ricardo Clarke, who has been unimaginably flexible and supported any and all of my career decisions no matter how far away from him they take me.

DEDICATION

Dedicated to the enduring memory of my beloved Poppa, Thomas Patrick Kelly.

Chapter 1. EXECUTIVE SUMMARY

Human-induced deforestation and climate change remain interlinked complex social and ecological challenges. REDD+ (reducing emissions from deforestation and forest degradation), programs seek to address both deforestation and climate change by providing financial incentives for forest conservation and reforestation activities, simultaneously reducing related carbon emissions and supporting sustainable local economic development. Integrated conservation and development projects have historically struggled to balance the multiple objectives of improved social, ecological, and economic outcomes and have often failed to achieve these goals simultaneously (Blom, Sunderland, & Murdiyarso, 2010; Chan et al., 2007; McShane et al., 2011; Roe, 2008). There have been recent calls for interdisciplinary research on social-ecological systems (SES), as scholars have recognized that the complexity of research on such systems requires multiple disciplinary perspectives (Agrawal & Ostrom, 2006; Binder, Hinkel, Bots, & Pahl-Wostl, 2011; McGinnis & Ostrom, 2014; Ostrom, 2011; Redman, Grove, & Kuby, 2004; Visseren-Hamakers, Gupta, Herold, Peña-Claros, & Vijge, 2012). REDD+ programs require an SES-framing because they seek to improve both social and ecological outcomes through a single project. My dissertation contributes three distinct papers that aim to address the need for more interdisciplinary research on the unique social-ecological structure of REDD+ projects. At the national scale, I start with a study of the diffusion of national REDD+ programs, I then turn to an analysis of the governance context to support land tenure security, a required foundation for REDD+ projects. I continue at the local scale, with a qualitative study of the role of project intermediaries in payments for ecosystem services[1] (PES) projects in Mexico, through an institutional analysis. My overall goal is to produce studies that clarify and integrate diverse theoretical understandings including those of policy diffusion, land tenure security, common pool resource (CPR) management, and ecosystem services, to identify strategies and future research objectives to help improve REDD+ programs.

REDD+ programs are rapidly expanding and influencing forest-use policy around the world (Agrawal, Nepstad, & Chhatre, 2011). In its simplest form, a REDD+ project is a PES project for carbon sequestration, allowing developing countries to use international financial support to fund forest conservation, with a goal of maintaining and enhancing forest and soil carbon sequestration capacity. Theoretically, REDD+ program funding would link to a global carbon market whose participants could pay for verified carbon credits generated by forest conservation and restoration. Linking to global carbon markets is economically efficient because it allows carbon market participants to decrease carbon emission reduction costs by taking advantage of relatively lower cost emission abatement strategies around the world (Nauclér & Enkvist, 2009).[2] The lack of globally linked carbon markets and an evolving set of carbon emissions monitoring, verification, and reporting (MRV) standards currently mar a PES-structure for most REDD+ projects (Denier,

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[1] Ecosystem services are the benefits that ecosystems and natural processes provide that support human populations (Millennium Ecosystem Assessment, 2005; also see Figure 4-1).

[2] Estimates of carbon emissions reduction costs find that reduced slash and burn agriculture, reduced pasture conversion, pastureland afforestation and degraded forest restoration, are among the lowest cost abatement strategies. Cost per ton of CO_2 equivalent range from less than 2 to 10 UK pounds (Nauclér & Enkvist, 2009).

L., Korwin, S., Leggett, M., MacFarquhar, 2014). In the interim, REDD+ funding comes from voluntary sources, both public and private, and funders do not yet hold programs to the standard of results-based payments (payments that are contingent on verified increases in carbon storage). Forests (even, in the case of weak governance structures, those that are privately owned) have long been studied as common pool resources.[3] They are a classic example of the challenge of providing a common good through collective action. REDD+ programs create an additional linkage between the social and ecological systems at the local level by using financial incentives to change forest use behavior.[4] An added complexity of REDD+ programs is that they emerged from the negotiations of partners to the United Nations Framework Convention on Climate Change (UNFCCC). This link has created an overarching international structure that interacts with the local-level social-ecological systems.

1.1 Chapter 2. The Spread of National REDD+ Programs

International-level discussions surrounding REDD+ policies began in 2005 with the introduction of the innovative new policy. The innovation suggested that developing countries with forested areas could generate tradable credits for carbon sequestration and contribute to global climate change abatement, while also securing financial support for their efforts. Since their introduction, REDD+ policies have spread to over 70 countries globally. The international-level REDD+

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[3] Non-excludable goods are those whose use is difficult to control, while rivalrous or subtractable goods are those whose use diminishes their stock, in the case where both are true and there is a scarcity of the good, it is considered a common pool resource (CPR) (Weimer & Vining, 2011).

[4] Project benefits to local communities will vary but may include direct monetary payments to participants, employment opportunities, or community wide benefits, such as infrastructure improvements.

discussions of the United Nations Framework Convention on Climate Change (UNFCCC), where REDD+ was initiated, continue to influence national-level forest policies. The theory of policy diffusion, which seeks to explain the transfer of a policy solution from one government to another following its innovation, are used in this study to explore the relationship between the international discussions concerning REDD+ and resulting national-level policy changes. REDD+ forums purposefully harness what policy scholars understand as policy diffusion by creating channels of communication and generating information about policy options. The term "governance by diffusion" was recently introduced in the literature as a name for such forums, those that recognize the ability of policies to diffuse among nations and seek to intentionally create circumstances to facilitate policy diffusion (Busch & Jorgens, 2012). In Chapter 2, I strive to identify which, if any, of the mechanisms of policy diffusion, are at work in such "governance by diffusion" initiatives regarding REDD+ programs.

I test the hypotheses of policy diffusion, including competition, learning, imitation, and normative coercion and negotiating coercion, as they relate to national REDD+ program adoption. Understanding the patterns of policy diffusion produced by the international forums is an important opportunity to garner intermediate information about the potential for the success of REDD+ programs. We need short- and medium-term feedback because there are significant lag times for observing REDD+ outcomes like reduced deforestation. The hypotheses of policy diffusion can be used to test if REDD+ programs are being pursued after countries learn about successes and lessons from other countries and consider the potential of REDD+ programs for their contexts (learning). Or, if alternatively, countries are motivated by funding opportunities (competition), or simply to appear more like regional leaders (imitation), or maintain policies similar to their peer-countries (normative coercion). I posit that the likelihood of long-term REDD+ program success will be lower in instances where a learning mechanism does not partially explain program adoption. More broadly, studying these dynamics provides information about international forums and their ability to promote a specific policy idea by harnessing policy diffusion, making them a potential model for other global policy challenges.

In my mixed-methods approach, I used three methods to test the hypotheses of diffusion within the international-level REDD+ context. To start, secondary data drawn from program websites was used to estimate quantitatively a conceptual network of potential REDD+ countries. Similar countries, defined based on cultural similarity and opportunities for communication, are closer in the estimated network. Next, I used a survey of country-level REDD+ policy experts to collect primary data on countries' motivations for pursuing REDD+ programs. The expert survey provided evidence to support the identification of the mechanism at work in the pursuit of a national-level REDD+ program and drew on a subset of 30 REDD+ eligible countries. Finally, an event history analysis model with a dyadic-data structure was estimated using the secondary data and incorporating the network similarity measure. The operationalization of quantitative hypotheses was used to triangulate expert-survey findings and is based on data representing the complete population of REDD+ eligible countries.

The survey results found that experts overwhelmingly agreed that their countries both observed REDD+ successes and considered the lesson, experiences, and successes of other countries in considering REDD+ programs (a learning mechanism). Whereas, there was slight disagreement that countries were motivated to appear more like regional leaders (an imitation mechanism). The quantitative model found that in general being culturally similar and having more opportunities to communicate increases the odds that one country will affect the policy-status in another country. The model results also showed that a country being culturally similar and a REDD+ pilot country had a positive and statistically significant effect on the probability of another country making their REDD+ policy more similar to that country. A pattern of diffusion we would also expect to see if countries are learning from the experiences of the pilot countries, as reported in the survey findings.

In the survey of experts, the strongest support was reported for a competition mechanism, though the quantitative evidence does not support this. Overall, the experts in the survey sample neither agreed nor disagreed that the policy decisions of their peers influenced their decisions to pursue a REDD+ policy (a normative coercion mechanism). Though, in the quantitative model, two negotiation blocs stood out in this regard. The effect of the proportion of countries within a shared negotiating bloc was statistically significant and positive for least developed countries bloc (LDC). The effect of the proportion of members in small island states (AOSIS) was statistically significant and negative. I found no support for a negotiating coercion mechanism of diffusion nor for a purely geographic proximity explanation of the diffusion of REDD+ policies

Had an alternative mechanism been supported, such as competition for financial resources or a normative pressure to maintain similar policies to peer-countries, it would have signaled that REDD+ programs might have been adopted without consideration for their likelihood of successful future outcomes. Based on this analysis, UN-REDD and the FCPF appear to have partially harnessed a learning mechanism in their attempts at promoting and diffusing the REDD+

policy innovation. These findings signal that REDD+ programs are more likely to be promoting policies suited to the specific contexts where they are adopted. REDD+ programs are more likely to be successful if forums can encourage policy learning.

Findings support that "governance by diffusion" forums at the international level can be effective in encouraging learning among countries and help to diffuse policy innovations rapidly. The structure of the UN-REDD and FCPF programs includes reducing barriers to national policy adoption and transparently tracking the progress of policy development. If "governance by diffusion" can harness a learning mechanism, as I find support for in the REDD+ forums, they may provide an appropriate model for the development of other policy venues to address similar global policy challenges.

Topics ripe for future research indicated by the findings of this work include further investigating the effects the LDC and AOSIS negotiating blocs are having on policy formation in their member countries. In addition, I find support for a learning mechanism at work within the REDD+ forums. However, there is an opportunity for future qualitative research to focus more narrowly on the learning mechanisms for which this work provides initial support. Future research could work to identify which aspects of the international forums are the specific mechanism supporting policy learning, knowledge-sharing meeting, conferences, reports, and website content are all possible mechanisms.

1.2 Chapter 3. Mapping the Global Governance Context for Land Tenure Security

Chapter 3 turns to focus on land tenure security. Land tenure security is a necessary foundation for REDD+ programs (Holland et al., 2014; Larson et al., 2013) and an explicit factor of many large-scale policy agendas because of the established link between secure land tenure and improved human well-being[5] (Payne, Durand-Lasserve, & Rakodi, 2009). I conducted a global mapping exercise undertaken to understand the spatial relationships among land tenure security, forest conservation, and human well-being indicators, which revealed the lack of a viable global dataset to represent land tenure security. There are currently only limited global datasets measuring the complex concept at the national scale. By creating a spatially explicit index, this study quantifies the national-level context for the emergence of land tenure security. Such a dataset provides information to REDD+ policy decision-makers about the ability of a national government to support land tenure security at the macro-scale, and therefore the government's ability to support REDD+ projects. As an input in global spatial analyses, the index allows for examining the relationships among the elements of land tenure security, forest conservation, and the well-being of local human populations. With knowledge about the potential for stronger or weaker land tenure security as provided by the index, decision-makers have better information about where they can and should strengthen REDD+ programs by incorporating land tenure security analyses and interventions.

[5] Studies have shown it improves food security, investment in education, economic development etc.

The GC-LTS index was developed following the recently published Robinson et al. 2017 framework and explicitly reflects elements of land tenure security definitions found in the literature. The GC-LTS index was developed to rely on a parsimonious dataset selected to best represent elements of definitions found in the literature, which were reviewed by a working group of senior land tenure experts. Two primary elements were identified through this process, each composed of three components. The first element represents political economy and includes proxies for political capacity, political will, and conflict. The second element represents formal institutions, and includes proxies for the capacity to adjudicate, exclusion authority and/or ability, and governance capacity. The GC-LTS index improves on existing available data by providing an index linked closely to concepts found in the literature, providing a transparent and consistent construction approach, and covering 165 countries.

As a heuristic example of its utility, in Chapter 3, I use geographic information systems (GIS) tools to spatially analyze the global relationships of the GC-LTS index with human well-being indicators and areas of high conservation concern. I find that the index is positively correlated with indicators of human well-being. I then show overlays that highlight areas of low capacity to support secure land tenure but which contain valuable forest and biodiversity conservation areas. Such global analyses can provide information about where support for land tenure security is weak but the need for forest conservation is high, and inform macro-level REDD+ policy development. A large-scale understanding of tenure security allows policy-makers to identify countries where interventions that strengthen tenure security prior to REDD+ project implementation, can improve the likelihood of project success.

The GC-LTS index fills a gap in the existing data and allows for the inclusion of land tenure security in global quantitative analyses. The GC-LTS index meets a data demand from practitioners and researchers and indeed has already been requested and used in analyses for Vulcan Inc.'s conservation programs, the TNC Water funds group, the TNC Indigenous Peoples and Local Communities Program Global Lands Team, and by researchers at International Center for Agricultural Research in the Dry Areas.

1.3 Chapter 4. The Role of Intermediaries in Mexico's CONAFOR PES Programs

Mexico's national PES program is unique in its reliance on intermediary consultants to support project development and implementation. When a community elects to participate in a project, intermediaries help them make changes to the ways they use their forests in order to comply with project requirements. Currently, there is limited empirical research on how intermediaries contribute to PES projects. Most literature is theoretical in nature and uses a rational-choice framework, ultimately positing that intermediaries serve to reduce transaction costs. Further, in the few empirical studies available, the term "intermediary" covers a broad set of actors; research findings on the population of intermediaries from these studies are therefore difficult to interpret because of the conflated motivations of disparate actors.

In Chapter 4, I inductively develop hypotheses about the role that external intermediaries are playing within PES-project institutional settings. I use a series of in-depth interviews with independent intermediaries who help facilitate local PES projects (n=9) and project participants (n=13) gather data regarding the roles intermediaries are playing in PES projects. My research objective is hypothesis generation but I use the social-ecological systems framework and the theories of common pool resource management and ecosystem services to develop my interview guides. These theories were important for structuring my interviews because they ensure that I collect data to characterize the social-ecological conditions and decision-context where intermediaries are working. From this perspective, I garner evidence about how intermediaries influence and mediate PES-project social-ecological contexts and local institutions. I then used grounded-theory to iteratively assess interview transcripts and develop a coding-scheme.

In my findings, I characterize the local institutional setting of PES projects. Based on this characterization, I then assess how intermediaries are working within local communities and which institutions specifically they are affecting. I analyze participant-reported forest uses as they relate to the ecosystem services framework. In my analysis, I focused on the role that intermediaries play in forest management institutions, their modification, and their implementation.

Based on this analysis, three primary hypotheses about the role of intermediaries emerged. First, because there is evidence that intermediaries contribute directly to institutional design, I suggest a hypothesis regarding the effect intermediaries participating in institutional design has on contract efficiency, human well-being, and forest conservation. Next, because intermediaries share program information widely and openly, I develop a set of two sub-hypotheses concerning the effect of this increased transparency 1) in reducing corruption and conflict over project resources and 2) on improving and increasing communication between local communities and regional or national government bodies. Finally, in the findings, there is evidence that project participation increases the salience of previously unrecognized ecosystem services. Leading to another set of two sub-hypotheses, 1) that project intermediaries can increase the salience of resources and their related services through information sharing and 2) that participation in PES projects increases the salience of resources and their related services.

Chapter 2. THE SPREAD OF NATIONAL LEVEL REDD+ PROGRAMS

2.1 ABSTRACT

Reducing Emissions from Deforestation and Forest Degradation (REDD+) programs have expanded dramatically since their first inclusion in climate negotiations in 2005. A set of international forums has emerged to harness the recognized power of policy diffusion and encourage national REDD+ program adoption among eligible nations. These forums create knowledge-sharing venues and seek to reduce informational and financial barriers to REDD+ program adoption. In this paper, hypotheses of policy diffusion are applied to these forums to discern which, if any, of the mechanisms of policy diffusion are at work. This research presents a novel application of diffusion theories to such international forums and contributes to the literature an approach to triangulating mechanism identification using mixed-methods. I conducted a survey of REDD+ policy experts from 30 countries to collect primary data on motivations for pursuing a REDD+ program. Survey results suggest that policy adoption may be partially driven by learning from other countries' experiences and successes. To triangulate this qualitative finding, a network analysis of eligible countries and a dyadic event history analysis model are estimated using a unique set of secondary data culled from REDD+ program websites. The event history analysis model finds statistically significant support that being culturally similar to and having opportunities to communicate with pilot countries (policy leaders) does influence the decision to pursue a REDD+ program. Combined, experts reporting that they are learning from other countries' experiences and quantitative evidence that pilot countries are influencing REDD+ program adoption, suggests that the international forums are supporting policy learning.

2.2 INTRODUCTION

The international-level discussions regarding REDD+ (Reducing Emissions from Deforestation and Forest Degradation) programs continue to foster the creation of national-level REDD+ programs. The concept of REDD+ was first introduced at the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC COP) in 2005. Since then, REDD+ programs have grown to encompass a wide array of integrated conservation and development approaches and are being pursued in nearly 70 countries. The unique policy venue of the UNFCCC COP and the parallel sub-meetings on REDD+ issues, occurring among partners of UN-REDD, the REDD+ Partnership, the Forest Carbon Partnership Facility (FCPF), and other similar international-level discussions, present a novel opportunity to explore an extension of the theories of policy diffusion.

Established in 2008, the UN-REDD program has driven the establishment of national-level programs in 30 countries (UN-REDD, 2017). UN-REDD works to support countries that express interest in REDD+ programs with funding and guidance. Parallel to the UN-REDD program, the Forest Carbon Partnership Facility (FCPF) emerged in 2008 to expedite funding for REDD+ activities. Managed by the World Bank, the FCPF facilitates funding transfers from developed countries to developing countries (FCPF, 2015). Membership to-date in UN-REDD and the FCPF differs to some extent, though as shown in Figure 2-1, the majority of REDD+ countries are pursuing both programs. An important distinction between the two is that UN-REDD partner countries intend to use REDD+ activities as part of their contributions to global carbon mitigation activities under UNFCCC agreements. This is not necessarily the case with FCPF partner countries. Despite potentially different intentions, both programs are fostering national REDD+ policies (FCPF, 2014; UN-REDD, 2015; REDD-Monitor, 2014).

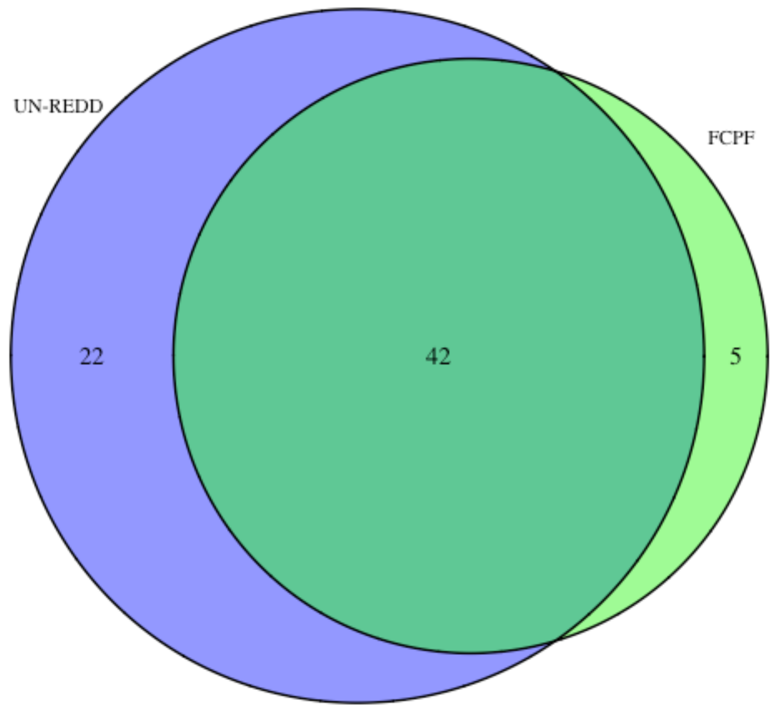

Figure 2-1 REDD+ Program Membership as of 2017
Data Sources:(FCPF, 2017; UNFCCC, 2017)

Two unique features of UN-REDD and the FCPF make them examples of what the literature has called "governance by diffusion" (Busch & Jorgens, 2012). The term "governance by diffusion" describes attempts to diffuse a policy innovation purposefully, such attempts reason that given the recognized ability of policies to diffuse among nations, it is possible to create programs to encourage and support diffusion. Proponents suggest that this can be done by creating channels of communication, generating information, and improving the "diffusability" of policies, among other approaches (Busch & Jorgens, 2012). UN-REDD and the FCPF are examples of this concept because of their explicit creation as programs to foster the spread of an innovative policy for forested-developing countries. By design, these programs help countries overcome primary internal barriers to innovation by providing financial and capacity-development resources needed to overcome obstacles (Stokes Berry & Berry, 2007). As part of REDD+ start-up programs, UN-REDD and the FCPF make financial and governance-capacity resources available to help overcome any constraints to innovation. Interested countries are then theoretically only constrained by their level of motivation to innovate.

Among developing countries, vulnerability to climate change impacts, and economic or regional considerations drive the formation of bargaining alliances, known as “negotiating blocs,” within the UNFCCC negotiations (UNFCCC, 2014). Two examples, the Alliance of Small Island States (AOSIS) and Least Developed Countries (LDC) each face severe and immediate impacts from climate change. These negotiating blocs submit extensively to the UNFCCC COP agendas to highlight their unique concerns about changing climatic conditions. Developing countries also form another set of bargaining alliances within the larger blocs along economic and regional lines. These alliances include the Common Market for Eastern and Southern Africa (COMESA), the Economic Community of West African States (ECOWAS), the Association of Southeast Asian Nations (ASEAN), the Union of South American Nations (CSN), and the African, Caribbean, and Pacific Group of States (ACP). These groups pursue diverse goals for their member nations and do not exclusively or even primarily focus on climate issues. They do meet to discuss issues and produce position documents on climate issues, which are generally aggregated into the larger developing nation negotiating bloc position statements. Sharing UNFCCC negotiating blocs can increase the number of opportunities for communication about REDD+ policies among countries and negotiating blocs may indicate shared policy beliefs on climate issues, making these groups important to the diffusion of national REDD+ policies and potentially highly influential in their adoption rate.

The theories of policy diffusion are well established in the policy processes and international relations literatures (Boehmke & Witmer, 2004; Gilardi, 2010, 2016; Oksamytna, 2014; Shipan & Volden, 2008, 2012; Simmons & Elkins, 2004; Stokes Berry & Berry, 2014). They seek to explain the diffusion or spread of a policy after a policy innovation event (Stokes Berry & Berry, 2014). In the case of REDD+, the policy innovation was the proposal brought by Papua New Guinea and Costa Rica to the 2005 UNFCCC COP (Submissions from Parties Governments of Papua New Guinea and Costa Rica, 2005). Given that scholars have provided consistent evidence that policies do diffuse, researchers have made recent calls for refocusing efforts on distinguishing among the mechanisms of diffusion at work (Gilardi, 2016). In addition to applying policy diffusion hypotheses to the unique context of "governance by diffusion" programs, this paper uses a mixed-methods approach to identify the specific mechanisms of diffusion at work in such programs.

The international REDD+ forums are designed to foster learning and knowledge exchange among REDD+ countries, as the international community strives to refine and adapt the initial REDD+ concept. A stated goal of the UN-REDD program is "technical capacity building support through sharing of expertise, common approaches, analyses, methodologies, tools, data, best practices and facilitated South-South knowledge sharing (UN-REDD, 2017b)." Similarly, a stated FCPF goal is to "disseminate broadly the knowledge gained in the development of the [FCPF] (FCPF, 2017)." The intent to provide opportunities for learning among countries through both programs is thus explicit. Further, as countries advance towards adopting REDD+ programs, their progress is tracked and published via the UN-REDD and FCPF websites in newsletters, blogs, and annual and semi-annual reports (FCPF, 2017; UN-REDD, 2017b). Countries also report on progress, lessons, and successes through knowledge-sharing workshops and meetings of partner countries. Collectively, these activities make REDD+ successes and lessons readily observable throughout the program development process. These features make the REDD+ international policy venues uniquely transparent, allowing countries to track step-by-step policy development in other countries.

When diffusion is thought to be the process contributing to policy adoption, researchers study three broad categories of diffusion mechanisms: emulation, learning, and competition (Maggetti & Gilardi, 2014). To test for evidence of these mechanisms, this paper uses a dyad-year data structure, following Fuglister & Gilardi, 2008, Fabrizio Gilardi, 2010, and Volden, 2006, who argue that the dyad format improves upon a country-year data structure. Dyadic models explicitly model the effect of each country-pair relationship on policy adoption in each year. In each observation, there is a policy "sender" and a policy "receiver." The "sender" country is potentially sending its policy status from the previous year to a "receiver" country in each year (Fuglister & Gilardi, 2008). That is, the policy of the "receiver" country may become more similar to that of the "sender" country. The dyad-year approach allows for a more nuanced analysis as the dependent variable can move from capturing a dichotomous outcome (policy is adopted or not) of the country-year data structure to a more complex outcome (policy status becomes more similar to that of country X or not, observed for each country; Volden, 2006). The disaggregation of country-country effects observed in each year can also allow for better tracing of the effects of country similarity on adoption rates (Fuglister & Gilardi, 2008; Volden, 2006). Given a new policy innovation, policy diffusion theories argue that two sets of variables can explain the eventual adoption of the policy by new countries, internal determinants and intergovernmental diffusions (Stokes Berry & Berry, 2014). Dyadic models can estimate internal and external determinants simultaneously while controlling for the complex data structure of repeated country observations and multiple time periods.

The logic of diffusion based on learning is that a government observes a policy that works well in another country, (meaning the policy is successful in terms of achieving the goals it is designed to achieve), and believes it will work well in the context of their own country, and is therefore motivated to adopt it (Moyson, Scholten, & Weible, 2017). The primary goal of REDD+ programs is reducing deforestation and forest degradation; a successful program would demonstrate achieving this outcome. However, as program monitoring has only recently begun for some pilot countries, this outcome is not yet observable, and may well be difficult to observe for many years based on the lag of ecosystem effects. Learning in this context, could, however occur if national governments use program outputs to measure success instead of outcomes. Outputs may include achieving stakeholder consensus or improving capacity to implement decentralized projects (Maggetti & Gilardi, 2014). Arguably, the knowledge sharing activities of the REDD+ programs' websites, meetings, and conferences may accelerate this process of learning based on outputs.

Countries may or may not truly learn from these activities, and could alternatively be motivated by competition for financial incentives, normative coercion to remain similar to peer-countries, or the desire to imitate environmental leaders, as described in the hypotheses that follow. These other explanations would signal that countries might adopt REDD+ programs without carefully considering the implications for their local contexts. Given that the long-term goals of reduced carbon emissions and improved human well-being have a significant lag time until they are observable, understanding the spread of REDD+ programs, and particularly the motivations for their adoption, is important to monitor as an intermediary indicator of their potential for long-term successes. If the mechanism behind the spread of REDD+ programs were learning, we would expect the likelihood of the long-term success of the program to be higher, as countries will have considered the suitability of such programs for their specific context. However, if REDD+ programs are pursued for alterative motivations, they may be ill adapted to the specific contexts of the adopting countries and have a higher likelihood of failure.

Emulation is a distinct form of diffusion that may present as learning but is more for show than substance. Emulation can be driven by three subclasses of mechanisms. Imitation, normative coercion, and negotiating coercion, are all mechanisms included in the category of emulation (Maggetti & Gilardi, 2014). The policy processes literature argues this form of diffusion may happen only in the short-term following a policy innovation (Stokes Berry & Berry, 2014). Imitation occurs when countries are motivated to adopt a policy to appear more like regional leaders with less regard for the actual substantive effects of a policy. In terms of innovative forest policy, pilot countries could present as regional leaders, leading to a desire for other countries to imitate their behavior and the imitation hypothesis (Shipan and Volden, 2008).

> ***Imitation Hypothesis****: A "sender" country that is a UN-REDD or Forest Investment Pilot (FIP) and is similar to a "receiver" country will increase the likelihood of the "receiver" country pursuing a REDD+ policy similar to that of the "sender" country.*

Distinguishing imitation from learning using secondary data alone is extremely difficult, as the observed influence of a pilot country on a "receiver" country's policy status may be attributed to either mechanism. As such, the expert survey is critical to triangulating the analysis of this hypothesis. Though it is not possible through the quantitative analysis alone, distinguishing between a learning mechanism and an imitation mechanism is important to understanding the true impact international REDD+ forums are having on REDD+ program adoption. In the quantitative analysis, I look for evidence to determine if imitation is occurring by testing this hypothesis, but I am not able to discern the motivations for this imitation. Countries may be driven by a desire to appear more like regional leaders without considering the substantive consequences of a policy. Yet, we could also observe the same pattern of diffusion if countries were making their policies more similar to those of regional leaders after considering the suitability of those policies for their own country contexts. As such, a significant finding for this hypothesis in the quantitative model coupled with no evidence of learning in the expert survey would lead to a conclusion of an imitation mechanism, while a significant finding for this hypothesis coupled with evidence of learning in the expert survey would support a learning mechanism.

Within the emulation category of diffusion mechanisms, there are also two types of coercive pressures possible: a strong negotiating pressure and a more passive normative pressure. Superficially, UN-REDD and the FCPF do not appear to be coercing countries into participating nor is there obvious pressure from peer-countries, unless there is leverage from the broader UNFCCC negotiation process being used that is not observed. Data on possible sources of coercion, including negotiating peers and international NGO's were collected during the expert survey. There is a more likely possibility of normative coercion pressure than negotiating pressure, as peer-countries may wish to emulate behavior to fit in. If normative pressure is a significant mechanism, a common way to operationalize this mechanism in the literature is an increase in the proportion of peer countries adopting a policy (Maggetti & Gilardi, 2014; Shipan & Volden, 2008, 2012). Following this trend, I would expect the likelihood of a country pursuing a REDD+ policy to increase as a higher proportion of their peer countries also pursue REDD+ policies. Recognizing there is not a clear distinction between the operationalization of the normative coercion hypothesis and the imitation hypothesis, I again will use expert interviews to make a distinction between these two mechanisms.

> ***Normative Coercion Hypothesis****: The likelihood of a "receiver" country pursuing a REDD+ policy more similar to a "sender" country's increases as the proportion of countries in their shared negotiating blocs pursuing REDD+ policies increases.*

Competition in the REDD+ setting is another possible mechanism of diffusion; REDD+ countries may see opportunities for both start-up funding and for long-term partnerships or better links to emerging carbon markets in the future and wish to remain competitive for these opportunities. As developed countries work to achieve their own carbon emissions reduction goals, they may seek to form partnerships with developing countries with forest resources through REDD+ programs. Developing countries with established REDD+ programs following FCPF and/or UN-REDD program guidance would be the most likely beneficiaries of such partnerships. As funding increases and nations can observe the funding received by others, a nation may increase its efforts to pursue a REDD+ policy to make itself more attractive than other similar countries that do not have established REDD+ programs or to remain competitive with other similar countries that do have established REDD+ programs for current and future economic benefits.

***Competition Hypothesis**: As the total amount of REDD+ funding received by a similar "sender" country increases, the likelihood of a "receiver" country pursuing a REDD+ policy more similar to the "sender" country's will increase.*

Early studies of policy diffusion attributed a large amount of explanatory power to geographic proximity. Formerly, governments were perhaps restricted by travel and communication options, now, technological advances have made communication and travel, and thus networking and conference opportunities increasingly globalized. Empirical work has refuted a purely geographic explanation of diffusion (Shipan & Volden, 2012). UN-REDD and the FCPF have no mobility constraints to the sharing and diffusion of policy ideas. Quite the opposite, creating opportunities for collaboration and communication are primary goals of the programs, which work to communicate lessons learned from REDD+ activities intentionally. Communication opportunities are also available as part of the broader UNFCCC negotiations. I do not, therefore, expect to find a significant effect of a geographically proximate "sender" country on the policy status of a "receiver" country.

2.3 Data and Methods

The approach to identifying the mechanisms of diffusion at work in the international-level REDD+ programs was threefold. First, secondary data drawn from program websites was used to quantitatively estimate the network of potential REDD+ countries, identifying countries that are closer in the conceptual network based on measures of cultural similarity and opportunities for communication. Next, I used a survey of country-level REDD+ policy experts to collect primary data on countries' motivations for pursuing REDD+ programs. The expert survey provides evidence to support the identification of the mechanism at work in the pursuit of a national-level

REDD+ policy and draws on a subset of 30 REDD+ eligible countries. Finally, an event history analysis model with a dyadic-data structure was estimated using the secondary data and incorporating the network similarity measure. The operationalization of the quantitative hypotheses is used to triangulate expert survey findings based on data representing the complete population of REDD+ eligible countries.

2.3.1 *Network Analysis – Country Similarity*

To estimate the conceptual distance between countries, I use network analysis methods. The similarity of countries is described using two sets of variables: data on cultural similarities, and data on opportunities to communicate. These data were selected based on the assumption that culturally similar countries will be more likely to communicate given the opportunity. Here, I describe cultural similarity using three parameters; a shared official language, a shared primary religion, and a shared colonial history (same colonizing country; Ghemawat & Reiche, 2011). In addition to cultural similarity increasing the likeliness of policy-makers communicating, shared membership in negotiating blocs increases the number of opportunities to communicate. Data were gathered from negotiating bloc websites that provide membership lists, while data on cultural variables are derived from the CIA world factbook (CIA, 2017).

Table 2-1 provides the descriptive statistics for the data I include in the network analysis. As shown, the data are either categorical or dichotomous values. As such, some of the more commonly used distance and similarity estimators (such as Mahalanobis distance and propensity scores, both more commonly used for continuous data) are not best suited for this data. Instead, I use a Gower similarity coefficient, which is designed to accommodate mixed-data including combinations of categorical and dichotomous variables as I have here (Gower, 1971). The estimation of the Gower similarity coefficient was performed using the *daisy* function of the R package *cluster* (Maechler et al., 2017). The Gower coefficient was rescaled to a zero-one scale after estimation to make its interpretation more intuitive. The un-scaled coefficient values are higher for dissimilar pairs; rescaling flips the values so that higher values correspond to countries that are more similar. A value of one is exactly similar, and a value of zero is not at all similar. Figure 2-2 below shows the resulting network graph as defined using the estimated Gower similarity coefficients.

The network's size and density make it difficult to visualize at lower resolutions. However, as shown, the network seems to follow some geographic patterns, which is likely because language, religion, and colonizing country are correlated with geographic proximity. A visual comparison of the network graph and the World Values Survey cultural map reveals shared patterns between the two (WVS, 2017). The cultural map is shown in Figure 2-3 for comparison. As shown, there is similar clustering in the network graph and the cultural map among Latin American countries. We can also see clustering along the map axes that are the same as the proximity of some countries in the network group, for example, Jordan, Iraq, and Lebanon fall along about the same value for survival vs. self-expression and are near each other in the network graph. While this visual comparison approach is subjective, comparing the network graph to an established

Table 2-1 Summary Statistics of Network Attributes

Indicator Variables (0 or 1)	*Proportion of Countries*	
COMESA	0.16	
ECOWAS	0.12	
ASEAN	0.06	
CSN	0.09	
ACP	0.57	
AOSIS	0.24	
SIDS	0.26	
LDC	0.37	
Islands	0.26	
Landlocked	0.22	
Categorical *Top Four Categories Shown (number of countries)*		
Most Recent Colonizing Country	United Kingdom	(39)
	France	(25)
	None	(20)
	Spain	(17)
Official Language *(most common where official not stated)*	English	(23)
	Spanish	(19)
	French	(16)
	Arabic	(13)
Most Common Religion *(by proportion of population identifying)*	Muslim	(37)
	Roman Catholic	(36)
	Protestant	(16)
	Christian	(11)

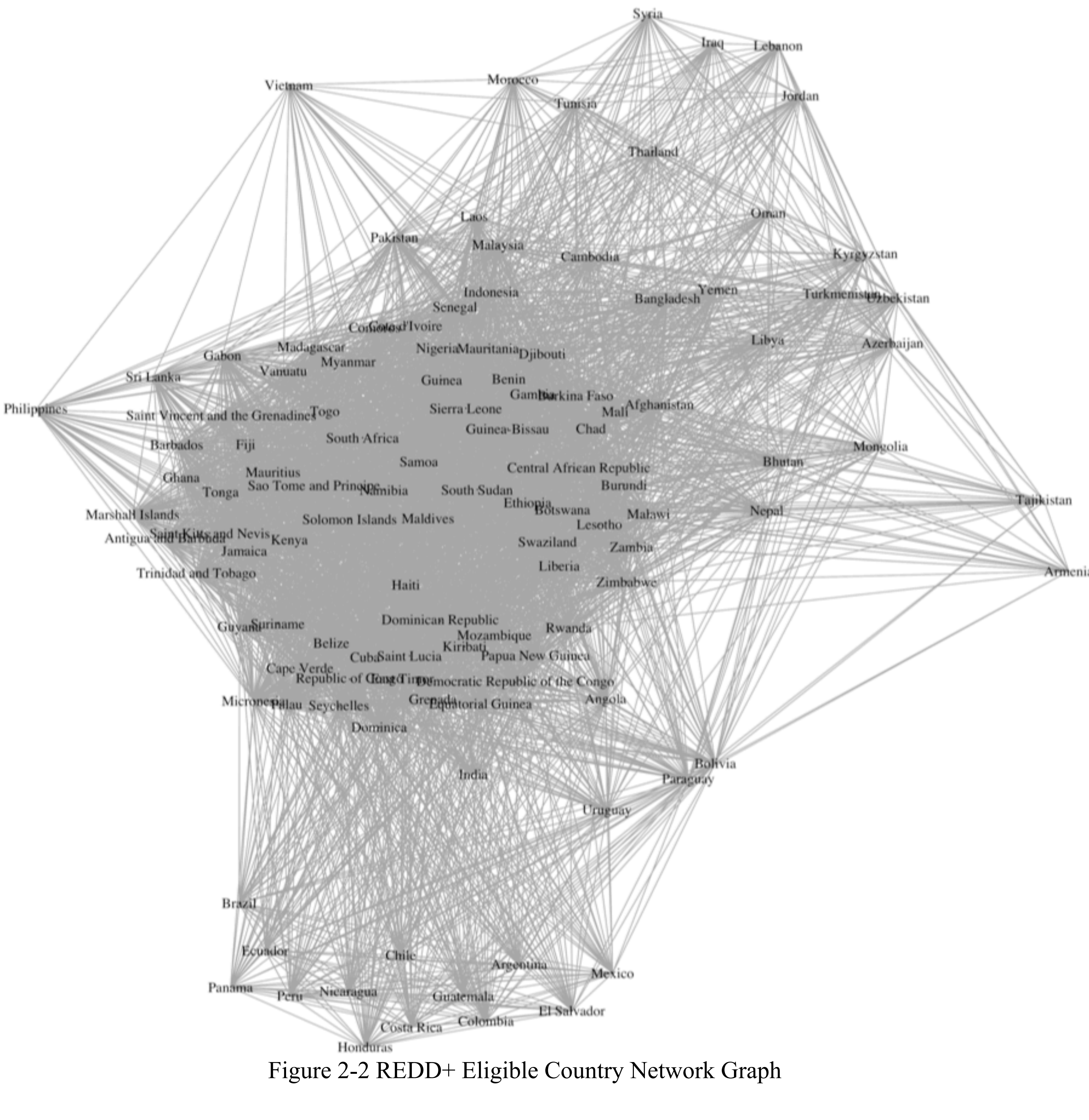

Figure 2-2 REDD+ Eligible Country Network Graph

research program on cultural similarity allows for some validation of my findings and supports that I am creating a convincing proxy for cultural similarity. In my case, cultural similarity is tempered with the inclusion of data on shared-negotiating blocks, which may explain some of the differences between the cultural map and my network graph.

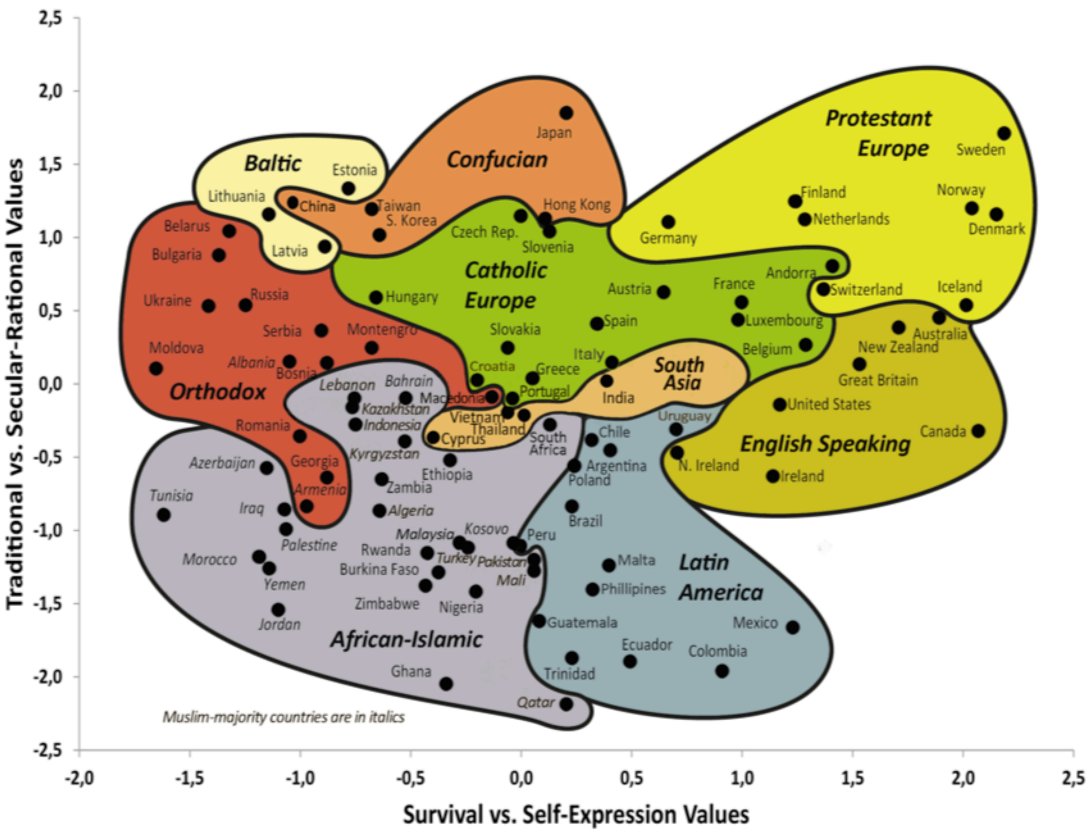

Figure 2-3 Cultural Map following Inglehart-Welzel (WVS, 2017)

2.3.2 *Expert Survey*

I conducted a survey of REDD+ policy experts in 30 countries via an online portal to gather primary data on the mechanisms of policy diffusion. The UN-REDD program publishes a contact list for all country-level focal points annually. Focal points are individuals who act as the point-of-contact for all matters concerning REDD+ at the national level. The focal-point contact lists were available for 2014 – 2017 at the time of writing (UN-REDD, 2017). All listed focal points were contacted via email with an invitation to participate in the online survey (see Appendix 2-2 Expert Survey Recruitment Email, for an English version of the invitation email). There are three official languages of the UN-REDD program, French, Spanish, and English, as such the survey was translated into all three languages and administered in the indicated language of the respondent (as listed on the focal-point contact sheets). Survey invitations were first sent in May of 2017, with a reminder sent three weeks after the initial email. Data were collected through August 2017. In total, 30 of the 65 countries contacted responded within the survey window, for a response rate of approximately 46.2%. Figure 2-4 shows the distribution of countries for which an individual responded within the complete eligible country network (as defined by the Gower similarity coefficient). Responses provided excellent coverage scattered throughout the network.

Due to an incomplete response, my survey results may be affected by non-response bias. To test for an observable bias in the response sample, I used a series of t-test. I compared my sample against to populations, all other countries currently participating in the development of a national REDD+ program (n=64) and all other REDD+ eligible countries (n= 128). I found no statistically significant differences between the response sample and all eligible REDD+ countries nor between the response sample and all other REDD+ countries. I tested for differences in total REDD+ funding received, GDP, the ratio of total REDD+ funding to GDP, the proportion of pilot countries, the max deforestation rate in the previous decade, the proportion of least developed countries, the proportion of AOSIS member countries, the proportion of SIDS countries, geographic region, and relative debt levels. Though I found that the response sample is representative of both the population of eligible REDD+ countries and of the population other REDD+ countries, there may still be unobservable characteristics by which these groups differ.

I designed the survey to be as concise as possible to encourage participation, as I recognized that policy experts have extremely limited time for such requests. The survey was designed to be completed in approximately 10 minutes and included two sections: a short qualitative section and a section with a series of Likert items (Appendix 2-3 contains the complete survey instrument, while Appendix 2-4 provides an image of the online format). Likert items were administered in a random order but taken together constituted five scales corresponding to the five hypotheses of policy diffusion - learning, imitation, normative coercion, negotiating coercion, and competition. Each set of items, ranging from 2-3 per scale, was averaged together to create an ordinal value for each country and a Likert scale for each hypothesis. Paired Wilcoxon signed rank test are used to assess differences among the resulting scales' distributions. This type of significance test was used because it is designed to evaluate ordinal data such as the Likert scales. These results were then used to identify motivations for a country pursuing a REDD+ program.

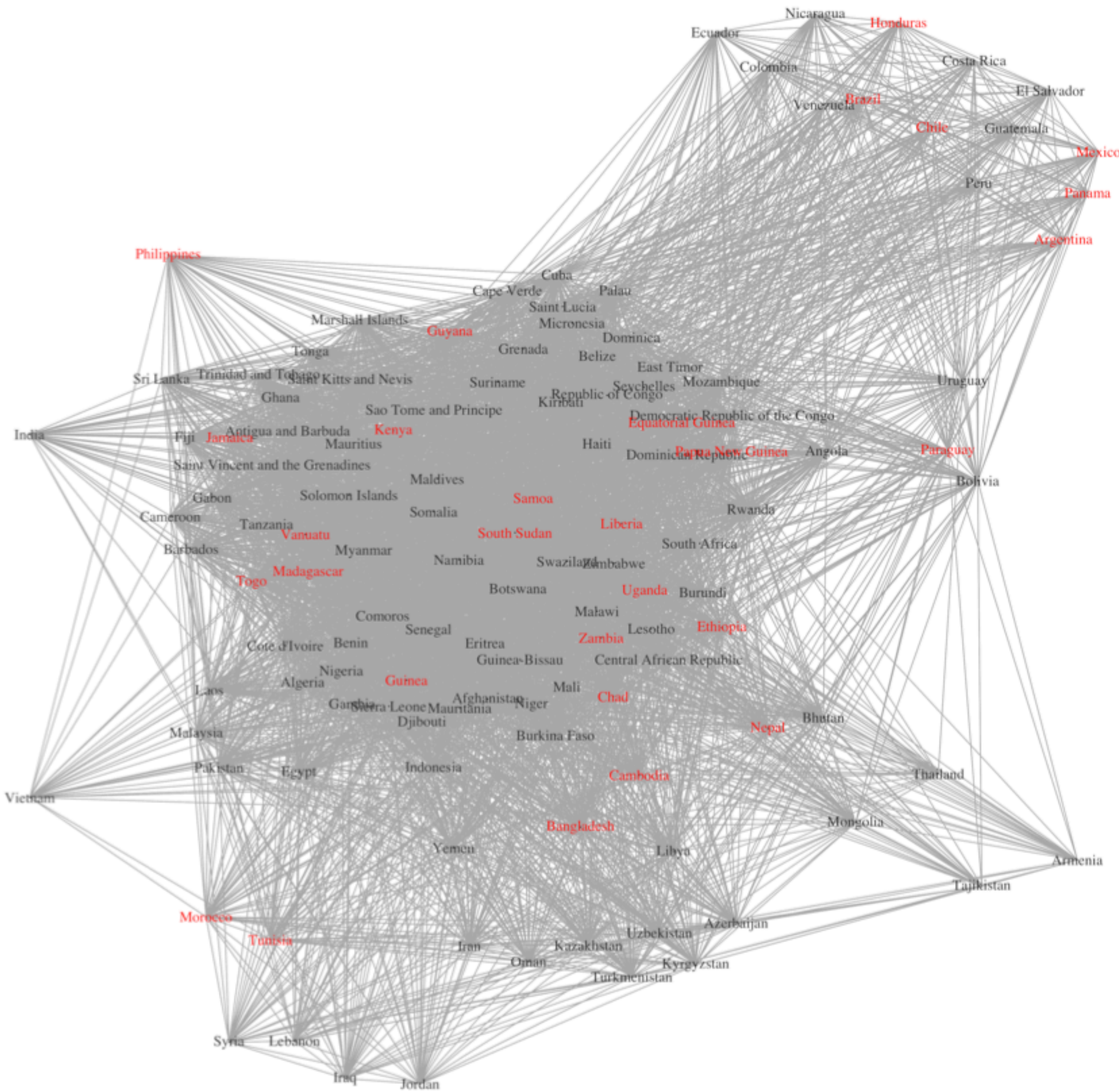

Figure 2-4 Country Network - Distribution of Survey Respondents Shown in Red

2.3.3 *Event History Analysis*

The event history analysis model was estimated using data culled from secondary sources including several online clearing-houses of REDD+ country data. The primary data source is the UN-REDD program website (UN-REDD Programme, 2017). Additional information is incorporated from the Forest Carbon Partnership Facility (FCPF, 2017), the Climate Funds Update (CFU, 2016), and the REDD desk (The REDD Desk, 2017). Data were structured in a directed dyad-year format, where each observation is uniquely identified by country-country-year (Gilardi, 2010). The estimated values of the Gower similarity coefficient were merged into this dyadic data structure.

Figure 2.5 provides a schematic of the logic behind using dyadic data. In each dyad, there is a "sender" country and a "receiver" country, for example, the red arrow in Figure 2.5 shows the India-Brazil dyad, where Brazil as the "sender" and India as the "receiver." Once the model is estimated, its coefficients represent the estimated effects of each "sender" country's covariate values on the "receiver" country's REDD+ policy status. Using a directed approach means each pair of countries is included in two positions, i.e., India-Brazil and Brazil-India are each included as unique observations in each year (Fabrizio Gilardi, 2010). The Brazil-India dyad is a unique observation for each year that estimates the effect of India's covariate values on Brazil's REDD+ policy status, where Brazil is the "receiver" country and India is the "sender" country.

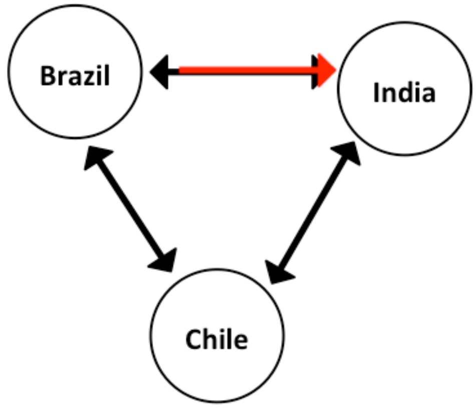

Figure 2-5 Directed Dyad Schematic

REDD+ strategies are highly variable due to the diversity of deforestation drivers, ecosystems, socioeconomic contexts, and legal systems across countries (Corbera, Estrada, May, Navarro, & Pacheco, 2011). UN-REDD and the FCPF are designed to aid countries as they make the national-level evaluations necessary to adapt the REDD+ strategy to their local contexts. To observe whether a country has adopted a REDD+ strategy into a legal framework, however, is difficult as REDD+ activities are variable and sometimes difficult to distinguish. National REDD+ policies are often integrated into existing policies and governance structures, which may not explicitly maintain the name "REDD+." Instead, specific activities, which meet the accepted international standards for REDD+ programs, are incorporated piecemeal. In order to capture a countries' progress towards a National REDD+ Policy, I used a combination of factors to define their policy status including: the year a country joins UN-REDD and/or the FCPF, the year a country signs a National Program document and/or signs an FCPF grant agreement, and the year of adoption of a REDD+ policy at the national level. These dates measure a country's progress towards a national policy. The join dates mark the time until a nation signals interest in a REDD+ policy. These dates also mark a country's entry into the larger policy community and increased exposure to information about REDD+ policies. The signing dates mark a country's commitment to develop and adopt national-level REDD+ policies and are the most observable measures of REDD+ adoption. In the case of UN-REDD, joining and developing a national program also signals the intent to link REDD+ efforts to the broader UNFCCC negotiations and future climate agreements (Denier, L., Korwin, S., Leggett, & M., MacFarquhar, 2014). This is a key distinction from the FCPF, which has no formalized connection to the UNFCCC negotiations.

The adoption of a formal policy is the most critical indicator of policy adoption, while many countries are still in the process of developing a formal policy, their participation in REDD+ forums signals their intent to do so. There are several paths to developing a national policy. Figure 2-6 shows four potential pathways. Early adopters, Mexico and Brazil, bypassed the international forums and developed their REDD+ national policies largely internally (though both have been active participants in UN-REDD and the FCPF). UN-REDD is supporting policy development for 64 countries, while the FCPF is supporting 48 countries currently; only five countries are participating in the FCPF while not participating in UN-REDD. As of June 2017, 14 countries have adopted explicit national REDD+ policy or strategy documents; an additional 16 countries have developed National Program documents through the UN-REDD process. The remaining REDD+ countries are still working towards national policies but are at varying stages in the process.

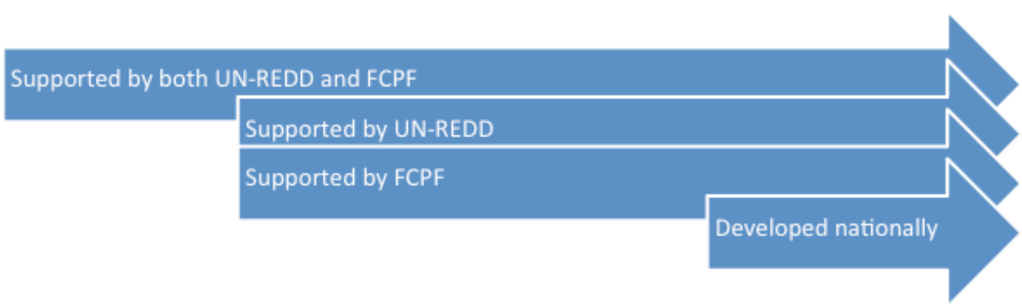

Figure 2-6 Pathways to National REDD+ Policies

To create the dependent variable for the quantitative model, I follow the approach used by Fuglister & Gilardi, 2008. The dependent variable measures whether the "receiver" country's REDD+ policy status in the current year moved closer to the policy status of the "sender" country in the previous year. For example, if in 2009 Fiji was a UN-REDD participant and Morocco was a UN-REDD participant and a FCPF participant, if in 2010 Fiji was a UN-REDD participant and a FCPF participant the observation for the Fiji-Morocco-2010 dyad would be coded as 1. If in 2011, both countries had maintained the same REDD+ policy status the Fiji-Morocco-2011 observation would be coded as zero. In model estimation, the dependent variable measures the likelihood that a “receiver” country’s policy status will become more similar to a “sender” country’s policy status in each year.

To test the diffusion hypotheses proposed, I use logistic regression. The model is estimated using multilevel logistic regression via maximum likelihood estimation[6]. This approach allows me to control for time periods using fixed effects, as well as unobservable internal differences among countries using random effects for the “receiver” country. The countries included in my analysis are all non-Annex 1 countries, classified as "Developing," this includes nations whose World Bank income statuses are low-income and middle-income. This resulted in a set of 128 REDD+ eligible countries.

[6] Models are estimated using the lme4 package version 1.1-13 in R (Bates et al., 2017).

The dyadic-structure of the data means that each covariate included is explaining the variation in each directed-country pair in each year. As control variables for this relationship, I include dichotomous variables indicating, if the countries share the same income level and if the countries are located in the same region. I also control for the maximum deforestation rate over the last decade of the “receiver” country and the total REDD+ funding per GDP received by the “receiver” country. Variation due to other internal “receiver” country differences is controlled for using random effects for each “receiver” country.

To test the hypotheses, I use the Gower similarity coefficient, which is a measure of cultural similarity and opportunities for communication. The interaction of the Gower similarity coefficient with the amount of REDD+ funding received by a “sender” country per year (as a proportion of GDP) is used to test the competition hypothesis. Seven covariates, each representing the proportion of a negotiating bloc that has a REDD+ policy in a given year, are included to test the hypothesis of normative coercion. Finally, the interaction of the Gower similarity coefficient with an indicator of “sender” country being a REDD+ pilot country is used to test for the imitation hypothesis.

Due to the large sample size generated by the dyad-year data structure estimates of statistical significance are adjusted to be more conservative. Large sample sizes can lead to arbitrary findings of significance at lower confidence levels, as such, I increase the confidence level here to reduce the possibility of a finding that is an artifact of the data and choose to draw conclusions that are more conservative. In the model presented, I reject the null hypothesis only at the 99% confidence level, a more conservative threshold than the 95% confidence level that is often standard practice. In addition, 99% confidence intervals are provided for each estimate. Model checks included reestimating the model using four different optimizers to test the model's sensitivity to estimation optimizers and to confirm parameter convergence. When comparing coefficient estimates across optimizers, I checked to ensure that all optimizers were returning nearly identical coefficient estimates. Very similar estimates from these different processes provide reassurance that a maximum has been reached when a non-convergence warning is generated in large-sample-size maximum likelihood estimation. Appendix 2-1 provides further discussion of the issues surrounding large-sample-size maximum likelihood estimation, as well as the checks performed.

2.4 Results and Discussion

The diffusion of REDD+ policies is ongoing. This paper uses data current through 2017 to test for mechanisms of diffusion apparent in the adoption patterns to-date. Figure 2-7 shows Kaplan-Meier curves for each of the four policy statuses. After over a decade of REDD+ efforts, approximately fifty-five percent of eligible countries have joined UN-REDD and around forty-percent have joined the FCPF. Slightly more than twenty-five percent of eligible nations have a UN-REDD national program, while nearly thirty percent have FCPF grant agreements signed.

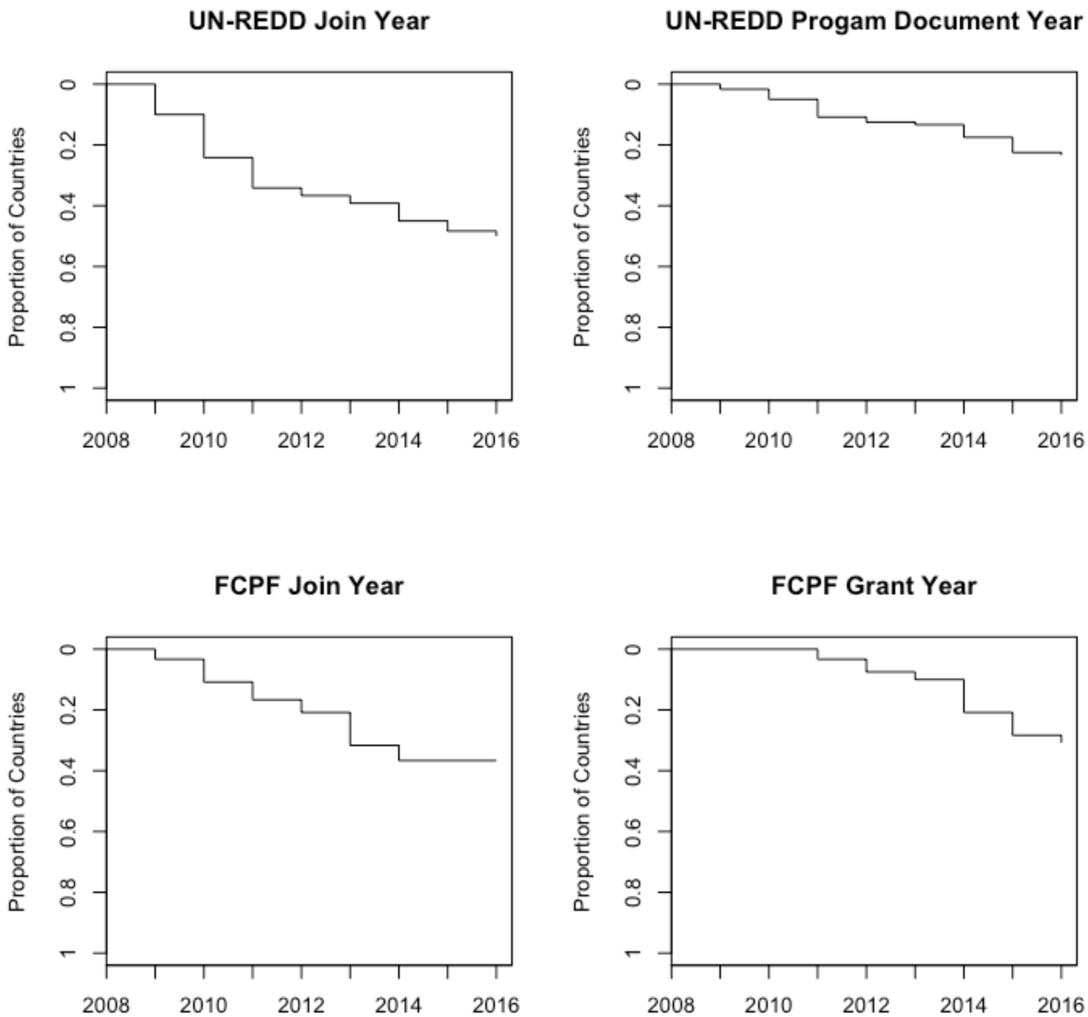

Figure 2-7 Adoption Rates across REDD+ Policy Statuses

As part of the expert survey, data were collected on whether policy experts observed successful outcomes or lessons and experiences from other countries with REDD+ programs. Specifically, experts rated their level of agreement with each of the following three statements regarding REDD+ programs:

- *The country I represent has observed successful outcomes of REDD+ programs in other countries.*
- *The approach to REDD+ in the country I represent has been affected by success(es) in other countries.*

- *In developing the REDD+ program in the country I represent, the experiences and lessons learned in other REDD+ partner countries were considered.*

Table 2-2 shows the proportion of countries that agreed with these three statements for two populations. The top row shows the proportion of agreement for only countries that have National Programs or signed FCPF grants (n=17), the same data are shown graphically in Figure 2-8. The bottom row of Table 2-2 shows the responses from all experts (n=34). The majority of respondents agree with the learning statements across these populations. The most telling finding is that 100% of respondents in countries with National Program or FCPF Grants agreed that their countries considered the experiences and lessons of other countries in developing their REDD+ program.

Table 2-2 Proportion of Countries in Agreement with Learning Statements

	Observed Successful Outcomes	Experiences and Lessons Learned Considered	Affected by Success(es)
National Programs / Signed FCPF Grants (n=17)	82	100	71
Full Sample (n=34)	69	94	71

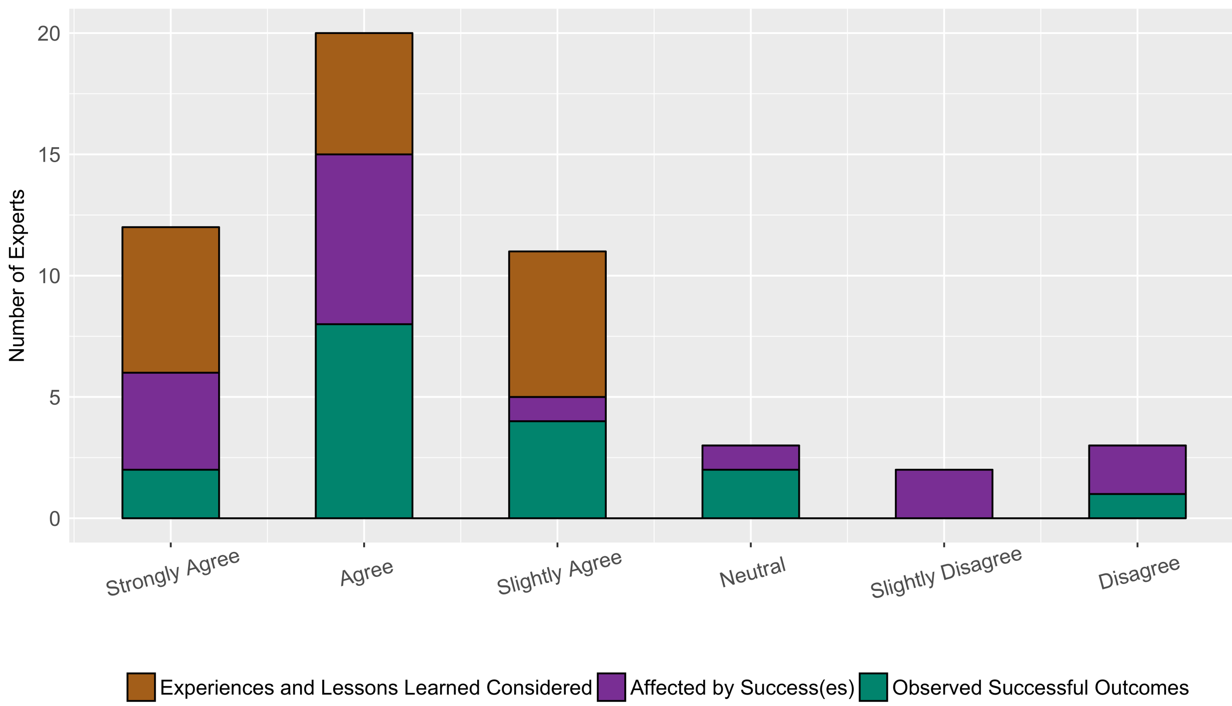

Figure 2-8 Results of Learning Likert Items

The aggregate results of the Likert scale questions from the expert survey are summarized in Figure 2-9. Moving from right to left on the figure, on average, countries disagreed that they were motivated by requests of peers or NGOs to pursue REDD+ policies, indicating no support for a negotiating coercion mechanism of diffusion. There is also slight disagreement that countries were motivated to appear more like regional leaders, the imitation hypothesis. The average response for whether normative coercion is at work is about neutral- overall countries neither agreed nor disagreed that the policy decisions of their peers influenced their decisions to pursue a REDD+ policy. The learning scale shows agreement with the learning statements and the competition scale shows the strongest level of agreement.

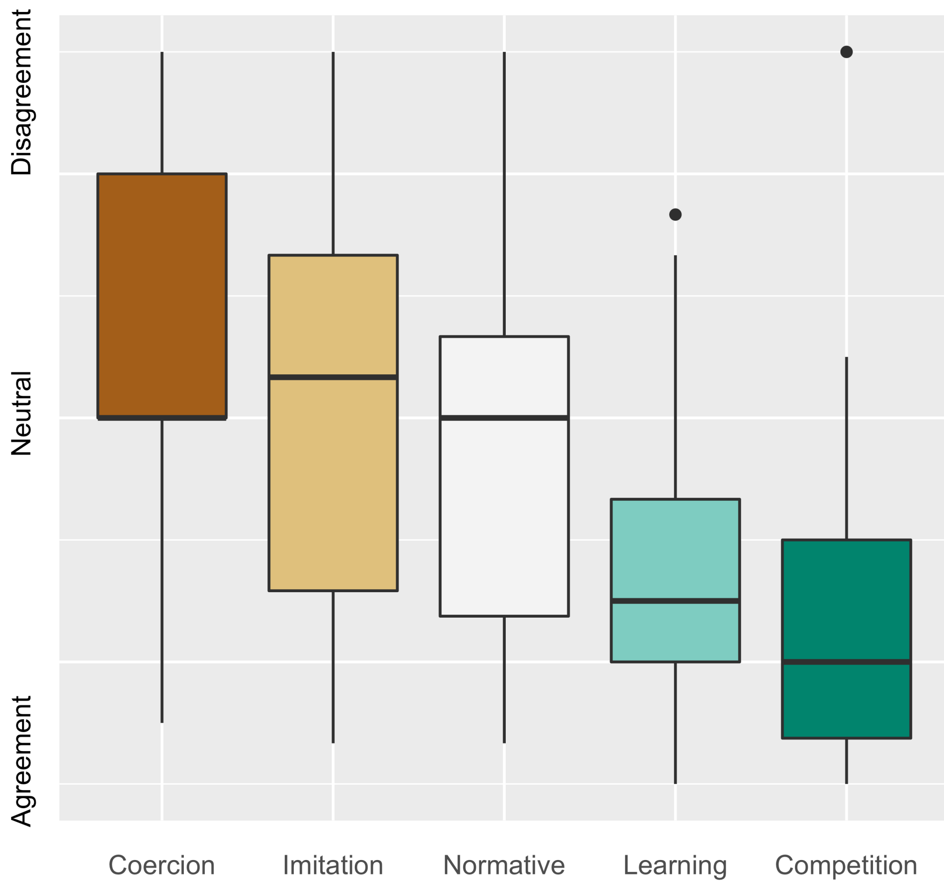

Figure 2-9 Expert Survey Results – Likert Scales

Table 2-3 lists the results of tests of significant differences among the Likert scales shown in Figure 2-9. Paired Wilcoxon signed rank test are used to assess the ordinal data from the survey. I find that the distribution of the learning scale is significantly different from that of the imitation scale. On average, respondents agreed that learning from other countries influenced their country's pursuit of a REDD+ program. In contrast, respondents slightly disagreed that they sought to imitate leaders in REDD+ policy development. Further tests found that the distributions of responses on each emulation scale - negotiating coercion, normative coercion, and imitation – are significantly different from the learning and competition scale distributions. And again, the emulation scales are centered around slight disagreement or neutrality, while the learning and competition scales are centered around agreement.

Table 2-3 Results of Paired Wilcoxon Signed Rank Tests

Likert Scales Compared	**v**	**p-value**
Learning vs. Imitation	79.5	0.002
Learning vs. Normative	93	0.004
Learning vs. Coercion	50.5	< 0.001
Learning vs. Competition	285	0.022
Competition vs. Imitation	42	< 0.001
Competition vs. Normative	0	< 0.001
Competition vs. Coercion	0	< 0.001

Results from the event history analysis model are summarized in Table 2-4. Due to the large sample size, the level of confidence for statistical significance used here is the 99% confidence level. Table 2-4 also provides the 99% confidence interval around these estimates. As shown, when all else is equal, a higher Gower similarity coefficient has a positive and statistically significant effect on the odds of a "receiver" country pursuing a policy more similar to a "sender" country. This means, that as hypothesized, being culturally similar and having more opportunities to communicate increases the odds that a "sender" country will affect policy

Table 2-4 Multilevel Logistic Regression Results

Covariate	**Estimate**	**99% Confidence Interval**	
(Intercept)	-25.086 (1.104)***	-27.929	-22.243
Same income level	0.020 (0.021)	-0.034	0.074
Same Region	-0.064 (0.026)	-0.130	0.002
Gower similarity	0.099 (0.026)***	0.031	0.167
*Funding per GDP * Gower similarity*	0.003 (0.016)	-0.039	0.044
*REDD Pilot * Gower similarity*	0.623 (0.282)***	-0.389	-0.108
AOSIS – proportion with REDD policy	-0.248 (0.054)***	0.011	0.158
LDC – proportion with REDD policy	0.084 (0.029)**	-0.032	0.045
CSN – proportion with REDD policy	0.007 (0.015)	-0.117	0.076
ACP – proportion with REDD policy	-0.020 (0.037)	-0.187	0.023
COMESA – proportion with REDD policy	-0.082 (0.041)	-0.045	0.043
ASEAN – proportion with REDD policy	-0.001 (0.017)	-0.006	0.095
ECOWAS – proportion with REDD policy	0.044 (0.020)	0.821	2.539
Total REDD funding as proportion of GDP	0.063 (0.015)	0.025	0.101
Maximum deforestation rate in previous decade	1.680 (0.333) ***	-0.103	1.349
Significance '***' 0.001 '**' 0.01			
Random Effects: Country	Standard Deviation: 3.16		

n	*AIC*	*BIC*	*Log Likelihood*
147,456	*21080*	*21318*	*-10516*

Note: Fixed effects for year are included in the estimation but not shown for space considerations.

adoption in a “receiver” country. I find that a “sender” country being a culturally similar and a pilot country has a positive and statistically significant effect on the likelihood of the “receiver” country making their REDD+ policy more similar to that “sender” country. This finding may support the imitation hypothesis, however as noted earlier, this pattern would also be observed if a “receiver” country was observing the pilot country’s policy development process via the successes and lessons published by the international forums and making a considered decision also to pursue a REDD+ program based on their own country’s context (a learning mechanism).

I also find some support for the normative coercion hypothesis. The effect of the proportion of countries within a shared negotiating bloc is statistically significant and positive for least developed countries bloc (LDC). Conversely, the effect of the proportion of members in small island states (AOSIS) is statistically significant and negative. In expert survey responses explored between LDC and non-LDC member countries the average responses for LDC countries regarding normative coercion show slightly more agreement, however, the difference is not statistically significant. A Wilcoxon rank test found that the normative Likert scales across LDC and non-LDC are not significantly different, with a p-value of 0.22. However, the sample size for tests across negotiating bloc is quite small, with 16 LDC having responded to the survey. The effect of the LDC negotiating bloc on policy making is a topic ripe for future research.

A comparison of the Kaplan-Meier curves for AOSIS members and all other eligible nations (Figure 2-10) confirms a slower rate of adoption for this negotiating bloc. A likelihood ratio test for each set of comparative curves finds that they are significantly different at the 95% confidence across all policy states. Research on AOSIS negotiating patterns within the UNFCCC has found this previously powerful and cohesive group has become fragmented (Betzold, Castro, & Weiler, 2011). In particular, members hold divergent views on REDD+ policies. Their slower adoption rates and negative effect on policy adoption align with this previous research.

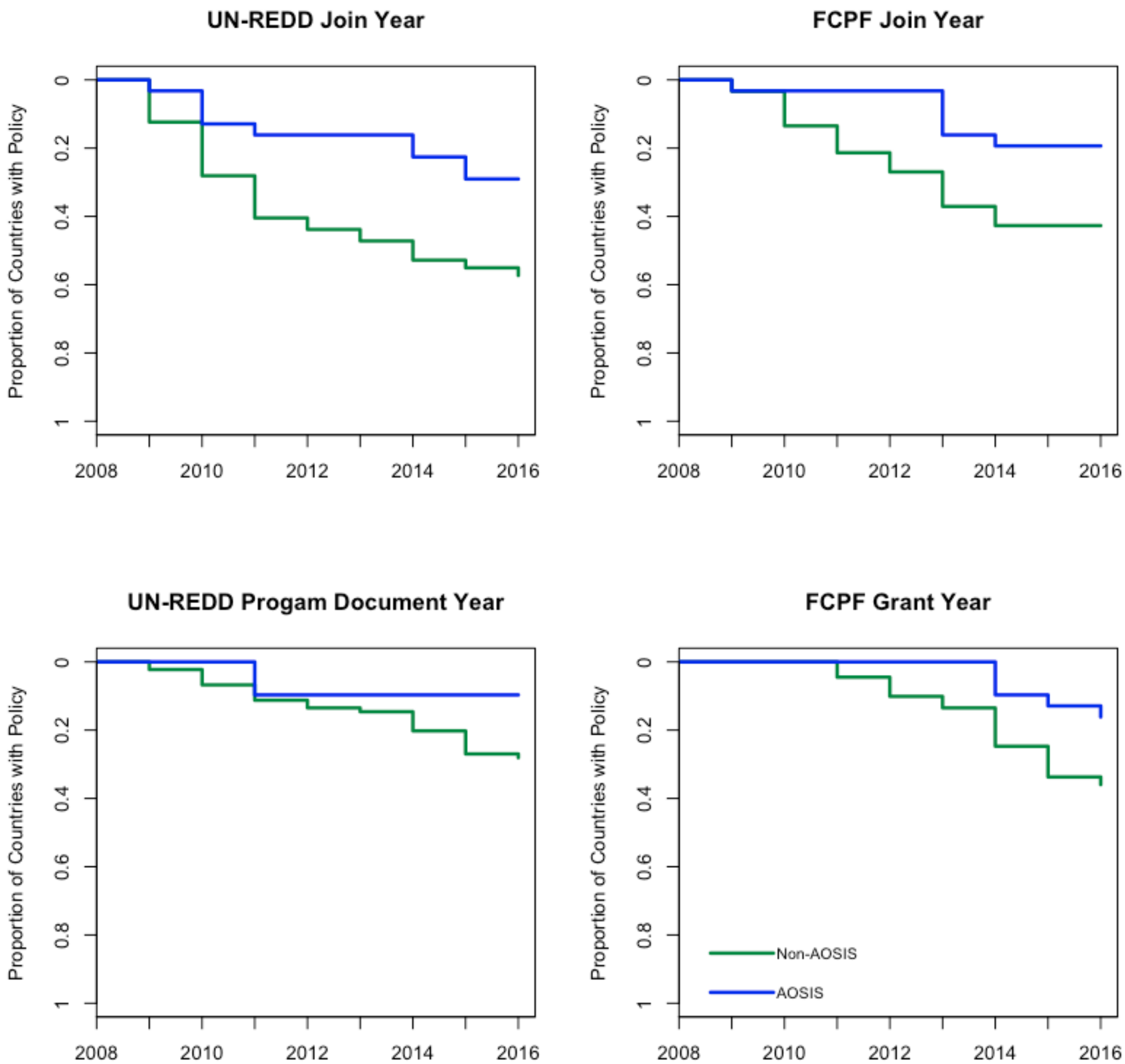

Figure 2-10 Adoption Rate for AOSIS Countries

By using a multilevel model, I control for variation that is attributable to the internal determinates of a country using random effects. This approach has the advantage of controlling for unobservable characteristics that affect a country's adoption of a REDD+ policy. Figure 2-11

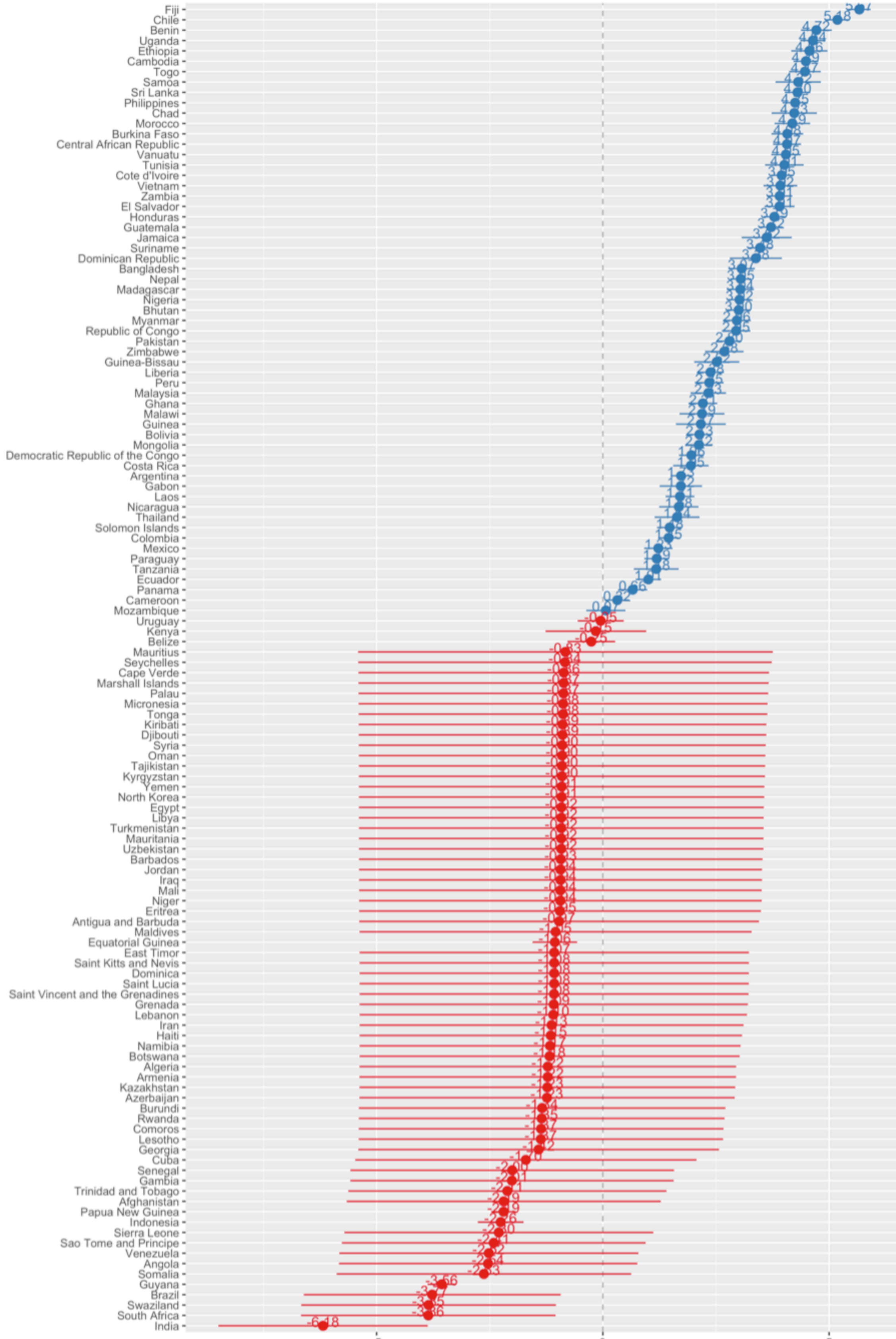

Figure 2-11 Random Effects of “Receiver” Countries

shows the distribution of the random effect for “receiver” countries, where red observations have a negative effect on policy adoption and blue a positive. The large confidence intervals around some red observation indicate that this country has only zeros observed for its REDD+ policy status. In addition to the random effects, I include two internal variables that are highly related to REDD+, the maximum deforestation rate in the country in the past decade and the total REDD+ funding as a proportion of GDP. The effect of total REDD+ funding is not significant, but the estimated effect of the maximum deforestation rate is significant and positive. Indeed, it has the largest magnitude effect of all the included covariates on the likelihood of a policy status becoming more similar to that of a “sender” country. This may be intuitive as countries with higher deforestation rates have more of a need to combat deforestation and forest degradation, as well as more opportunities to restore and reforest. The model also tests for a geographic relationship by including an indicator variable for when countries share the same region. However, the effect is not statistically significant, as expected, I find no support for a purely geographic proximity explanation of the diffusion of REDD+ policies. While the expert survey shows the strongest support for the competition hypothesis, this is not corroborated by the model, which finds no statistically significant effect of the internal funding level or of the funding level of culturally similar “sender” countries.

Taken together, the expert survey results provide evidence that REDD+ policy forums are indeed harnessing a learning mechanism. Countries are motivated to adopt REDD+ policies based on observed successes in other countries. While being influenced by a culturally-similar pilot country alone does not show learning, it does not contradict that a learning mechanism is at play and is indeed in line with the learning explanation. We would expect the patterns of adoption found in the model results to be the same. These findings suggest that the international REDD+ forums are operating as intended in their stated goals. By increasing opportunities for discussion and knowledge sharing, countries are able to adopt REDD+ programs after considering the successes and lesson from the same policies in other countries.

This study is limited in that the response of country experts was incomplete and experts were not asked in the open-ended portion of the survey to discuss specific instances of policy learning or successes they observed. This is because the Likert items were designed to identify which, if any, of the five potential mechanisms were at work. Before the analysis of the expert survey data, I could not predict with which Likert items experts would agree. Without evidence to support which mechanisms to emphasize during the limited open-ended survey, the questions were kept more general. There is, therefore, an opportunity for future research to focus more narrowly on the learning mechanisms for which this work provides initial support.

2.5 Conclusion

REDD+ programs seek to intentionally promote the adoption of national-level REDD+ policies, poising them to make significant changes to global forest use policies. In the short time since the policy innovation in 2005, REDD+ policies have spread to 70 countries and attracted billions of dollars of funding (CFU, 2016). This paper has explored the patterns of this diffusion and tested for specific mechanisms driving this process. It contributes to the literature both by tackling the recent calls for refocusing policy diffusion research on identifying specific mechanisms (Gilardi, 2016) and by providing a novel application of these theories to “governance by diffusion” programs.

Based on this analysis, though each has slightly different intentions, both UN-REDD and the FCPF appear to have partially harnessed a learning mechanism in their attempts at promoting and diffusing the REDD+ policy innovation. In a survey of REDD+ policy experts from 30 countries, experts overwhelmingly agreed that their countries both observed REDD+ successes and considered the lesson, experiences, and successes of other countries in developing their own REDD+ programs. Further, the event history analysis multilevel logistic regression model did not find conclusive quantitative-support for the alternative mechanisms of diffusion. These results are a promising signal that REDD+ programs are likely promoting policies that are well-suited to the specific contexts where they are adopted. Had an alternative mechanism been supported, such as competition for financial resources or a normative pressure to maintain similar policies to peer-countries, it would have signaled that policies may have been adopted without consideration for their likelihood of successful future outcomes.

These findings signal that international forums can disseminate policy information and help to diffuse policy innovations by allowing member countries to observe the successes of early adopters and learn from their experiences. This provides preliminary validation of "governance by diffusion" as a tool for promoting policies that are desirable at the international scale. Following the structure of UN-REDD and FCPF, including reducing barriers to national policy adoption and transparently tracking the progress of policy development, could aid in the development of similar policy venues to address other global policy challenges.

Chapter 3. MAPPING THE GLOBAL GOVERNANCE CONTEXT FOR LAND TENURE SECURITY[7]

3.1 ABSTRACT

Tenure security is widely regarded as an effective factor for improving human well-being (food security, economic development, etc.). Land tenure security is incorporated into the Sustainable Development Goals and is a necessary foundation for conservation policies, including payment for ecosystem services (PES) and REDD+ (reducing emissions from deforestation and forest degradation) programs. To date, little work has provided a spatially explicit description of how land tenure security relates to forest conservation and human well-being variables globally. In this paper, I create a global index, the Governance Context for Land Tenure Security index (GC-LTS index), using existing global datasets. This global layer is an important advance for practitioners and researchers working in coupled-human-natural systems because land tenure security is directly and indirectly related to natural resource management decisions, yet we lack an explicit quantitative representation of the concept. I find that indicators of human well-being, both of individual well-being and of trends in human development, are significantly correlated with the GC-LTS index. I also create overlays of the GC-LTS index with remaining intact forest areas and with the number of terrestrial endemic species to demonstrate an exploratory analysis of the relationship of the GC-LTS index and areas of conservation priority globally.

[7] This chapter is informed by expert input from the Land Tenure Security, Conservation, and Human Well-Being at The Nature Conservancy.

3.2 INTRODUCTION

Land tenure security is a necessary foundation for achieving many global policy goals. Research has largely found a positive relationship between land tenure security and human well-being (Lawry et al., 2014; Payne, Durand-Lasserve, & Rakodi, 2009; Rodgers & Menon, 2012). As a result, "control over land" is an explicit part of Goals 1 and 5 of the Sustainable Development Goals[8]. It is unsurprising that policymakers, practitioners, and researchers working in international development and conservation increasingly see land tenure security as an important consideration for achieving their goals. However, given finite resources, policymakers require evidence to help them prioritize locations where land tenure security should be a primary consideration in resource allocation and program development. A data-derived indicator with global coverage is needed to help make such determinations, but there are currently two primary barriers. First, land tenure security is multidimensional, and so a land tenure security indicator should represent key elements found in the vast literature on the concept, and provide clear documentation to ensure transparency in what is and is not represented. Second, global data on elements affecting land tenure security are relatively scarce. As a result, past efforts have had limited global coverage. This paper addresses these two limitations by developing the Governance Context for Land Tenure Security index (GC-LTS index) to inform global analyses that seek to incorporate land tenure security.

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[8] Sub-goal 1.4: "By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance.", sub-goal 5.a "Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws." (United Nations A/RES/70/1, 2015).

Research on land tenure security and environmental outcomes has found ambiguous relationships, but it remains foundational for environmental conservation policies, such as payments for ecosystem services (PES) and reducing emissions from deforestation and forest degradation (REDD+) programs. These programs require that land tenure and its associated rights are clear in order to provide incentives and benefits for the people in charge of managing the forests (W. Sunderlin, Larson, & Cronkleton, 2009). In turn, working in areas with secure tenure gives practitioners the assurance that project contracts are made with people who will have long-term control over the use of the forest resource. Therefore, programs can seek to ensure better conservation outcomes by relying on existing land tenure security or working to improve security (Larson et al., 2013; Naughton-treves & Day, 2012; Naughton-Treves & Wendland, 2014; W. D. Sunderlin et al., 2014; World Resource Institute, 2013). In the context of other conservation policies, such as protected areas and reserves, where exclusionary rights are necessary, land tenure security also plays an important role. In general, conservation planning and resource-allocation decision-making that incorporates socioeconomic data have been shown to contribute to more efficient resource allocation (Bode et al., 2008; Possingham, Bode, & Klein, 2015; Wilson, McBride, Bode, & Possingham, 2006). Broadly, understanding the land tenure security context of a location may mediate the costs, threats, and benefits of conservation projects (B. E. Robinson et al., 2017; Wilson et al., 2006). Securing land tenure can reduce the uncertainty of the expected outcomes of conservation investments. A global dataset is therefore valuable for improving REDD+ and conservation-planning decisions and for a better understanding of the spatial relationship of land tenure security and areas of conservation priority.

Identifying and aggregating spatially explicit variables affecting land tenure security is complex, which may explain the lack of data on land tenure security at the global scale. A common source of data on land tenure security comes from primary research studies, which often collect information at the local scale. While this locally-relevant information is useful for identifying drivers and impacts of land tenure insecurity for specific contexts, these data have limited utility for conducting cross-country comparisons and, by their nature, lack the global coverage needed by many decision-makers. There are some existing research efforts working to provide global data on land tenure security for specific forms of tenure or for specific resources, such as the LandMark project's focus on community and indigenous tenure and the Rights and Resource Initiative's focus on forest tenure (LandMark, 2017; RRI, 2017). These efforts can serve as important complements to a global index, but because of their specific foci do not provide a broad, baseline understanding of the tenure security context across countries.

Five extant data sets were considered as potential representations of land tenure security globally. Three of these, maintained by the Property Rights Alliance, Heritage Foundation, and the World Bank, provide global datasets on the strength of property rights (Property Rights Alliance, 2016; The World Bank, 2015; Heritage Foundation, 2015). While property rights are a key element, they only serve as a partial proxy for the broader concept of land tenure security. A large literature discusses the complexity and nuance of measuring land tenure security (J. W. Bruce & Migot-Adholla, 1994; B. E. Robinson et al., 2017; Simbizi, Bennett, & Zevenbergen, 2014; van Gelder, 2010). These sources highlight that other elements, such as the political will of the government, its governance capacity, and the broader political-economic context, interact with property rights to produce the degree of land tenure security in a location. Two existing efforts that have aggregated data to provide information on land tenure security more comprehensively, but these also fall short of addressing the limitations outlined above. USAID and ARD Inc.'s (2005) Insecure Tenure and Property Rights rankings, attempted to capture various elements of tenure security, but their data set only covered 85 countries and their methodology was opaque and perhaps too costly to implement in every country and replicate across years. The International Property Rights Index does aggregate data on the legal and political environment for both physical and intellectual property rights covering 129 countries, however, their focus is not explicitly on land tenure security but again on property rights (Property Rights Alliance, 2016).

This paper advances the current body of global measures of land tenure security by developing the GC-LTS index. I do so by building on the Robinson et al. (2017) framework of tenure security and operationalizing two key components contributing to land tenure security: the political economic and formal institutional components. The inclusion of these components in the Robinson framework was informed by an extensive literature review on land tenure security and screened via expert input. The GC-LTS index includes data to represent six core elements of these two components, which are: exclusion authority, capacity to adjudicate, governance capacity, conflict, political will, and political capacity. These six elements can be represented with proxy variables to characterize the broader governance context for land tenure security in a country.

The overarching goal of the GC-LTS index is to create a replicable and transparent index at the national scale with nearly global coverage. The GC-LTS index provides several advances over existing available indicators. First, the GC-LTS index focuses explicitly on factors affecting land tenure security that can plausibly be represented at the national scale. The GC-LTS index focuses on components of tenure security that apply to all populations in a given country and does not articulate the distribution of rights or that rights are consistently enforced across all populations, but represents the broader context influencing the emergence land tenure security. Because it focuses on broader contextual elements, the GC-LTS index allows for cross-country comparisons, which can provide useful information for policymakers interested in developing tailored strategies to address the governance context for land tenure security. Second, the GC-LTS index expands geographic coverage to include 165 countries. Finally, the GC-LTS index allows for global analyses of whether the governance context for land tenure security is associated with broader ecological or human well-being outcomes. The GC-LTS index complements local-level tenure security analyses by providing a first step for understanding the broader drivers of land tenure security in a country.

Section 3.3, Data and Methods, briefly summarizes the literature on how land tenure security is defined and the approaches to its measurement used by existing research programs. This analysis justifies the selection of the six core elements of the GC-LTS index, which comprise the political economic and formal institutional components. I then turn to a review and description of the data sources selected as proxies for these core elements.

In Section 3.4 Results, the distribution of the GC-LTS index is presented as a global map. The findings follow expected patterns; countries experiencing on-going conflicts on their soils or civil unrest have very low GC-LTS index values, while countries with developed economies have higher values. I next explore cross-country comparisons between countries with similar GC-LTS index values. These comparisons reveal significant variation across the core elements of the GC-

LTS index, indicating that different approaches may be necessary to strengthen the governance context for land tenure security even in countries that look similar using aggregate GC-LTS index values.

Section 3.4 Results continues with an exploration of the relationships of the GC-LTS index with key human well-being and conservation priority variables. I find indicators of individual human well-being and trends in human development are significantly correlated with the GC-LTS index. An overlay of the GC-LTS index with intact forest areas reveals a bimodal distribution of the GC-LTS index within intact forests and shows that the majority of remaining intact forest area is located in countries where the governance context for tenure security is relatively weak. An overlay of the GC-LTS index with the number of terrestrial endemic species by ecoregion highlights countries with high numbers of terrestrial endemic species but with lower GC-LTS index values. While intended as a heuristic for the use of the GC-LTS index, these overlay analyses highlight the potential for the GC-LTS index to contribute to high-level decision-making exercises. These two examples highlight areas where tenure interventions may be expected to improve human well-being and where further study could help us to understand the potential of such interventions to improve conservation outcomes. I conclude with a discussion of these results and their broader implications.

3.3 Data and Methods

3.3.1 *Defining and Measuring Land Tenure Security*

The definition of land tenure security is discussed extensively in the literature (Alden Wily, Veit, Smith, Dubertret, & Reytar, 2015; FAO, 2002; Knox, Caron, Miner, & Goldstein, 2011; Simbizi et al., 2014). This paper builds on Robinson et al.'s (2017) land tenure security and conservation framework to define the GC-LTS index. The framework was developed through an extensive review of the literature (summarized in Appendix 3-1, Table A3-1. Complete Definitions and Table A3-2. Elements of Tenure Security Definitions in the Supplemental Materials Section), and synthesized common themes of land tenure security definitions to identify three main components of land tenure security: informal institutions, formal institutions, and political economy. This section briefly summarizes this underlying literature to provide the foundation and justification for the elements selected for inclusion in the GC-LTS index and their corresponding proxies.

Overall, land tenure security definitions commonly include the ability to defend rights, or the expectation that when a right is challenged it will be sustained (Alden Wily et al., 2015; J. W. Bruce & Migot-Adholla, 1994; John W. Bruce, Wendland, & Naughton-Treves, 2010; Burnod et al., 2012; Meinzen-Dick, 2014; Naughton-Treves & Wendland, 2014; Schlager & Ostrom, 1992). The likelihood of losing part or all of the rights or that the right holder will be able to reap benefits by hold or transfer is also commonly included in definitions (J. W. Bruce & Migot-Adholla, 1994; John W. Bruce et al., 2010; Holden & Yohannes, 2001; Payne, 2004; Razzaz, 1993). The consistency of the inclusion of property rights in the definitions highlights its importance for understanding the land tenure security context. The GC-LTS index includes the right holder's exclusion authority or ability, represented by a proxy for the strength of property rights. The strength of property rights alone, however, does not guarantee secure land tenure, as much of the literature points out.

A broader commonly occurring element of tenure security definitions is the government's capacity to protect or support those property rights. As Bruce et al. state the "supporting legal and political environment affects whether good laws on property rights deliver the needed security of property rights (John W. Bruce et al., 2010).” Good governance is critical to the success of tenure reform strategies. Deininger and Feder list government’s role as including, defining and enforcing property rights, providing reliable information to reduce transaction costs, and providing cost-effective management of land-related externalities (K. Deininger & Feder, 2009). Meinzen-Dick argues, “rights are only as strong as the institutions that stand behind them (Meinzen-Dick, 2014).” The GC-LTS index includes the government’s capacity to adjudicate and the capacity of the government overall to represent this concept. To capture the context within which land tenure systems function, the GC-LTS index also includes a political economy component. This broader component mediates the governance environment within which a country’s land tenure systems operate, and in turn the provision of land tenure security.

A third common element of many definitions was the perception of land tenure security. Perception is often cited as more important to understanding local land use decision-making than the legal status of land tenure (Burnod et al., 2012; Payne, 2004; Brian E. Robinson, Holland, & Naughton-Treves, 2014; van Gelder, 2007, 2010). “To a large extent, land tenure security is what people and communities perceive it to be (LandMark).” In van Gelder’s tripartite view, tenure security is a composite constituted of “the perception of the dweller with regard to his situation, the legal status of his tenure, and the de facto conditions (2010).” Local perceptions are a critical component of determining the level of tenure security in a given area. At the broader scale of the GC-LTS index, perceptions are not feasible to include directly. Indirectly, the GC-LTS index captures some elements of perception through assessments of the strength of property rights and the level of perceived corruption in a country.

The GC-LTS index includes six elements structured by the Robinson et al. framework and closely linked to the literature summarized above. The definitions of the selected elements are listed in Table 3-1 and are drawn from the political science and public policy literatures. As summarized in the table, within formal institutions, the GC-LTS index includes three elements: exclusion authority, capacity to adjudicate, and governance capacity. Within political economy, the GC-LTS index includes the elements of conflict, political will, and political capacity.

Table 3-1 Definition of Elements

Element	Definition
Political Economy	
Political capacity	Ability of a government to implement a set of policy choices.
Political will	Extent of committed support by decision makers to a set of policy choices.
Conflict	Struggle between opponents over values and claims to scarce status, power, and resources.
Formal Institutions	
Capacity to adjudicate	Formal legal process of resolving a dispute.
Exclusion authority/ability	Ability to refuse access to and use of a particular resource.
Governance capacity	Ability to promote the interests of society as a whole and promote effective public policy.

The elements selected for inclusion in the GC-LTS index were next compared with those used by existing research programs. This review included the methodologies from the World Bank's Land Governance and Assessment Framework (LGAF), the Generic Land Tenure module of the Living Standards Measurement Survey, the World Resources Institute's Governance of Forest Initiative, and LandMark's scoring system for the Global Platform of Indigenous and Community Lands (Alden Wily et al., 2015; Klaus Deininger, Selod, & Burns, 2011; Galudra et al., 2010; Holden, Ali, Deininger, & Hilhorst, 2015; World Resource Institute, 2013). In summary, the core elements of the GC-LTS index are included in various ways in these existing research programs. Although these programs have different overall foci and some work at the local- or household-scale, they prioritize the assessment of similar elements of the tenure context to those included in the GC-LTS index.

3.3.2 *Representing the GC-LTS Index at a Global Scale*

Based on the Robinson et al. framework and extensive literature review, the six selected elements are a parsimonious collection that can best characterize the governance context for land tenure security at the global scale. In order to operationalize the theoretical concepts, I turned to an extensive review of existing available datasets, including over 30 data sources. In an ideal and unconstrained data-world, data measured specifically for the purposes of representing land tenure security would be used. Currently, very little data of this nature with global coverage exists. However, promising new ventures will produce better-tailored data for future iterations of the GC-LTS index. For example, the World Bank's Enabling the Business of Agriculture land use initiative (which this year launched a land indicator scoring pilot (World Bank, 2017)) is a very promising data source as its coverage expands. I also anticipate including the Global Property Rights index, PRIndex (PRIndex, 2017), which is currently collecting survey data on the local perception of land tenure security via Gallup polls. In the following paragraphs, I outline the currently available data sources determined best to represent the six elements of the GC-LTS index.

The first element of the political economy component is political capacity. Political capacity is a way to measure government efficiency, it "represents the ability of a government to implement a set of policy choices (Arbetman-Rabinowitz & Johnson, 2007)." Based on this definition the Government Effectiveness indicator from the Worldwide Governance Indicators was selected. This indicator measures "the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies (Kaufmann, Kraay, & Mastruzzi, 2011)." A high value of this indicator signals a high degree of political capacity.

The second element of the political economy component is political will. Political will is the "extent of committed support by decision makers to a set of policy choices (Post, Raile, & Raile, 2010)." In contrast, the absence of political will would be the lack of support for a set of policy choices. Where decision makers are easily swayed by self-interested action (corruption), there will be a lack of commitment to advancing policy in the interest of the public good. As such, the level of perceived corruption is used to represent the level of political will. The corruption perception index "aggregates data from a number of different sources that provide perceptions of business people and country experts of the level of corruption in the public sector (Transparency International, 2015)." Where this index is higher, there is a lower degree of political will to uphold a given set of policy choices, which would include those related to the land tenure systems in a country.

The final element of the political economy component is conflict. Conflict broadly is the "struggle between opponents over values and claims to scarce status, power, and resources (Coser, 1956)." To represent conflict at the national scale, the Political Stability and Absence of Violence indicator from the Worldwide Governance Indicators is used. This indicator measures the "perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including domestic violence and terrorism (Kaufmann et al., 2011)." This measure rounds out the political economy component of the GC-LTS index. Taken together, the three elements represent the broader context of a country that affects land tenure security outcomes.

Included in the formal institutional component is governance capacity. Governance capacity is “the condition under which effective public policy can be promoted” for “the interests of society as a whole (Frischtak, 1994).” In the context of land tenure security, the capacity of the government to maintain a registry of land is central to fostering security. The World Bank’s Ease of Doing Business measure of the ease of registering property is used to represent this element. The ease of registering property indicator is intended to measure “the quality of the land administration system in each economy. The quality of land administration index has five dimensions: reliability of infrastructure, transparency of information, geographic coverage, land dispute resolution, and equal access to property rights (World Bank, 2016).” These capacities are central to the formal institutions necessary to promoting secure land tenure.

The second element of the formal institutional component is exclusion authority and ability. Exclusion authority or ability is “the ability to refuse another individual, group, or entity access to and use of a particular resource (RRI, 2012).” This element is represented using the strength of property rights. There are two existing global data sources measuring the strength of property rights, after careful review, the concept as measured by the World Economic Forum was selected as the primary data source for this element. However, because this preferred data-source only includes data for 140 countries, to avoid losing coverage in the overall GC-LTS index, where World Economic Forum data is unavailable, I use the data available from the Heritage Foundation (Heritage Foundation, 2015). Both of these measures use similar methods, surveying experts in a country to generate the respective indices. Stronger property rights indicate a higher degree of tenure security overall.

The final element of the formal institutional component is the capacity to adjudicate. Capacity to adjudicate is the legal process of resolving a dispute (Ware, 1990). To represent this element, the Worldwide Governance Indicator for Rule of Law is used. It measures “the extent to which agents have confidence in and abide by the rules of society and in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence (Kaufmann et al., 2011).” Having higher confidence in the adjudication system creates a better context for the security of right holders.

These six selected global datasets operationalize the two main components, political economy, and formal institutions, and create the GC-LTS index. Datasets were selected to maintain coverage of as many countries as possible. All six elements (listed in Table 3-2) were first scaled to a 0-1 range and then weighted equally to form the GC-LTS index. Currently, there is insufficient evidence in the literature to support weighting these components based on their comparative contributions to securing land tenure. As such, I make no a priori assumptions about the relative importance of each element for attaining land tenure security and weight them equally.

Table 3-2 Land Tenure Security Index Elements and Corresponding Proxies

Element	Proxy	Data Source	Original Range[a]	Year
Political Economy				
Political capacity	Government Effectiveness	World Governance Indicators	-2.5 – 2.5	2014
Political will	Corruption Perception Index	Transparency International	0 - 100	2014
Conflict	Political Stability and Absence of Violence	World Governance Indicators	-2.5 – 2.5	2014
Formal Institutions				
Capacity to adjudicate	Rule of Law	World Governance Indicators	-2.5 – 2.5	2014
Exclusion authority/ability	Strength of Property Rights	World Economic Forum / Index of Economic Freedom	1 – 7 ; 0 - 100	2015
Governance capacity	Registering Property	Ease of Doing Business	0 - 100	2015

[a] In all cases, a higher value of an indicator corresponds to a higher overall GC-LTS index value. Table S4 in the Supplemental Materials provides a correlation matrix for the six elements.

3.4 Results

The results of the initial analysis, which aims to generate a spatially explicit index of the governance context for land tenure security, are summarized in Figure 3-1 – 3-3. Figures 3-1 and 3-2 present the political economic and formal institutional components of the GC-LTS index, respectively, while Figure 3-3 presents the GC-LTS index. Red areas represent values nearer to zero on the GC-LTS index, while green areas represent values nearer to one on the index. Higher values indicate stronger governance contexts for land tenure security.

Examining the complete GC-LTS index, some values are predictable based on current regions of conflict and unrest. For example, the Central African Republic, Chad, Syria, the Democratic Republic of the Congo, and Haiti all have weak governance contexts for land tenure security, and these countries are considered to be among the most fragile states (Fund for Peace, 2016). Similarly, the more developed countries in Europe, North America, and Australia are represented as having stronger governance context for land tenure security[9].

The GC-LTS index allows for cross-country comparisons of its individual elements, which can provide insights into whether or not drivers of land tenure security are similar or dissimilar for countries with similar values. For example, Figure 3-4 shows the values of the six index elements for Guatemala and Suriname, both of which have an overall GC-LTS index value of 0.44. As shown, unseen within the averaged values, the actual composition of the GC-LTS index is quite different for the two countries. In Guatemala, the GC-LTS index elements are relatively weaker on government effectiveness and rule of law than in Suriname, while Guatemala has relatively higher values for the ease of registering property and the strength of property rights. This exploration of element values can provide information to help refine tenure intervention policies, including how to target policies designed to improve the strength of tenure security. The focus in Suriname, for example, may be oriented towards improving the land registration process and ensuring landholders are able to demonstrate and defend their rights, while the focus in Guatemala may be more political, working to reduce corruption to ensure existing land tenure systems are upheld or respected.

[9] For a detailed comparison of the GC-LTS with the Insecure Tenure and Property Rights ranking (USAID/ARD, 2005) and with the International Property Rights Index (IPRI, 2016), please refer to the Supplementary Materials section.

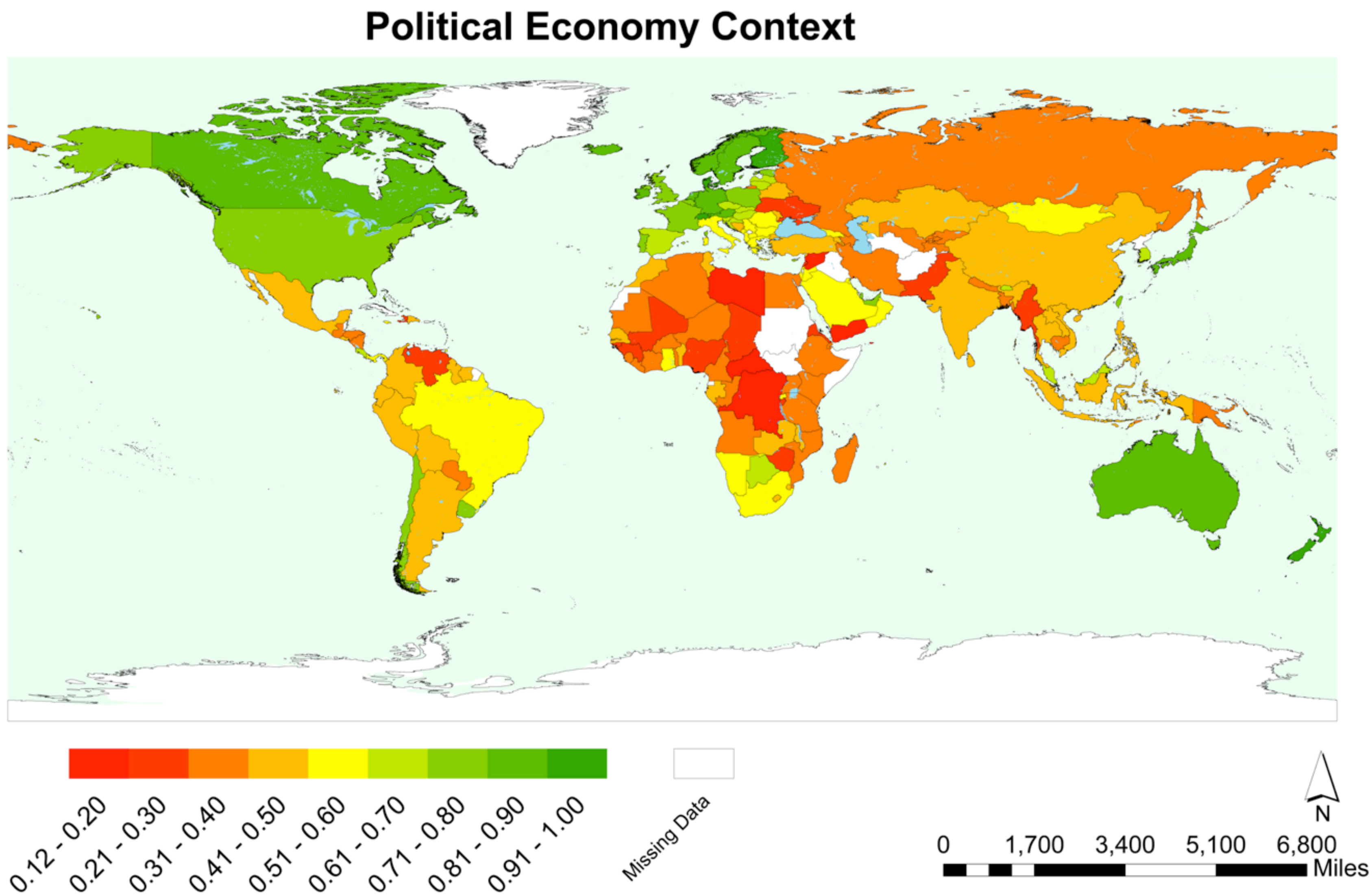


Figure 3-1 Political Economic Context

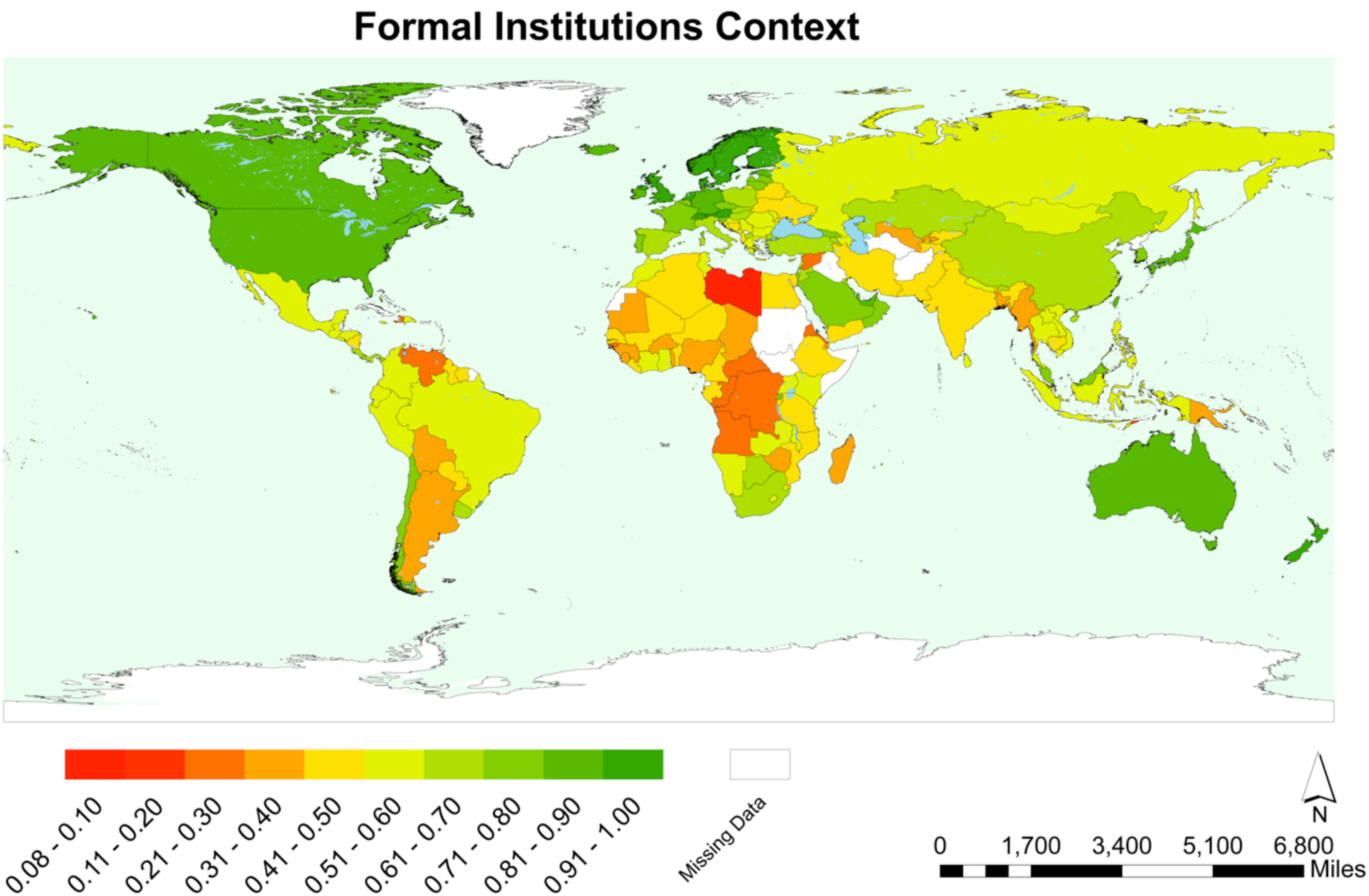


Figure 3-2 Formal Institutions Context

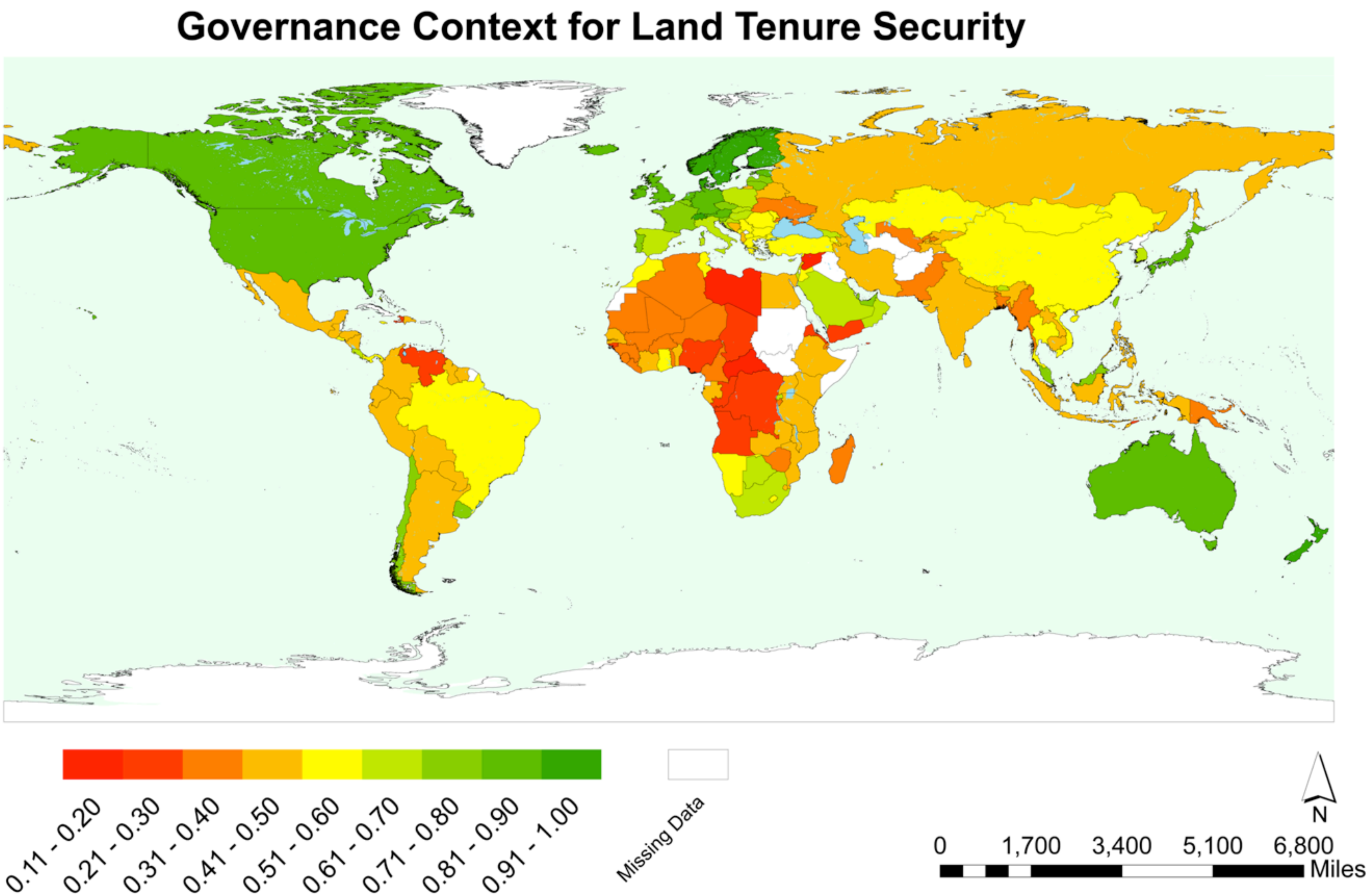


Figure 3-3 Governance Context for Land Tenure Security

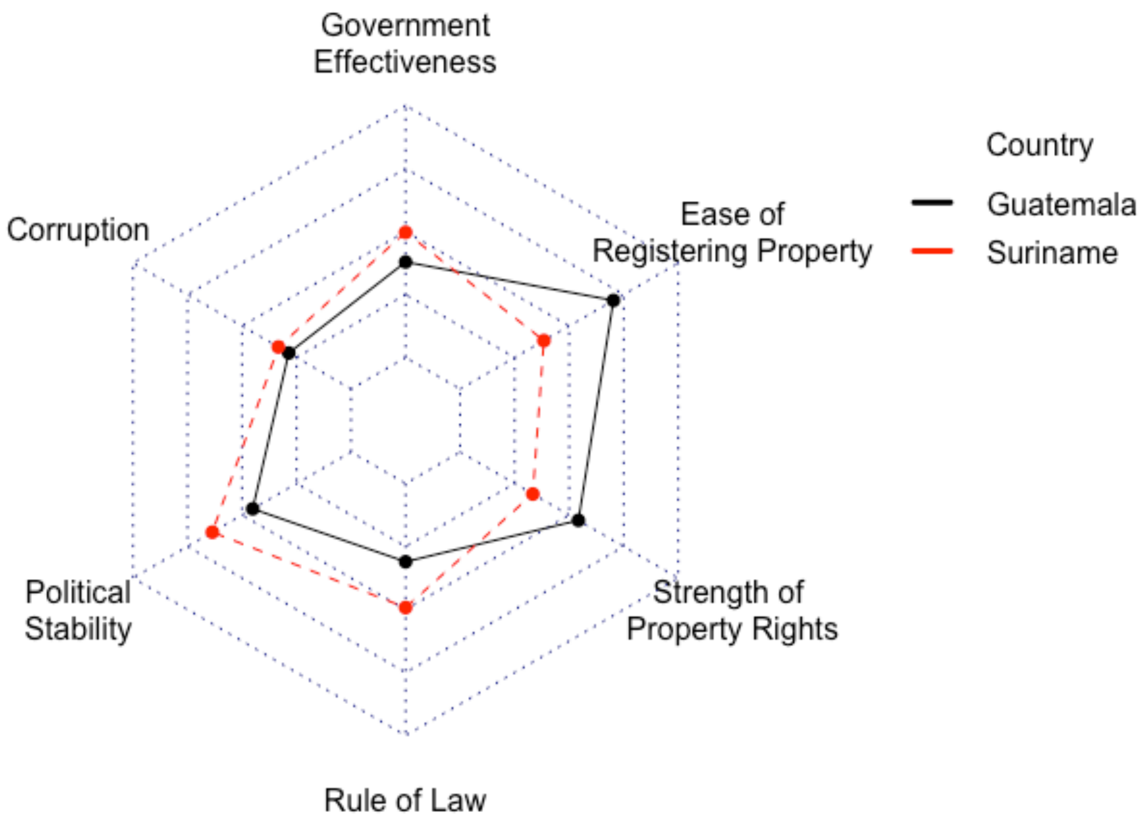


Figure 3-4 Radar Plots: Comparing GC-LTS index Values across Countries

Note: The GC-LTS index value for both Guatemala and Suriname is 0.44.

3.4.1 *Relationships among the GC-LTS index, Human Well-Being Indicators and Conservation Priorities*

While examining the GC-LTS index alone is of interest and provides important context for development and conservation practitioners beginning to understand the governance context for land tenure security for a country, the relationship of the GC-LTS index with measures of human well-being and conservation priorities also provide compelling insights. The GC-LTS can be incorporated into large-scale planning efforts to provide an initial measure of the land tenure security context of a country.

3.4.2 *Relationship of the GC-LTS Index and Human Well-Being Indicators*

In general, I expect human well-being variables to be positively correlated with the GC-LTS index, as a large body of literature finds positive associations between land tenure security and human well-being. The relationships of the GC-LTS index and a collection of human well-being indicators were examined using correlation estimates. Individual-level well-being indicators including the human development index, access to clean water, and life expectancy at birth and measures of broader trends in human development including measures of uneven development, human flight, and human rights violations are included. The correlation and tests of significance for this analysis are summarized in Table 3-3 below, where the unit of analysis is a country.

Table 3-3 Correlation of the GC-LTS index with Human Well-Being Indicators

Individual Well-Being		
Human Development index	0.75	***
Access to Clean Water	0.37	***
Infant Mortality	- 0.67	***
Human Development Trends		
Uneven Development	- 0.80	***
Human Flight	- 0.77	***
Human Rights Violations	- 0.72	***
*** Pearson's correlation is significant at the 95% confidence level		

In all cases, I find statistically significant correlations in the expected directions. The GC-LTS index is positively correlated with the Human Development index and access to clean water, while infant mortality, measured as deaths per thousand births, is negatively correlated. These findings indicate that in areas with a stronger governance context for land tenure security, the indicators of individual well-being are higher. Further, the GC-LTS index is negatively correlated with uneven development, human flight, and human rights violations. These negative relationships mean that in areas where infant mortality rates, uneven development, human flight, and human rights violations are higher the governance context for land tenure security is weaker. Although these analyses are based on correlations, the directions of the relationships are in line with what would be expected given the goal of the GC-LTS index to represent areas more able to support secure land tenure.

3.4.3 *Relationship of the GC-LTS Index and Conservation Priorities*

Next, I overlay two maps of conservation data with the GC-LTS index. The first map (Figure 3-5) shows areas of remaining intact forest (Potapov et al., 2008), areas which are of critical concern for forest conservation initiatives including REDD+. The second map (Figure 3-7) shows terrestrial endemic species by ecoregion, including mammals, birds, and reptiles (Hoekstra & Molnar, 2010), which are areas of primary concern for biodiversity conservation goals.

Figure 3-5 highlights areas of intact forest that have a weaker governance context for land tenure security. Intact forest areas are defined as "an unbroken expanse of natural ecosystems within areas of current forest extent, without signs of significant human activity, and having an area of at least 500 km^2 (Potapov et al., 2008)." These areas are of primary concern to conservation practitioners, for both their biodiversity and habitat values and for their carbon sequestration capacities. Shown in another way, Figure 3-6 graphs areas of intact forest by GC-LTS index value. The graph reveals a bimodal distribution of remaining intact forest, with about 30% of remaining intact forest located in countries with relatively strong contexts to support land tenure security. This primarily accounts for the Boreal forest in North America, as shown on the map. This finding signals that tenure security may not be a primary consideration in the continued conservation of these areas, as overall, the countries where they are located have the capacity to support secure tenure, though there are likely over barrier to their continued conservation. The majority of intact forest area, however, occurs in areas with GC-LTS index value under 0.49 or areas with weaker governance contexts for land tenure security. Patterns of development and land-use have to date spared these forests from human encroachment, but without secure tenure they are more vulnerable to overuse and conversion (W. Sunderlin et al., 2009). Areas of remaining intact forests with lower GC-LTS index values signal locations where in-depth analyses of the tenure context may be beneficial for conservation programs. The Robinson et al. (2017) framework provides an excellent entry point for practitioners whose programs may benefit from incorporating tenure interventions into broader conservation approaches. Left unconsidered, the weaker governance context for land tenure security may interfere with or undermine forest conservation program objectives.

Figure 3-7 shows the relationship between the number of endemic species by ecoregion and the GC-LTS index. Here, the map shows the ratio of the number of endemic species and the value of the GC-LTS index. Areas shown in red represent places where the ratio of endemic species to the GC-LTS index is highest, that is, a higher number of endemic species, and a lower GC-LTS index value, where the ratio value is lower the number of endemic species is low or zero. This analysis highlights several countries as potential priorities for further study based on the governance context for land tenure and a high degree of species richness. In South America, areas of Colombia, Ecuador, Peru, and Brazil all have large swaths of very high ratio values. In Africa, the red areas highlight Madagascar, the Democratic Republic of the Congo, Ethiopia, Kenya, and Tanzania.

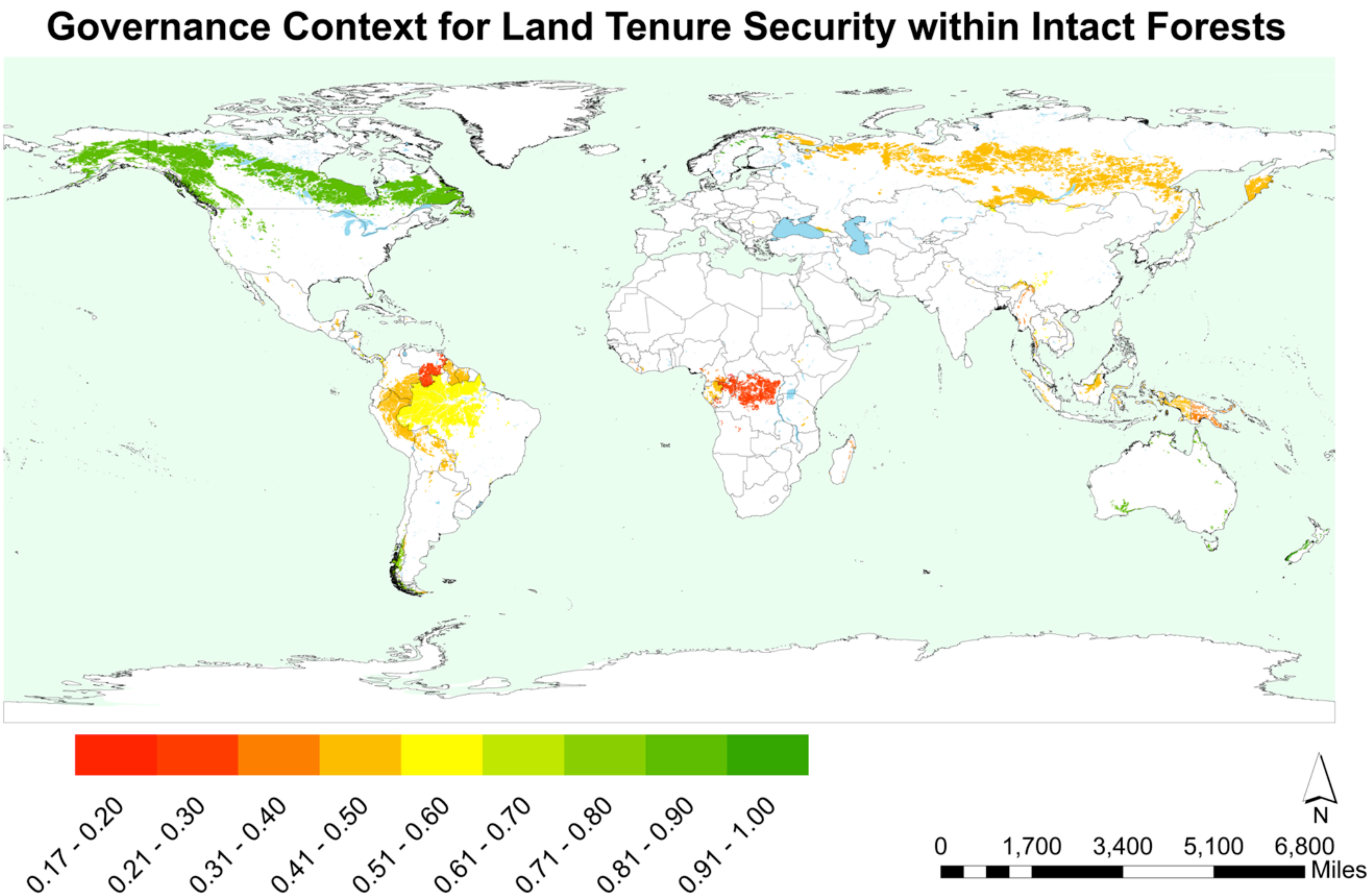


Figure 3-5 Governance Context for Land Tenure Security within Intact Forest

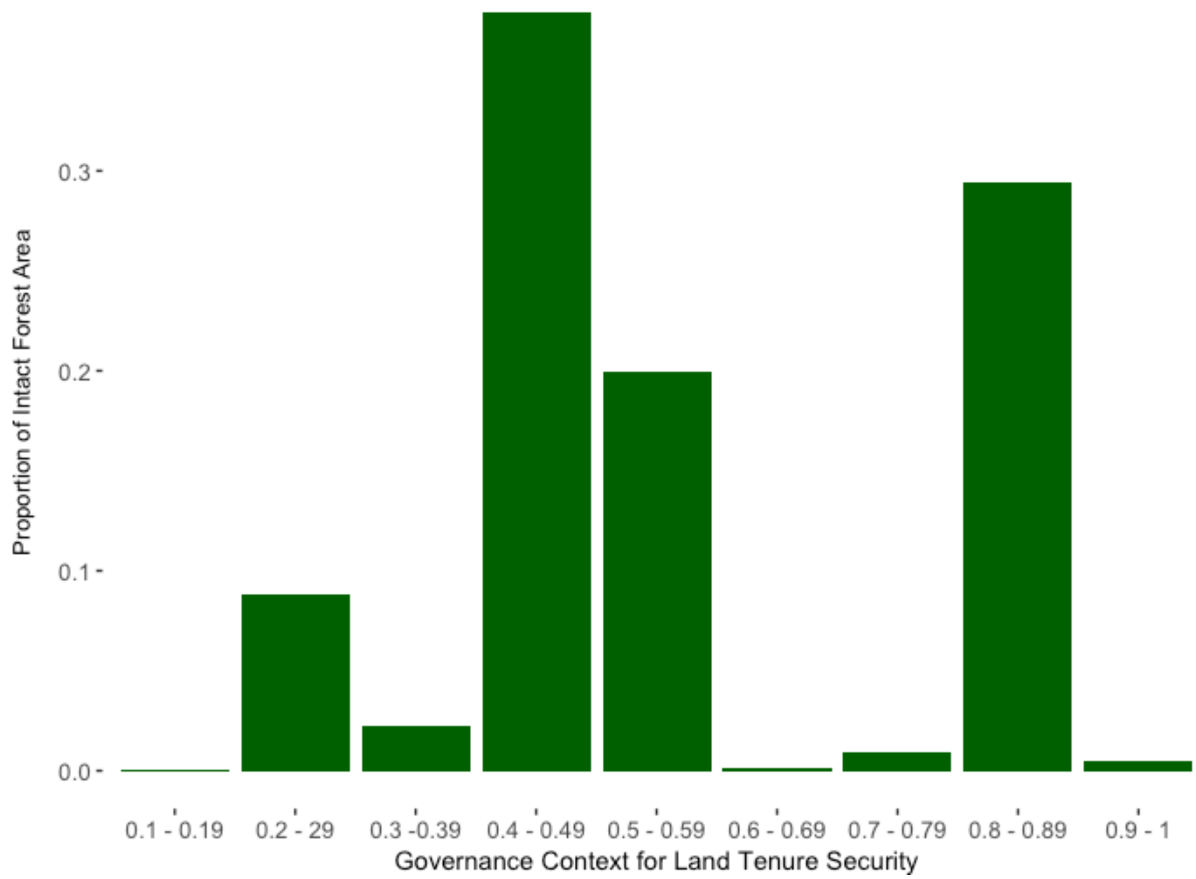


Figure 3-6 Proportion of Intact Forest by GC-LTS Index Value

Finally, in South East Asia, Indonesia and Papa New Guinea stand out in this analysis. The maps presented in Figures 3-5 and 3-7 provide heuristic examples of how the GC-LTS index can be incorporated into spatial-planning exercises to consider the relationships of land tenure security and conservation priorities. While the current literature is ambiguous on the relationship of land tenure security and conservation outcomes, the trend in conservation policies towards market-based mechanisms that rely on secure tenure make this a critical avenue for expanded research.

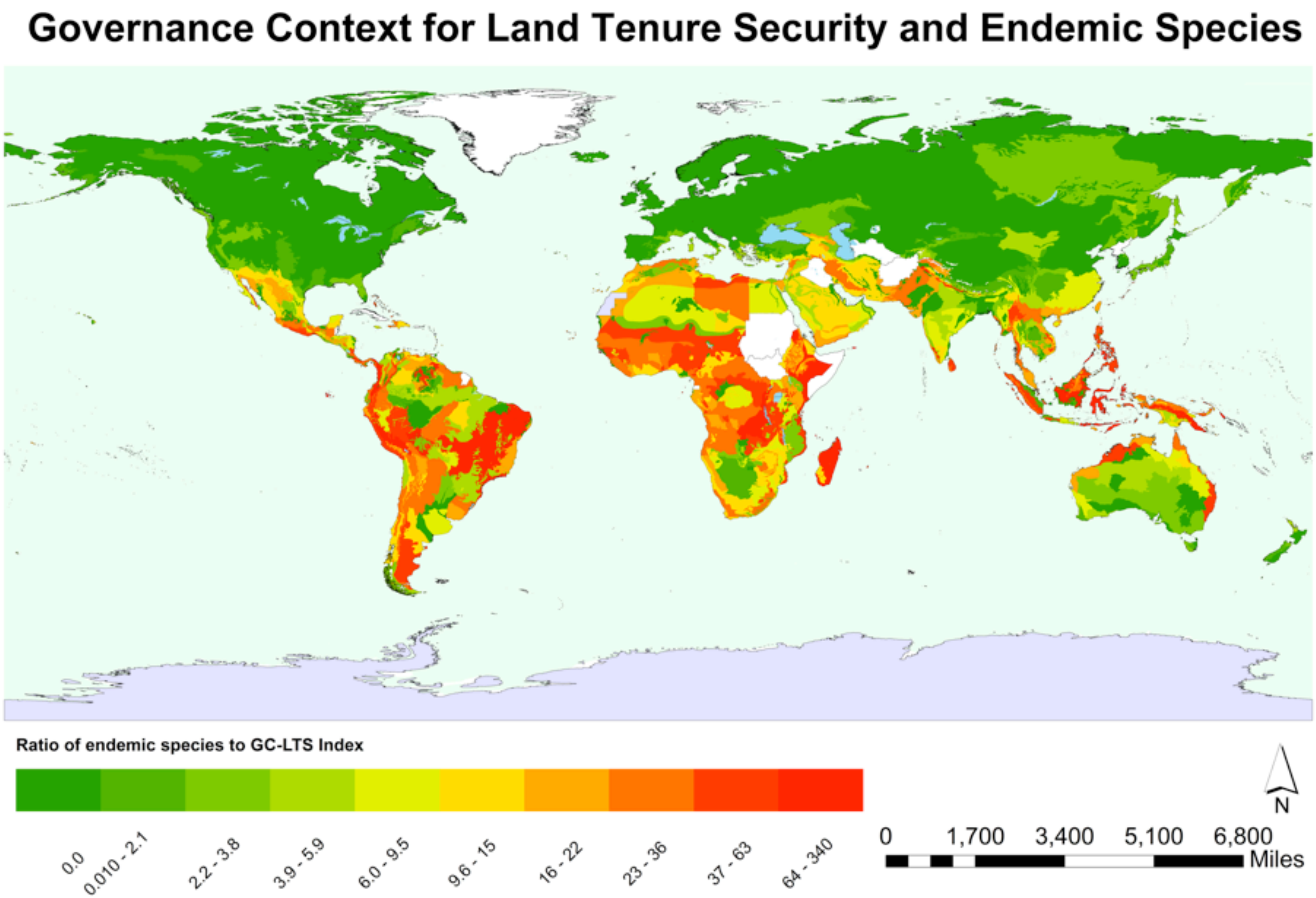


Figure 3-7 Governance Context for Land Tenure Security and Endemic Species

3.5 Discussion & Conclusion

Land tenure security is increasingly being considered as an explicit factor of many large-scale policy agendas. However, the lack of data on land tenure security with sufficient global coverage has limited the ability of policymakers to allocate resources and tailor policies based on an understanding of the land tenure security context. This paper presents a data set covering 165 countries based on a transparent construction approach that can help policymakers and decision-makers begin to integrate tenure security considerations into their work at a broader spatial scale.

The GC-LTS index addresses limitations in existing related datasets and builds on Robinson et al.'s (2017) framework on land tenure security. The GC-LTS index is an improvement for several reasons, its elements are driven based on an extensive review of land tenure security literature and research programs, and it is constructed from carefully selected data proxies. Further, its transparent construction methodology allows for cross-country comparisons of GC-LTS index values and of the six elements of the index. For example, if a country's GC-LTS index composition shows a relatively low governance capacity this may signal an opportunity for land tenure system interventions to increase capacity. While, if a country's value is lower for exclusion authority, the need to strengthen property rights may point to a land titling intervention. The GC-LTS index also increases global coverage as compared to other existing datasets to cover 165 countries. The layer is designed to create spatial overlays and aid in broader-scale analyses of the relationships of the governance context for land tenure security and other variables of interest. In the analysis, I find that the GC-LTS index is correlated with indicators of human well-being in the expected directions.

As an illustration, I then demonstrate the utility of the dataset for global level analyses of the geographic relationships of the governance context for land tenure security and areas of conservation priority. These overlays highlight areas of conservation priority, which have lower GC-LTS index scores, and thus weaker support for land tenure security. Conservation planning for efficient resource allocation is in practice more complex than this illustrated example. The theories outlined in the framework presented by Robinson et al., 2017 can be of use to conservation planning efforts as they consider the influence of land tenure security more broadly in their work. In conjunction with this theoretical understanding, the GC-LTS index can provide a dataset readily available for integration into quantitative planning efforts. In particular, it may be useful in identifying areas where further evaluations of the relationships among land tenure security and conservation outcomes are needed.

The GC-LTS index is an indicator designed for coarser scale analyses, and, as such, does not account for subnational variation of the governance context for tenure context or informal institutions. Local level variations and conditions may mitigate the conclusions drawn from macro-level analyses. The average national-level data used for the GC-LTS index does not represent the distribution of rights across or within populations, which will be variable depending on the power structures and degree of marginalization for some populations. In particular, local perceptions of land tenure security have been shown to be critical for promoting and improving secure land tenure. In addition to conducting a broader scale analysis with the GC-LTS index during the planning process, practitioners interested addressing land tenure security challenges should conduct local land tenure security analyses by evaluating perceptions, informal institutions, and other institutional and socioeconomic factors that likely affect land tenure security (for a list of such approaches see Appendix A, Robinson, et al. 2017).

Local perceptions of tenure security are critical to land tenure security, but there are no existing global datasets on local perceptions of tenure security. A new promising research initiative will contribute to filling this important data gap with global scale data. The PRIndex project's data collection work is still ongoing but will improve future analyses dramatically and provide a new source of data to incorporate into future iterations of the GC-LTS index (PRIndex, 2017). The inclusion of this data would further differentiate the GC-LTS index from existing indicator options. I see similar promise in the Enabling the Business of Agriculture report (World Bank, 2017) which will provide data on the titling process for agricultural lands specifically.

The mounting evidence on the importance of land tenure security has led many policymakers and researchers to see it as an important pathway for solving some of the world's most pressing social-ecological challenges. The GC-LTS index fills an existing information gap by providing data needed by practitioners and policymakers to make informed decisions in global prioritization exercises to develop policies and allocate resources.

Chapter 4. THE ROLE OF INTERMEDIARIES IN MEXICO'S CONAFOR PES PROGRAMS

4.1 ABSTRACT

Mexico has a rich history of promoting both decentralized communal land tenure and payments for ecosystem services (PES) policies. A unique structure of Mexico's national PES programs is their reliance on intermediary consultants to promote and support project development and implementation. Little empirical research has focused on these intermediaries in PES projects, though they perform important tasks in the dissemination of information regarding programs (Huber-Stearns, Goldstein, & Duke, 2013; Pham, Campbell, Garnett, Aslin, & Ha, 2010) and, theoretically, lower transaction cost for participants (Van Noordwijk et al., 2007). In this paper, I use a series of in-depth interviews with PES project participants (n=13) and the independent intermediaries who help facilitate local projects (n=9) to inductively develop hypotheses regarding the roles intermediaries are playing in PES projects. Interview guides were developed by referencing tools designed to support research on complex social-ecological and forest management systems including; the field manual of the International Forestry Resources and Institutions (IFRI) research program (Wertime et al., 2007), the social-ecological systems (SES) framework (McGinnis & Ostrom, 2014), and the ecosystem services framework (Millennium Ecosystem Assessment, 2005). I then used the qualitative method of grounded-theory to assess the forest management institutions and the role that intermediaries play in the modification and implementation. I find that intermediaries are affecting institutional design, forest use monitoring, and the nested relationships between local communities and regional government bodies. I also find that ecosystem service salience is limited to provisioning services, signaling that project participants are not initially aware of the regulating services that forests provide, services that are

the target of most PES projects. I propose three hypotheses related to intermediaries' roles based on this analysis: one concerning how intermediaries' direct involvement in institutional design effects project outcomes; a second regarding information-sharing and the transparency encouraged by intermediaries and its effect on reducing corruption and project-related conflicts; and finally, one concerning how project participation encourages resource salience and whether intermediary information-sharing activities can contribute to improving local resource salience.

4.2 Introduction

Participation in REDD+ (Reducing Emissions from Deforestation and Forest Degradation) and payments for ecosystem services (PES) projects changes the existing rules-in-use for forest management and alters the cost-benefit trade-offs of forest conservation activities. Participants receive benefits from the projects, either direct monetary compensation or in-kind resources, which theoretically offset the costs of changes in their forest-use patterns. REDD+ and PES projects are voluntary; therefore, understanding how landholders make decisions about participation in them is both theoretically and practically important. Establishing a project at the local level generates transaction costs, for example, it requires project proponents to inform potential participants of the opportunity, or for potential participants to pursue project information (Van Noordwijk et al., 2007). In practice, promoting projects and encouraging participation can fall to the project implementing body or to external intermediaries, or a combination of the two (Huber-Stearns et al., 2013). Intermediaries are independent consultants who work to support the development and implementation of PES projects in local communities.

When a local community chooses to participate in a REDD+ or PES project, the project introduces a new set of institutional arrangements for forest management. To-date there is limited research on the roles that intermediaries play within these new institutions (Huber-Stearns et al., 2013; Pham et al., 2010; Van Noordwijk et al., 2007). In addition to the PES projects potentially altering the institutions for a forest resource, project intermediaries can also change the decision-setting for individuals. This can occur through several means. First, intermediaries may introduce the concept of the PES project for the first time, creating a new and previously unknown opportunity for communities to elect to change the rules-in-use for forest resources by participating in a project. Second, intermediaries may mediate the decision-setting by providing access to information that both lowers transaction costs and improves resource management transparency. Finally, intermediaries may translate the complex project structures and requirements into more user-friendly explanation for participants to consider. The ways in which intermediaries may affect the decision-setting align with the theories of transparency, mainly that intermediaries may lower transaction costs by acquiring and interpreting information, this new information may in-turn help individuals make better decisions about PES participation (Fung et al., 2007, pp. 61-64; 121-125).

The scarce existing research on this topic suffers from two limitations. Firstly, researchers use an imprecise and overly-broad definition of what constitutes an intermediary. The term "intermediary" is used to describe "non-government organizations, international agencies, local organizations and professional consulting firms (Pham et al., 2010)," which can each "operate at a different level and can have different functions (Pham et al., 2010)." The scope of this term allows for too much variation in the actors studied as intermediaries, who have diverse motivations and goals for their work. This conflation of actors limits researchers' ability to draw conclusions about their role within projects as it relates to institutional changes. Secondly, the theoretical work available has proposed hypotheses regarding how intermediaries operate within projects based on a purely rational-choice framework, assuming that intermediaries only serve to reduce transaction costs (Van Noordwijk et al., 2007). This approach overlooks recent research on the importance of local norms in the acceptance of REDD+ projects (Cromberg, Duchelle, & Rocha, 2014; Peterson St-Laurent, Gélinas, & Potvin, 2013a, 2013b).

This study seeks to address these two limitations and to contribute empirical findings to the literature. I focus my research on one set of intermediaries, private contractors registered with the Mexican forest agency. Focusing on a specific type of intermediary allows me to draw conclusions across my sample. Further, I use institutional analysis to gather information about the complex social-ecological systems of PES projects, allowing me to capture both classic economic motivations but also local norms that may influence the PES decision-context. My goal is to inductively develop hypotheses about the role that external intermediaries are playing within this broader context. I do this using the qualitative method of grounded-theory, an approach that allows for the emergence of hypotheses based on the analysis of systematically collected data (Bitsch, 2005).

When elements of tightly linked social-ecological systems are studied in isolation, with a single disciplinary perspective, the inherent complexity and interlinked nature of these systems is overlooked (Binder et al., 2011; McGinnis & Ostrom, 2014; Redman et al., 2004). This can lead to biased or oversimplified research findings and ultimately a poor understanding of potential outcomes from policy changes. In this paper, I therefore sought a research tool that allowed for the interdisciplinary reasoning necessary for understanding the complex system of a PES or REDD+ project (Binder et al., 2011). The social-ecological system (SES) framework is designed to consider in parallel the institutional and ecological factors of resource management. In the SES framework, its authors see an expanded version of the Intuitional Analysis and Development framework, allowing for better integration of the ecological sciences with the social sciences (Ostrom, 2011a). The SES framework is therefore an ideal tool for framing an analysis of the institutional PES and REDD+ contexts and their corresponding ecosystem services. In this paper, I use the SES framework to characterize PES-project decision-contexts by linking theories of decision-making in a common pool resource (CPR) decision-context and the theories of human reliance on ecosystems, or ecosystem services, to structure two qualitative interview guides. My overall research objective is hypothesis generation but using the foundation of CPR and ecosystem services theories to develop interview guides ensures that I collect data sufficient to characterize the local social-ecological conditions and broader decision-context where intermediaries, the focus of this research, are working. From this perspective, I garner evidence about how intermediaries influence and mediate PES-project social-ecological contexts and local institutions.

4.2.1 *Forest Policy Trends*

As the international-level negotiations surrounding REDD+ proceed, they stand to drive changes in the forest management policies for developing countries (Agrawal et al., 2011). In particular, REDD+ programs often encourage a transition to market-mechanism based policies (Minang & van Noordwijk, 2012). Market-mechanisms create financial incentives for behavior change by using a system of tradable permits to create a new form of property rights and a market where none previously existed (Salamon, 2002). Tropical forest land-use policy has trended towards decentralization in recent decades, transferring decision-making power to local and regional actors, making market-mechanisms more tenable, as they require landholders to voluntarily participate (Chhatre & Agrawal, 2009). Broadly, there are three competing but not necessarily exclusive institutional structures used to manage land use. These structures include private property rights, government management, and communal management (Acheson, 2006). The trend towards decentralization is also a retreat from government-management institutional structures. Government management or command-and-control policy tools, such as national parks and exclusionary conservation areas, have historically been at-odds with the well-being of forest-dwelling and forest-adjacent human populations (Andersson, 2006; Jack, Kousky, & Sims, 2008; Roe, 2008). By failing to account for the high costs borne by these important stakeholders, command-and-control policy tools have created negative incentives for communities, often exacerbating deforestation and forest degradation (Oldekop, Holmes, Harris, & Evans, 2016).

Decentralization is seen by many scholars as a way to make resource management more democratic and improve both equity and efficiency (Ribot, Agrawal, & Larson, 2006; Tacconi, 2007). Decentralization transfers management and decision-making powers from the national-level agencies to local communities or individual landholders. With increased decision-making power, local communities have more of a voice in forest management. Under decentralized forest land-use policies, a diversity of institutional structures is still possible but market-mechanisms, such as those of PES and REDD+ programs, become more feasible (Andersson, 2006; Holmes & Potvin, 2014). Specifically, in the REDD+ and PES contexts, forest landholders or regional managers can make participation decisions based on expected local outcomes. By offsetting the costs incurred by local communities of changing forest use habits, PES and REDD+ programs can address a long-overlooked barrier to sustainable forest management – the costs borne by local communities. In concept, these programs can both improve outcomes for forest conservation and outcomes for forest stakeholders, who bear the burden of the costs of changes in forest land-use policy (Holmes & Potvin, 2014). In practice, the findings on whether decentralization alone improves outcomes for humans and nature are mixed (Larson & Ribot, 2004), though recent research has found that granting official rights in combination with forest-use restrictions does improve forest outcomes (Holland et al., 2017).

Direct costs associated with PES-project participation may include changing behaviors at a household level, (e.g. not collecting wood for cooking) and the small-business level (e.g. changing land-use from agriculture to reforestation), or increased monitoring costs to protect forest resource investments (improved or additional monitoring). Participants also bear costs associated with reorganizing or restructuring of use practices. In some PES programs, the costs of participation, in addition to being offset by program payments, are partially offset by intermediaries. While decision-making power still ultimately rests with the local governance body or private landholder, intermediaries help inform participation decisions by providing information about program costs and benefits (Huber-Stearns et al., 2013; Pham et al., 2010). They bring technical expertise and help communities comply with the complicated program requirements. Their role in facilitating projects may provide support where local forest institutions may lack capacity.

4.3 SETTING

4.3.1 *The Evolution of CONAFOR's PES Programs*[10]

In Mexico, *ejidos* and *comunidades* are two forms of communally held lands resulting from large-scale decentralization initiatives. These systems are unique to Mexico, where the federal

[10] CONAFOR Program information was provided in an interview with a CONAFOR director on 1/27/2016.

government has promoted “social property” systems since the late 19th century through agrarian reform and land redistribution programs (Assies, 2008). The top-down creation of the *ejido*/*comunidad* system through federal law has resulted in a combination of decentralized decision-making power and an established and nationally consistent local-governance structure for communally held lands. In 1992, a reform of the system was shown to reduce conflict and increase transparency (Feder & Feeny, 1991). This system has created an ideal context for local-level common pool resource management and for national-level PES programs. As a strong governance context and secure land tenure are key foundations for the successful implementation of PES and REDD+ projects (Naughton-Treves & Wendland, 2014; W. Sunderlin et al., 2009). Further, research has shown that communally managed lands, and *ejidos* in particular, result in lower deforestation rates, though participant motivations seem to be to prioritize livelihood gains as opposed to forest cover gains (Brian E. Robinson et al., 2014).

Mexico was home to some of the earliest iterations of PES programs, having had projects as early as the late 1990s. The official national forestry commission (CONAFOR) sponsored programs began in 2003 with two funding streams, payments for hydrological services and payments for carbon sequestration (FAO, 2013). Since their creation, there have been ongoing internal discussions about how to transition the programs to a true market-mechanism structure. Currently, projects pay for completed outputs, the activities in management plans, as opposed to project outcomes, like verified conserved forest, improved water infiltration, and carbon sequestration. Payments for outputs do not create the assurance an outside investor would need when participating in a PES project, therefore CONAFOR remains the primary funding source for the vast majority of projects. To try to improve upon the existing structure, Mexico received support from the World Bank and Global Environment Fund in 2006. In 2008, the first guidelines for a matching-funds approach were drafted. Projects under the matching-funds structure are funded partially by CONAFOR and partially by an environmental service-user, such as a down-watershed municipality or a corporation benefiting from the services created by project activities. It is still not purely a market-mechanism approach but it makes the advance of allowing service-users to directly fund service-producers. Both the original PES structure and the matching-funds structure are still operating in Mexico currently (CONAFOR, 2016).

4.3.2 *Study Site Locations*

The state of Puebla is located in central Mexico on the high plain. Puebla has a mountainous terrain including several active volcanoes with its highest point of elevation reaching 18,410 feet (5,610 m) and its lowest 328 feet (100 m). This variability in altitudes results in diverse climatic conditions driving the diversity of ecosystems in the state. Figure 4-1 provides a reference for the variety of land uses that are generally feasible at varying elevations. I begin this section by laying out the relationship between elevation and land use because elevation is also culturally important in this region, and therefore drives much of the broader context within which PES programs are operating. Within Puebla's broad-range of elevations, PES projects are operating across several ecosystems and competing with varying alternative land uses.

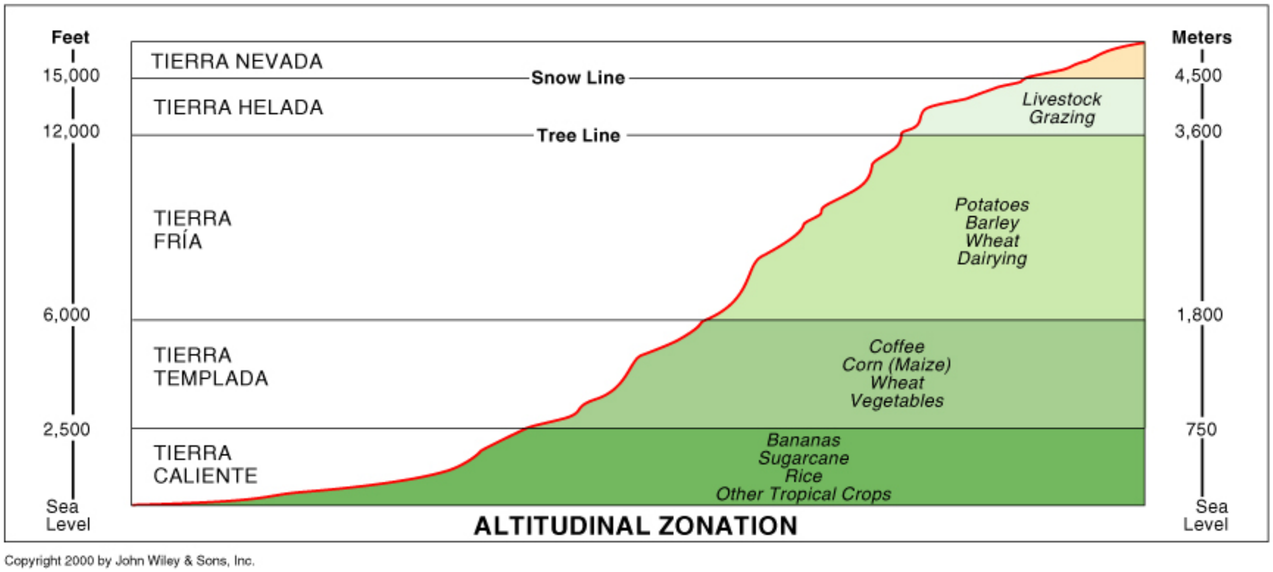


Figure 4-1 Land Uses by Altitudinal Zones (Rhoda & Burton, 2010)

Figure 4-2 maps the municipalities where the communities I interviewed are located. The municipalities fall into four geographic clusters. Figure 4-3 shows the three major ecosystems in the municipalities, based on potential vegetation[11], while Figure 4-4 provides the land cover of those areas as of 2010. As shown, the major ecosystems of the communities include coniferous oak forest, dry scrubland, and deciduous tropical forest. Figure 4-4 shows the relative fragmentation of the primary ecosystems. The northern three municipalities are dominated by coniferous oak forest, which is fragmented by agricultural lands. In the case of Chalcicomula de Sesma, a large area of the municipality is occupied by Pico de Orizaba (shown as denuded in Figure 4-4), an active volcano, and the highest peak in Mexico. To the southeast, Tehuacán's

[11] Potential vegetation maps represent the land cover that would be expected in the absence of human development (Meiyappan & Jain, 2012).

ecosystem is mixed with areas of dry scrubland and deciduous tropical forest. Tehuacán also has the largest area of human settlement, the city of Tehuacán that occupies a significant spatial area.

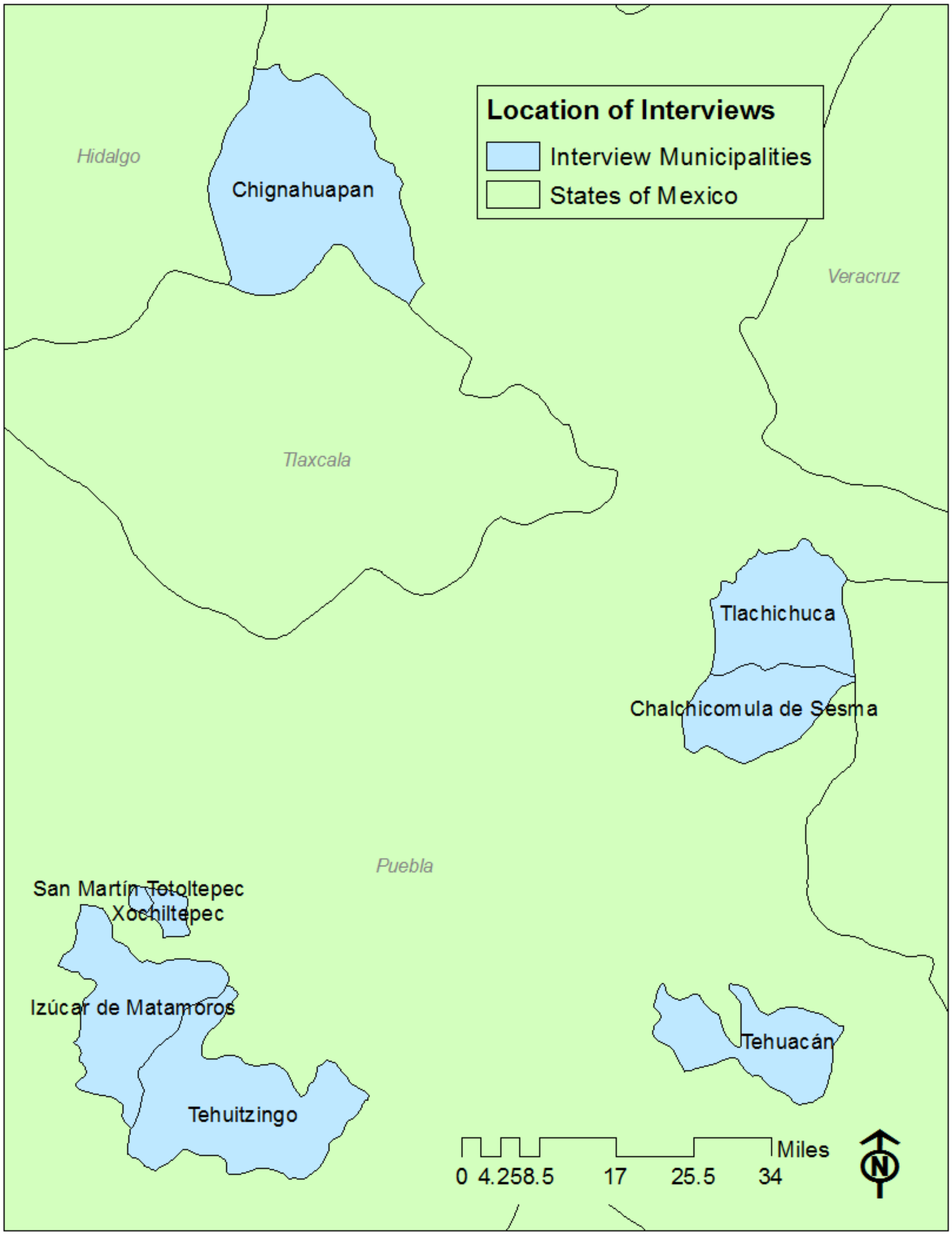
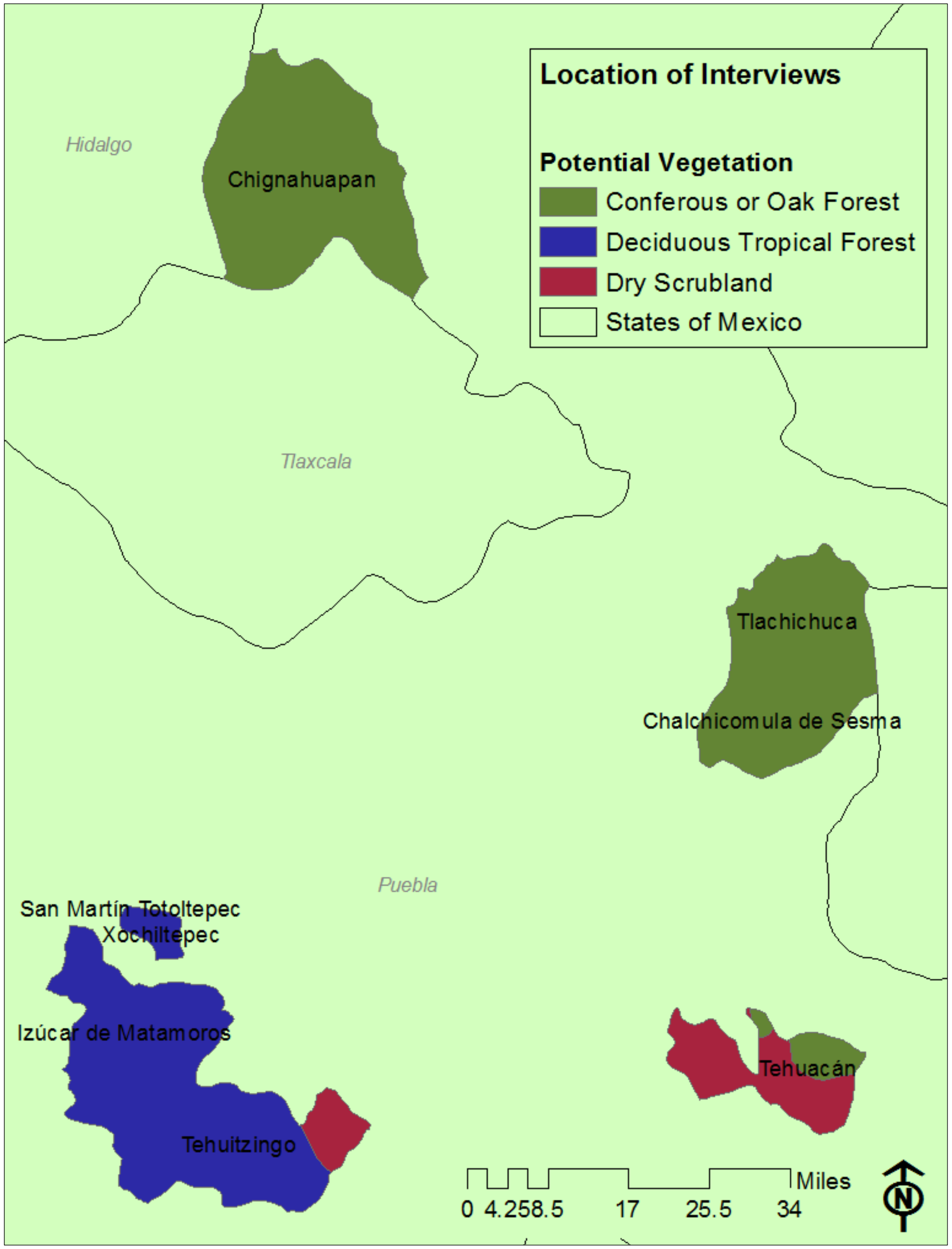


Figure 4-2 Municipality Location



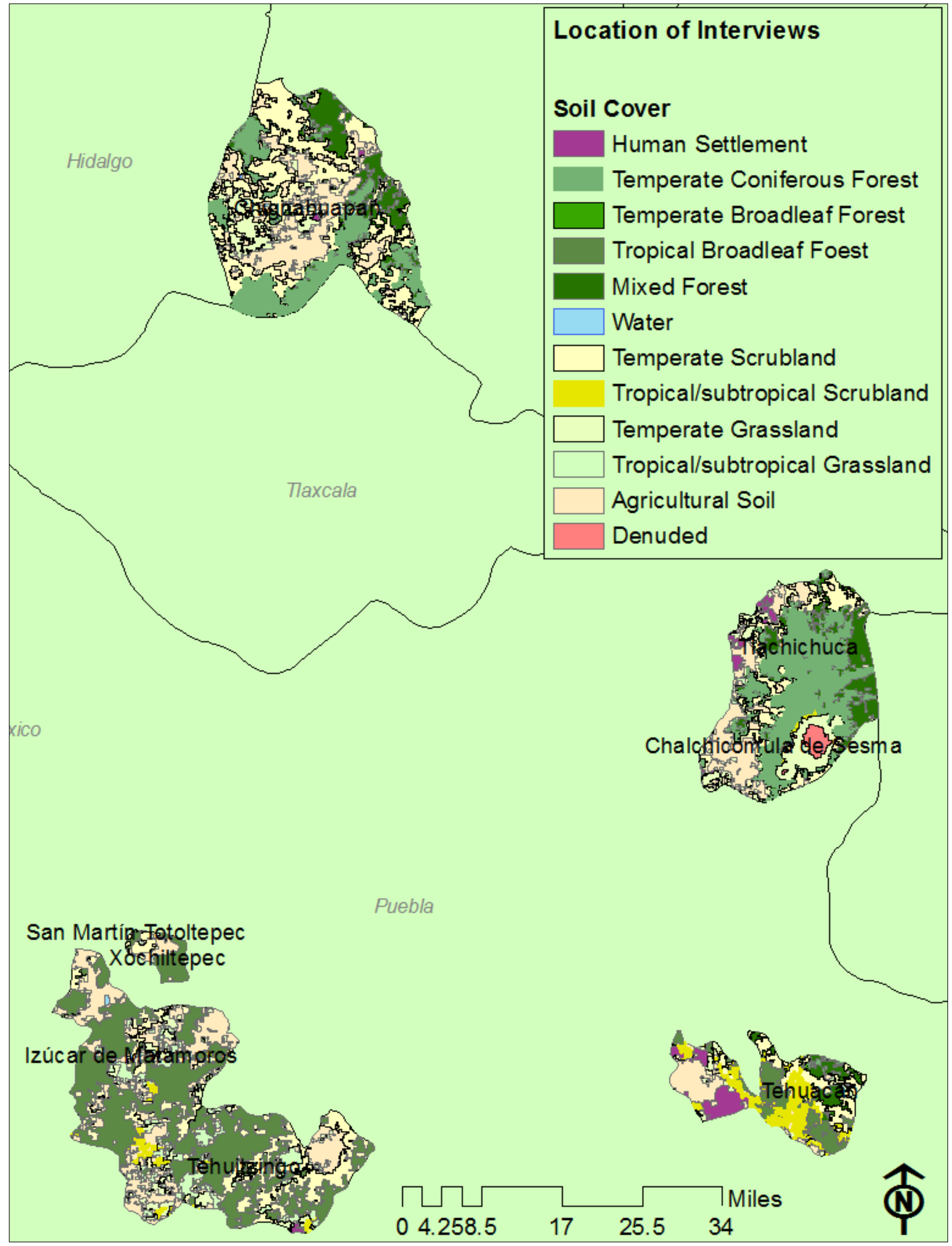


Figure 4-3 Potential Vegetation

Figure 4-4 Soil Cover and Land Use

Finally, in the southwest corner, the four remaining municipalities are primarily tropical deciduous forest, but again fragmented by agricultural lands and areas of dry scrubland. The PES activities and their associated goals vary along ecological lines in these locations. In the coniferous oak and deciduous tropical forests, activities include reforestation and sustainable forest management with goals of improved aquifer recharge, increased carbon storage, and improved fire safety. In the tropical scrublands, activities include planting maguey and installing drainage breaks, with a primary goal of improving aquifer recharge. Less common activities include promoting home gardens and the production of *palma*[12] products (mats and baskets) to promote environmentally sustainable small businesses.

Figure 4-5 shows the distribution of municipality land area by land tenure form, as shown across locations, *ejido* landholdings are the largest area of land held in six municipalities, private is the second most common tenure form overall, and the most common tenure form in two of the locations. A smaller proportion of area is held by *comunidades* and there is a very small area of public landholdings in four municipalities.

The populations living in the municipalities are primarily agricultural households, with some focused entirely on forestry (within the coniferous oak forest areas), and others more diversified, including some forestry, but not as a primary income source. Table 4-1 provides summary statistics of socio-economic data for each municipality derived from the 2010 Mexican Census (INEGI, 2010). Across municipalities, the range in population densities is between 0.39 and 2.34

[12] Palm leaves are traditionally cut, dried, and then used to weave a variety of products.

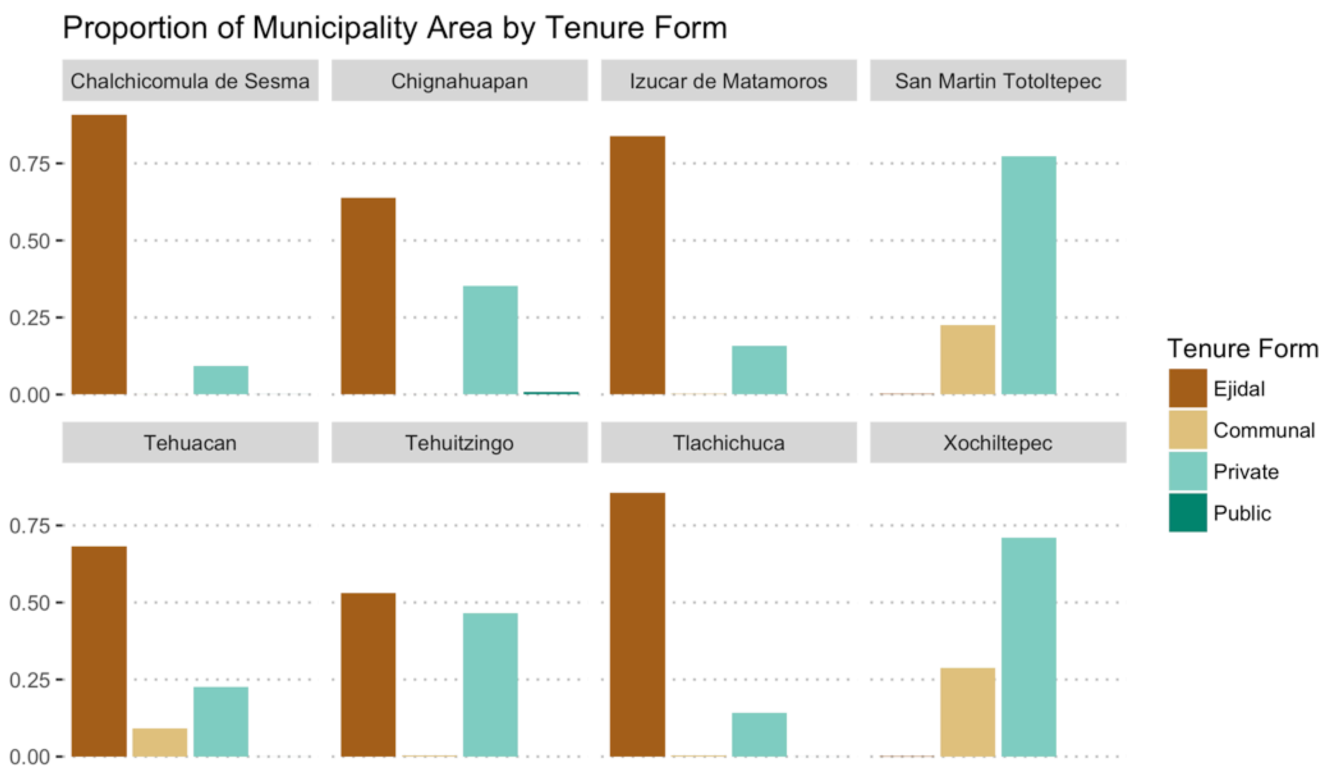


Figure 4-5 Proportion of Municipality Area by Tenure Form[13]

people per hectare, with the notable outlier of Tehuacán, which includes a major urban city and has a population density of 15.16 people/ha. There are slightly more female residents than male residents, the proportion of the population that is male ranges from 0.45 to 0.49, while the average age of residents ranges from 27 to 33 years old. The proportion of the population that self-identifies as indigenous in the municipalities ranges from 6 to 36 percent. The average years of education for those over age 18 ranges from 5 – 8 years and literacy rates are between 79% and 89% of the population. On average the proportion of the population over 15 that is

[13] Please see Appendix 4-4 for a table of the complete tenure area breakdown by municipality.

Table 4-1 Descriptive Statistics Municipalities[14]

Municipality	Chalchicomula de Sesma	Chignahuapan	Izúcar de Matamoros	San Martin Totoltepec	Tehuacán	Tehuitzingo	Tlachichuca	Xochiltepec
Total Population	43,882	57,909	72,799	651	274,906	11,328	28,568	3,187
Population Density (per ha)	1.33	1.12	2.34	0.65	15.16	0.39	1.29	1.62
Total Area (ha)	33,070	51,919	31,172	995	18,133	28,991	22,129	1,964
Altitude (m)	5,747 (max)	3,400 (max)	1,500 (max)	1,360 (mean)	2,950 (max)	1,025 (mean)	3,480 (max)	1,500 (max)
Proportion Male	0.49	0.49	0.48	0.48	0.47	0.47	0.48	0.45
standard error	*0.01*	*0.01*	*0.01*	*0.01*	*0.00*	*0.01*	*0.00*	*0.01*
Age (Years)	27.42	28.00	29.34	31.16	27.05	33.38	27.51	30.37
standard error	*0.67*	*0.87*	*0.73*	*1.28*	*0.13*	*1.10*	*0.31*	*0.79*
Indigenous	0.20	0.16	0.20	0.36	0.18	0.06	0.15	0.07
standard error	*0.02*	*0.03*	*0.02*	*0.04*	*0.01*	*0.02*	*0.02*	*0.02*
Year of Education	6.8	6.3	7.2	5.9	8.1	5.8	6.0	4.8
standard error	*0.47*	*0.32*	*0.40*	*0.35*	*0.07*	*0.50*	*0.20*	*0.20*
Literacy Rate	0.85	0.84	0.83	0.84	0.89	0.79	0.81	0.82
standard error	*0.01*	*0.01*	*0.01*	*0.01*	*0.003*	*0.02*	*0.01*	*0.01*
Percent Looking for Work	0.03	0.01	0.02	0.02	0.01	0.01	0.01	0.02
standard error	*0.005*	*0.002*	*0.004*	*0.006*	*0.001*	*0.002*	*0.002*	*0.004*
Economically Active	0.56	0.53	0.49	0.47	0.62	0.33	0.45	0.40
standard error	*0.01*	*0.02*	*0.02*	*0.03*	*0.003*	*0.01*	*0.02*	*0.02*
Average HH Monthly Income[15]	208,075	178,156	113,023	154,581	100,185	76,443	39,517	123,755
standard error	*49,850*	*75,468*	*16,448*	*47,654*	*3,541*	*22,040*	*7,362*	*18,745*
Median HH Monthly Income[16]	3,858	3,429	4,286	2,571	6,429	1,714	2,571	2,571

[14] Summary statistics were calculated using the *survey* package, version 3.2 in R (Lumley, 2017).
[15] Income is reported in 2010 Mexican pesos.

economically active ranges from 33% to 62%, lack of job opportunities were commonly mentioned during interviews, between 1% and 3% of the municipality populations report being actively looking for work. Though this number is low, it does not account for those who are no longer actively seeking work. The average household income ranges widely from 39,500 to 208,100 Mexican pesos; these estimates are highly skewed however, with median household income ranging from 1,700 to 6,400 pesos. The largest disparities between the average and median income levels occur in Chalchicomula de Sesma, Chignahuapan, San Martín Totoltepec, where the median household makes less than 2 percent of the average household income.

4.4 METHODS

4.4.1 *Developing Interview Guides*

Primary data were collected using in-depth structured interviews. This data collection method was selected because it supports the method of grounded-theory data analysis by collecting data on known topics of interest and by allowing unanticipated topics to emerge (Bitsch, 2005; Campbell, Quincy, Osserman, & Pedersen, 2013). Interview guides were created by referencing the IFRI research manual, the ecosystem services framework, and the variables needed to characterize participant decision-making (Millennium Ecosystem Assessment, 2005; Ostrom, 1990; Wertime et al., 2007). The key elements and variables of these materials are summarized below; interview questions were designed to capture each. Interview guides for both intermediaries and participants are provided in Appendices 4-2 and 4-3.

4.4.1.1 Summary of Key Elements and Variables

In Ostrom's pioneering work on CPR management through collective action, Governing the Commons (Ostrom, 1990), the focus was learning about the characteristics of existing governance structures. Using observations about these characteristics, Ostrom developed eight design principles exhibited by long-enduring CPR institutions (Ostrom, 1990). The International Forestry Resources and Institution (IFRI) research network, a large research project, builds on Ostrom's design principles, applying them to data collection on self-governing forestry institutions. The design principles of self-governing forestry institutions include (Wertime et al., 2007):

DP - 1. the expected value of long-term use of a forest exceeds the expected cost of managing the forest;

DP - 2. local forest users participate in and have continuing authority to design the institutions that govern the use of a forest system;

DP - 3. the individuals most affected by the rules that govern the day-to-day uses of a forest system are included in the group that can modify these rules;

DP - 4. the institutions that govern a forest system minimize opportunities for free riding, rent seeking, asymmetric information, and corruption through effective procedures for monitoring the behavior of forest users and officials;

DP - 5. forest users who violate rules governing the day-to-day uses of a forest system are likely to receive graduated sanctions from other users, from officials accountable to these users, or both;

DP - 6. rapid access is available to low-cost arenas for resolving conflict between users or between users and their officials;

DP - 7. monitoring, sanctioning, conflict resolution, and governance activities are organized in multiple layers of nested enterprises; and

DP - 8. the institutions that govern a forest system have been stable for a long period and are known and understood by forest users.

In the context of communities implementing PES or REDD+ projects, long-term self-governing institutions may or may not be present, however the design principles provide an outline for considering the ideal institutional-context for sustainable forest-resource maintenance. Project agreements will define a set of rules for forest-use in addition to any preexisting rules-in-use. In instances where the design principles are not present, the project may define them or intermediaries may help support their development. As a result, some of the Design Principles necessary to sustainable CPR management may be existing management structures, while others will be achieved through program structures and contract agreements, and intermediary actions, which will vary considerably across projects. Others may not be observed and perhaps are not necessary to the support a REDD+ or PES project.

Individuals in a CPR decision-making process are understood as boundedly-rational (Ostrom, Cox, & Schlager, 2014, p. 273). In contrast to a rational-choice decision maker[16], the concept of bounded rationality recognizes that humans cannot process unlimited information and may not have access to all necessary information. Further, in developing countries, markets are often incomplete; restricting individuals from pursuing rational-choice driven decisions. Ostrom's conception of individual CPR decision-making is governed by the interaction of several considerations: internal norms and discount rates that influence the assessment of expected costs and benefits of different strategies and result in the selection of a resource management strategy or selection of rules-in-use (Ostrom, 1990). This process of internal individual information processing is a concept termed, the "internal world" (Ostrom, 1990). Understanding the "internal world" of forest-use stakeholders facing a PES enrollment decision requires information regarding their values, the forest resources, the information they have, their beliefs and the information process they use to make similar

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[16] In rational-choice theory, as understood in neoclassical economics, individuals make decisions based on their preferences over a complete set of options in order to maximize their well-being. They are assumed to have access to perfect information about the options, and unlimited information processing capacities (Simon, 1955).

decisions (Ostrom et al., 2014). In developing the SES framework, the scholars followed Ostrom's work by identifying a set of six variables that can be empirically measured to characterize forest resource users' internal worlds (Gibson, Mckean, & Ostrom, 1998; McGinnis & Ostrom, 2014; Ostrom, 2009). The authors argue that the cost benefit trade-offs forest stakeholders face can be described empirically with the following variables:

- IW- 1. salience of the resource;
- IW- 2. a common understanding of how use affects the resource;
- IW- 3. trust and reciprocity;
- IW- 4. autonomy over resource management by the users;
- IW- 5. prior experience;
- IW- 6. discount rates.

Forest use is more than a land-use decision. Stakeholders also use forests for foraging, wood gathering, medicinal plant gathering, and other cultural and spiritual services, a large array of benefits for forest and near-forest communities that are not linked to holding the land itself. These sets of uses are considered ecosystem services, or the benefits that ecosystems and natural processes provide that support human populations (Millennium Ecosystem Assessment, 2005). As shown by the green boxes in Figure 4-6, ecosystem services fall into four broad categories: supporting, provisioning, regulating, and cultural. Interviewees were asked to report forest-resource uses, which were categorized according to the ecosystem services framework to gain a better understanding of the services forests provide to community members, as well as the salience of the variety of services.

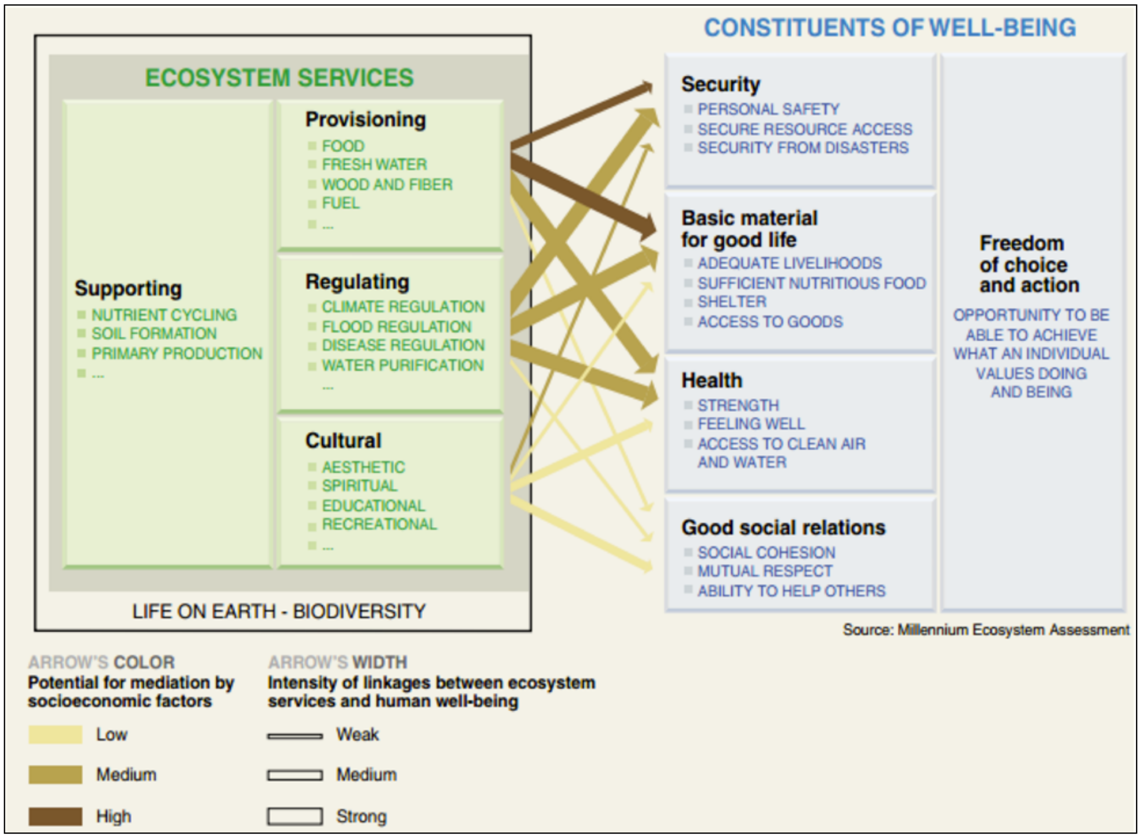

Figure 4-6 The Ecosystem Services Framework

4.4.2 *Data Collection Process*

Fieldwork focused on two populations, 1) the intermediaries who facilitate participation in CONAFOR PES programs and 2) the community and landholders participants. In order to characterize the institutional setting and the roles intermediaries play within it, I conducted structured in-depth interviews, community site visits, analyzed available secondary data, existing literature, and documents collected during fieldwork.

Primary data collection was done through structured-interviews. I conducted fieldwork over a six-week period from February 2016 – April 2016. I used a two-stage snowball sampling process to identify program participants. I first emailed all "*tecnicos*" listed as approved by CONAFOR on

February 24th (Appendix 4-1 contains the recruitment email). Of the 53 *tecnicos* emailed 18 responded and 9 were available and willing to meet for in-person interviews. The interviewed *tecnicos* work in eight municipalities in the state of Puebla.

After intermediary interviews were complete, follow-up appointments for site visits and document review were scheduled. When possible, intermediaries introduced me to program participants with whom they work. In total, I interviewed 13 program participants. All intermediaries and participant interviews were conducted in Spanish, recorded, and then transcribed. The average length of an intermediary interview was 46 minutes and the average participant interview was 10 minutes in length. Thematic coding following Saldana (2009) was done using transcribed interviews in Spanish to preserve meaning. Codes were created in English using the NVivo 11 program.

There are no available data specific to the participant or *tecnico* populations that allow me to estimate the potential bias of my sampling process directly. Superficially, I am more likely to have received responses from *tecnicos* located in areas with better Internet coverage. The smallest unit of analysis with data available to make judgments of the potential bias is at the municipality-level. These data describe the municipality populations as a whole, and are not limited to project participants. Further, these data can only indirectly represent the *tecnico*s working in a given municipality. Table 4 – 2 provides a comparison of summary statistics for the municipalities represented in my sample (sample) and for all other municipalities in the state that have had active PES projects in the last 3 funding cycles (non-sample). As shown, there is no statistical difference in the proportion of adults that are economically active, the population literacy rate, the gender distribution, or the average household monthly income. The median household monthly incomes are also almost identical. There are statistically significant differences in the average age, average number of years of education, and percent looking for work, however the magnitude of the estimated differences in these means is relatively quite small. On average, members of non-sample municipalities are a little more than a year older than those in sample municipalities and have slightly more than half a year more education. The proportion of the adult population looking for work in non-sample municipalities is 0.6 percentage points higher. The magnitude of these differences is quite small. In contrast, the magnitude of the difference in the proportion of the population that is indigenous is noteworthy, the proportion of the population identifying as indigenous in the non-sample population is 7 percentage points higher than the sample population. Assuming the project participants are on average, similar to the general population, the only discernable difference between the sample and non-sample populations is the proportion of self-identifying indigenous peoples.

Table 4-2 Comparison of Summary Statistics Sample vs. Non-sample Municipalities[17]

	Mean (Non-sample)	**Mean (Sample)**	**t-test p-value**	**Estimated Difference**
Proportion Economically Active	0.56	0.57	0.1	0
Literacy Rate	0.87	0.86	0.2	0
Proportion Male	0.48	0.48	0.3	0
Average HH Monthly Income[18]	122,180.25	116,893.40	0.6	0
Median HH Monthly Income [19]	5,142.00	5,143.00	NA	NA
Age (Years)	28.95	27.73	<0.0001***	1.2
Year of Education	8.05	7.48	<0.0001***	0.56
Percent Looking for Work	0.0202	0.0166	<0.0001***	0.0062
Indigenous	0.24	0.17	<0.0001***	0.071

*** Significant at the 99% confidence level.

These data do not directly describe the *tecnico* sample, we can reasonably assume though that *tecnicos* working in the sample municipalities and *tecnicos* working in similar non-sample municipalities are similar. Given that I find limited evidence of significant large-magnitude differences between the non-sample and sample municipalities, I assume that the *tecnicos* sampled are a reasonable representation of other *tecnicos* working in the state of Puebla. I do have to assume however that my sample of *tecnicos* does not represent *tecnicos* who work more closely or predominantly with indigenous communities. This estimation of potential bias obviously does not account for unobserved differences within *tecnicos* and within participant-communities but provides a basic understanding of the potential bias of my non-random sample.

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[17] Summary statistics were calculated using the *survey* package, version 3.2 in R (Lumley, 2017).

[18] Income is reported in 2010 Mexican pesos.

4.4.3 *Code Saturation*

This section reviews the number of interviews for each group that achieved code saturation. Qualitative methods practitioners disagree on the number of interviews necessary to reach saturation, the point at which an additional interview would not generate new meaningful codes. The top half of the range is between 30 and 60, but some argue that as few as 12 interviews are sufficient (Maggetti, Gilardi, & Radaelli, 2013). One often cited study by Guest and colleagues found that after 12 interviews, 97 percent of high-value codes (those which reoccurred in many interviews) had been identified (Guest, 2006). In a review of PhD research using qualitative methods, the authors found that ground-theory studies generally fell between 20-30 interviews (Mason, 2010). To track for saturation, I aggregated the number of new first-round codes generated with each additional interview, agnostic of whether the code would be considered high-value.

Figure 4-7 shows the number of new first-round codes generated and the corresponding cumulative contribution to the proportions of codes generated across all interviews for both intermediaries (Panel A) and participants (Panel B). The marginal contribution of each additional intermediary interview begins to decline around the sixth interview by which time over 90% of new codes have been generated already, as seen in the bottom graph of panel A. The intermediary interviews show a consistent pattern, where only one or two new codes were generated in each of the last three interviews. Panel A shows a smooth distribution and signals that saturation was reached by the seventh interview. The story for participant interviews is quite different; the marginal contribution of each additional participant interview begins to decline almost immediately after the first interview, during which 44% of all new codes were generated.

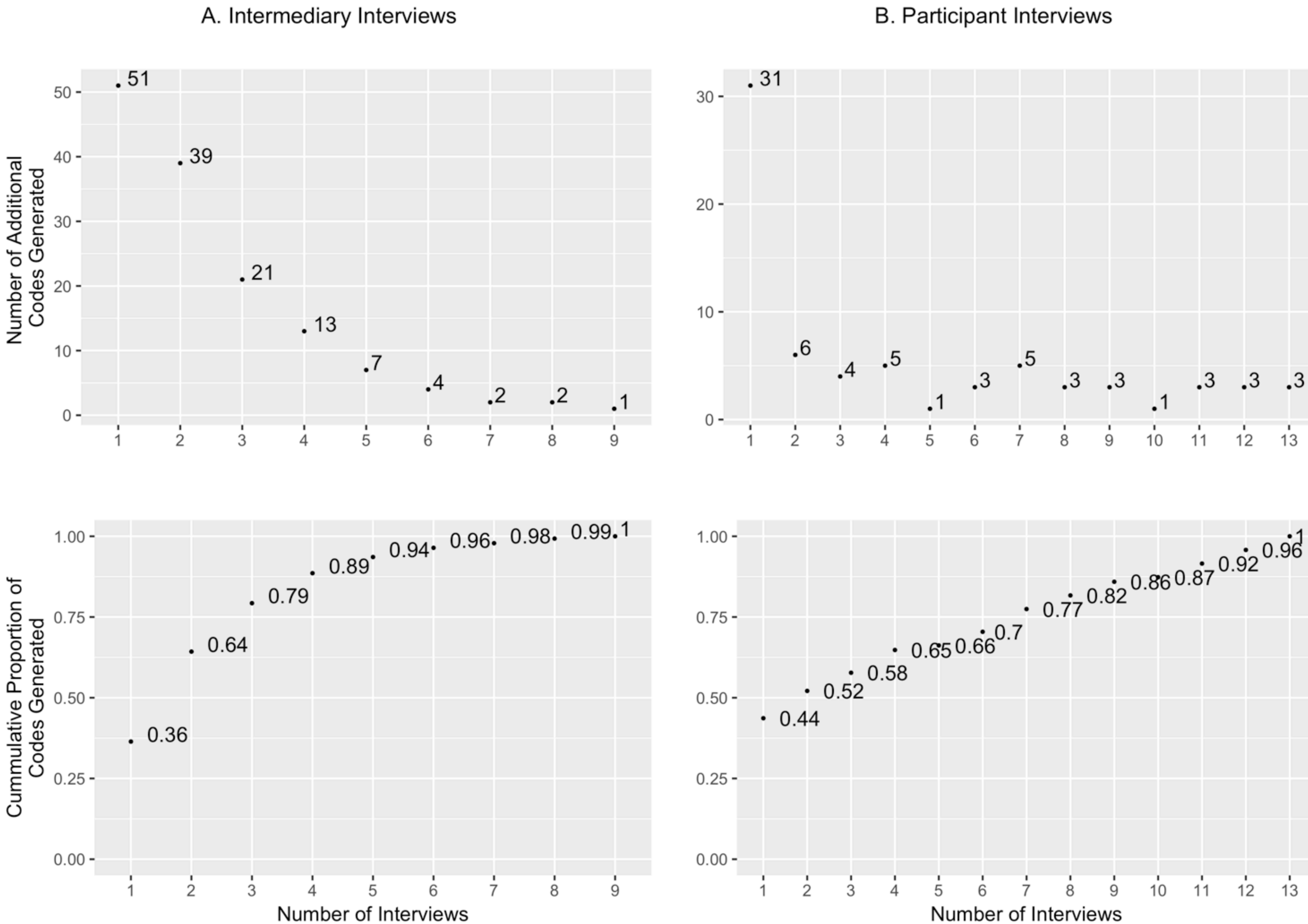

Figure 4-7 Graphs of Code Saturation

While this story is hidden slightly in the cumulative proportion graph in the bottom of panel B, this is due to the smaller total number of codes generated by this population. Each additional participant interview after the second generated only between one and five new codes as shown in the top graph of panel B. Ninety percent of codes were generated by the 11^{th} interview. While the distribution is not as consistent as that of the intermediary interviews, participant interviews reached 96% saturation at 12 interviews.

4.4.4 *Intercoder Reliability*

A second-coder helped to verify the coding-scheme developed through my iterative coding process. In general, the intercoder reliability process consists of allowing a second-coder to code a subset of interview transcripts independently using the near final coding-scheme. The codes of the second-coder are then compared with those of the primary-coder to look for reliability of the coding-scheme, where reliability means that "two or more equally capable coders operating in isolation from each other select the same code for the same unit of text (Campbell et al., 2013)." A statistic of reliability is then calculated based on the two sets of coded-texts, if the statistic's threshold is met the process is complete and the coding scheme is finalized. If not a process of negotiation to resolve conflicting codes is undertaken between the two coders and the coding scheme is modified.

In my context, that the second-coder is a native of Mexico makes her an ideal resource to validate my interpretation of the meaning of interview transcripts for two additional reasons. First, Spanish is not my native language and a native speaker as a second-coder is able to ensure that I did not miss any subtle nuance in the transcripts. Second, she is more attuned to Mexican culture and norms, helping me to ensure that I did not miss any meaning attributable to cultural differences between my interviewees and myself.

For coding validation, I selected a random sample of interview transcripts that accounted for ten percent of each of the populations - *tecnicos* and participants. Ten percent of interviews is noted in the literature as a sufficient sub-sample for coding-scheme validation (Campbell et al., 2013). The second-coder received my coding-scheme and the interview sub-sample in an NVivo file format. The unit of text used to assign a code was delineated by a response to a question – regardless of length. The unit of text used is important for calculating intercoder reliability statistics. While there is disagreement on how to unitize text, a question response is the most natural demarcation for my data (Campbell et al., 2013). Before she coded, I oriented the second-coder to the two sets of codes which make up the coding-scheme – one set for *tecnicos* and one set for participants, but we did not discuss the content of the codes themselves. The second-coder then coded the randomly selected sub-sample of transcripts independently using NVivo.

I next compared the coded transcripts I generated to those the second-coder generated using Krippendorff's alpha. I used Krippendorff's alpha as the statistic of reliability because it was designed to handle multiple coders and is not affected by sample-size (Krippendorff, 1980). Coding matrices were exported from NVivo and imported to R where I used the *kripp.alpha* function for the *irr* package to calculate the alpha values (Gamer, Lemon, Fellows, & Singh, 2012). The average alpha-value for the transcripts was 0.7. The minimum acceptable threshold for drawing conclusions from a coding-scheme is an alpha-value of 0.667 (Krippendorff, 1980). Since we met this threshold in the first-round of second-coder evaluation, the inter-coder reliability process was concluded. These results mean that I can be reasonably confident that an alternate coder would code transcripts following my coding-scheme in the same way that I would.

4.5 Results

This section starts with a characterization of the local institutional setting of PES projects following the guidelines of the IFRI research program. Based on this characterization, I then turn to an analysis of how intermediaries are working with local communities and which institutions they are affecting. I continue by reporting findings on how local communities decide to participate in PES projects. Finally, I provide an analysis of the local ecosystem services and their salience to local communities.

4.5.1 *Overview of Local Forest Institutions*

Based on interviews and review of documents provided by the Mexican Agricultural Agency (RAN)[19], the *ejido*/*comunidad* local governance structures on paper provide the majority of the CPR design principles identified by Ostrom and currently in use by the IFRI research program (Ostrom, 1990; Wertime et al., 2007)[20]. Almost universally[21], participants noted that only members of their community used the forest, this reduces the potential for free-riding and conflicts with external actors (DP - 4, 6, 7). Among community members, the awareness of allowed uses in a given area was reported to be very high. Participants noted that there were designated areas for common uses and individual parcels for agricultural use. Areas were recognized either through

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[19] RAN provides guidance to communities on establishing local governance bodies.

[20] Appendix 4-5 summarizes the assessment of the local institutional context against the IFRI design principles.

[21] In only one community did the respondent report that people outside the community use the forest.

communication among users or through inclusion in a forest management plan. No community reported internal conflicts resulting from a lack of self-regulation of uses in designated areas. The clarity of both the group of forest users and the boundaries of allowed use areas both appear to be well established in the communities and both are principal to the sustainable management of a CPR and necessary foundations for PES projects (Ostrom, 1990).

Decision-making power in the local-governance context rests ultimately with the elected executive leadership of the *ejidos/comunidades*, most decisions are reached by votes of all active *ejido*/community members (DP - 2, 3). Though conflicts were not reported in most communities, when they do arise the first venue for their resolution is an *asamblea* meeting. In cases where resolution through the *asamblea* is not feasible, regional external governance bodies are the next available venue for resolution (DP - 5, 6). This may include a regional RAN office or a CONAFOR satellite office depending on the conflict (DP - 7).

4.5.2 *The Role of Intermediaries*

Intermediaries supporting community PES projects can become involved initially either by seeking out eligible communities (n=4) or by relying on good word of mouth to bring interested communities to them (n=5). Intermediaries reported a few first steps when they are initiating a relationship with a new community, most start by gauging the interest of the community members or of community leadership (n=7). Some wait on the annual rules-of-operation to be released by CONAFOR to confirm for the upcoming year what activities are being funded and where (n=2). Some intermediaries start by sharing past successes with the new community by planning a trip to a community that has a successful project (n=3). This is the strategy used by an intermediary who has been working in similar community development projects for over 40 years. He notes that:

> *"I bring them to a project that is working, and show them what they did, and let them ask the project owner in real life, let them ask openly everything they want, in order for them to find out where they are going and what they will need, or what requirements should be met to establish a new project." (my translation)*

When deciding whether or not to work with a community, intermediaries highlighted two main traits they look for, that the community is organized (n=4) and that the community wants to work (n=5). They also make sure that the community meets the program requirements (n=3). From the perspective of the intermediaries, participants decide to join a PES project primarily because of the economic benefits for the community (n=6), which aligns with the reasons reported by the participants themselves. In some cases, when there are salient resource constraints, like soil degradation (n=2) or a lack of water (n=3), environmental reasons are also motivating. The environmental benefits in most cases are not considered or are of secondary concern. One intermediary commented, that community leaders had an awareness of the environmental benefits and needs of their communities but the general community population was only concerned with the economic benefits:

> *"The leaders or those that solicit the projects, they say [it's] because, "Well, it helps us in the environmental part and we generate jobs," And the people, they like it because it generates..." (my translation)*

Intermediaries report their roles in project development to be varied. The most common role is assisting with paper work (n=8) including diagnostic reports and management plans, but most importantly completing the forms needed to apply for support and maintain the project in good standing once it is approved. The next most common role is technical assistance (n=3) and supervision of work to ensure that it meets project standards (n=4). Intermediaries also inform people of the existence of programs (n=4). Less commonly, intermediaries reported managing community participation (n=2) and supporting the development of better community organization (n=1).

Intermediaries report that it is in their best interests to share as much information as possible with participants (n=5). They communicate with leadership and through informational meetings, they try to "*be transparent and share all of the information*." They need to be sure that the community is willing to do all of the necessary activities to meet project requirements. Intermediaries explain how the programs work (n=4), lay out the rules of participation (n=2) and all of the benefits (n=3). One intermediary interviewed stated that "*all of this has to be said to them and they have to agree, because if at the time of doing the work they may say, 'you didn't tell us and I will not do it'* " (my translation).

The benefits projects provide from the perspective of the intermediaries are many. Matching participant responses, the most important benefits noted by intermediaries was also the economic resources, mainly employment (n=8). Intermediaries recognized that environmental benefits for the community themselves (n=5), particularly water conservation (n=3) were important benefits. Other benefits the intermediaries identified included soft skills developed through the course of project implementation, such as participants learning new skills (n=2) and improving their management and organizational capacities (n=5). One benefit important to the continued sustainability of natural resource management in communities is that the projects improved their awareness of ecosystem services (n=3). One intermediary offered that most participants start a project for economic reasons but learn about environmental benefits throughout the course of the five years of the project:

> *"they lack more information about the environmental services that the forests generate… ultimately [participants] are more informed: … they know which services the forests are generating. … It's a question of education and it's a question of capacity … that the people start to realize that these activities regardless of whether they can receive [monetary] support from municipalities, that they should be done in an environmental way" (my translation)*

Intermediaries are often a primary source of information for participants (n=6) and intermediaries noted that it is in their best interest to be a transparent as possible with participants (n=5). By linking participants who may question the transparency of PES-funds received to the CONAFOR website intermediaries can quell distrust. One intermediary commented that he tells participants, "*If you want to see the information about how much money is supporting the ejido … everything is on the Internet and you can download*" (my translation). In this sense, even though the CONAFOR program is transparent by publishing this information, without the support of an intermediary to direct community participants to where to find the information. the benefits of that transparency would not penetrate to the local level.

Project intermediaries had a large variety of ideas on how to improve programs, and there was limited agreement across intermediary responses. However, the two most common challenges noted a lack of funding for programs (n=2) and that the minimum area requirement limited eligible participants. By being too high, the requirement excluded otherwise eligible participants with smaller landholdings who are often more marginalized populations (n=2). It was also noted that operating rules change frequently, as each new federal administration changes the programs, making it difficult for intermediaries to sustain projects (n=2).

Difficulties generated by the incongruence of the *ejido/comunidad* governance structures and the PES program requirements were also noted. Local leadership is elected for 3-year terms while PES projects last for a minimum of 5 years, this presents a challenge for intermediaries who need to forge relationships with new leadership halfway through a project. Intermediaries noted that some new leaders are not as supportive of the PES project making project completion difficult. One intermediary notes that new leadership may suspect the intermediary of corruption or collusion with the former leadership and want to start fresh:

> *"… they suspect that I worked with the previous authority, I made certain confidential or corrupt relationships, it's the first thing they think. So they say, "since he already has this experience, he is going to screw me; best that I bring a new one, a new one for me that I recently met and start the work from zero." This affects the projects because the little you have advanced is going to regress" (my translation)*

This cycle of turnover is frustrating for intermediaries, though in the long-term one intermediary noted that there is a solution to this incongruence:

> *"A project that has a life of three years does not have any viability, it doesn't work… So, for this reason, we went, on the basis of the law to form societies of rural production, and form cooperatives, and the cooperative is the one that visualizes the project and then this project we take it to at least through the first phase of 5 – 8 years. And at this moment, they are the same leaders for the life of the organization, so that they can operate the project and the project can mature. … If we don't do this in Mexico, we are condemned to live organized to vote but not organized to produce. "*

4.5.3 *Local Decision-Making and PES Project Participation*

Using interview transcripts, here I qualitatively characterize aspects of the forest resource users' "internal worlds". Participant responses indicate that among community members there is trust and reciprocity (IW-3). Participants noted that forest users were almost exclusively from their own communities and that users knew which areas were designated for communal use, and no conflicts among users were reported (IW-3). There is also clear evidence that forest users have autonomy over resource management both from the laws that govern social property at the national level and from the locally recognized authority of the *asamblea* and community leadership (IW-4). It is apparent that users have prior experience with forest resources and in some cases ancestral knowledge of the resource (IW-5). One participant noted that information about how to use resources is inherited, "*they get conveyed, they get inherited … From the grandfathers to the father to the sons*" (my translation).

What is less clear is whether users share a common understanding of how use affects forest resources and the salience of the resource (IW-1 & IW-2). As shown in the analysis of ecosystem services (Section 4.5.4 below), services that are easily observed are more salient and explicitly mentioned during interviews. Regulating services, like water purification and carbon sequestration, are much less salient and this may be why there is little evidence of an understanding of these systems and how use affects these services. For example, when participants were asked to note changes in the ecosystems where projects where implemented responses were vague including that the resources were "getting much better," "more abundant," or "cleaner." Were the resource services more salient and effects of use better understood, I would expect responses to include observations that were more specific. In only one case, erosion control was specifically mentioned.

Overall, the participants agreed that the PES projects were very beneficial for their communities. Four participants made unsolicited comments about the excellence of the programs. Participants first learned about the PES projects various channels, the most common were CONAFOR outreach (n=4), word of mouth (n=4), and being contacted directly by an intermediary (n=3). When making the decision of whether to participate respondents overwhelming considered the economic incentives including free materials (n=9; n=2 respectively), while a smaller number considered sustainable forest resource management (n=4). The information sources used to inform the participation decisions were varied but a large proportion of participants reported relying on the intermediary to provide project information (n=6). Others reported relying on *asamblea* meetings to inform themselves (n=3). Less commonly, some participants considered the needs of the community (n=2), the state of the forest resource (n=2) and traditional knowledge when making the decision (n=2).

With the implementation of the projects, participants noted the largest benefit to their communities was that many people now had the assurance of a job (n=9) and further in one case that the *asamblea* now had a better understanding of how to attract financial resources for their community (n=1). Several participants noted that the forests were improving with the implementation of the projects, though again this was communicated in vague terminology (n=5). Less frequently, participants noted that they had a better awareness of the need to conserve forests (n=2) or a stronger assurance that they would be conserved (n=1).

4.5.4 *Ecosystem Services*

During interviews, participants in PES projects listed the uses they get from their forest resources. The most common forest-uses included firewood (n=10), livestock grazing (n=6), extractive use for local consumption (n=5), and collecting maguey to make mescal (n=5). After coding, I categorized the reported uses according to the categories of the ecosystem services framework. This categorization is shown in Table 4-2. All of the uses participants reported are in the provisioning category. In addition, a few services are both provisioning and cultural or provisioning and supporting services, as they arguably fit into more than one category. Provisioning resources are most easily observed and will have more salience than regulating and supporting services in most contexts. It is not surprising that participants report uses that they can see and which are tangible. However, these findings point to a lack of awareness of the services that are commonly targeted by PES programs, the regulating services of carbon sequestration and aquifer recharge are not readily observable to users.

Table 4-3 Reported Ecosystem Services

Cultural	**Provisioning**	**Regulating**	**Supporting**
Medicinal plants	Medicinal plants		Forest Management
Maguey - mezcal	Charcoal		Maize
Palma	Firewood		Livestock Grazing
	Livestock Grazing		
	Maguey - mezcal		
	Palma		
	Rocks for building		
	Timber Extraction		
	Forest Management		
	Maize		

4.6 DISCUSSION AND HYPOTHESES

This section outlines two sets of hypotheses drawn from the analysis of my qualitative data. The first set focuses on the role of intermediaries while the second set focuses on PES program design.

4.6.1 *Hypotheses Regarding the Role of Intermediaries in PES Projects*

My results show that intermediaries affect institutional arrangements including the design of local forest-use rules (DP-2), the monitoring of forest-use behaviors (DP-4), and mediating the link between the local governance body and CONAFOR state and national offices (DP-7, nested-enterprises). In addition, there is evidence that PES projects affect the cost-benefit trade-offs for forest stakeholders, including by changing the salience of their resources (IW-1) and potentially also affecting their common understandings of how use affects those resources (IW-2). These qualitative findings lead me to the series of hypotheses listed below that are of interest for future research.

I found several instances where intermediaries are able to bolster local forest institutions. While institutions that govern forest-use are ultimately the decision of the local forest-users subject to national laws (DP-2), intermediaries are often the first to introduce the concept of PES projects. Providing access to information about the projects opens up new possible institutional arrangement for local forest users to consider. Further, intermediaries play a large role in drafting management plans and the necessary paperwork once the decision to participate is made by local community members. They aid in drafting new rules for forest use while ensuring that the rules comply with the CONAFOR program requirements. Their support lowers the transaction costs associated with making changing to the rules-in-use for the forest resources, as they are able to interpret and explain the complex program rules that may otherwise be daunting for participants.

The first and most basic hypothesis to test based on these findings is concerning institutional design. Does the role of intermediaries in helping local communities change their resource rules-in-use improve project outcomes? This could be measured in terms of contract efficiency, better human well-being outcomes, and better environmental outcomes.

> *Hypothesis 1. Intermediary participation in institutional design improves PES project outcomes, (including more economically efficient contracts, better local livelihood outcomes, and better environmental outcome) as compared to the same outcomes in PES project developed without an intermediary.*

Whether local forest institutions are able to minimize free-riding, rent-seeking, asymmetric information, and corruption (DP-4) in general is not discernable from the data examined here. In the context of PES projects however, I do find evidence that intermediaries play a role in mitigating the emergence of these challenges. They are the first line of assessment of PES project activities, and serve to support monitoring activities. Though this is not their primary role, several intermediaries noted that they supervised work to ensure quality. I also found evidence that intermediaries increase transparency by sharing PES program information broadly, interpreting complicated information for participants, and directing communities to available on-line information sources. In the qualitative findings, there is evidence that by increasing transparency, intermediaries can help reduce the potential for corruption and conflict over project financial resources. Connecting participants to publicly available data on financial disbursement amounts also reduces the opportunity for corruption amongst local leaders who could otherwise attempt to conceal the true amount. In my results, I also found that intermediaries increased communication between CONAFOR and local communities through their information-sharing activities, resulting in a sub-hypothesis worth investigating as it relates to their role in maintaining and linking these nested-enterprises of forest governance.

Hypothesis 2a. Increased information sharing by intermediaries increases transparency resulting in less corruption and fewer project related conflicts as compared to PES projects without an intermediary.

Hypothesis 2b. Intermediary monitoring results in less corruption and fewer project related conflicts as compared to PES projects without an intermediary.

Hypothesis 2c. Increased information sharing by intermediaries increases transparency resulting in more and better communication between local governance bodies and the forestry agency or other regional governance body as compared to PES projects without an intermediary.

Finally, resource salience and communal understanding of how use affects a resource were changed by PES project participation. Though in the ecosystem services data summarized from participants, the salience of less visible services is not demonstrated, that PES projects may help participants progress towards better understanding of the complete set of services produced by forests is critical. Intermediaries can then play a role both in increasing resource salience and promoting a better understanding of how forest-use can affect these, less easily observed services (IW-1). In the long-term, the recognition of the full set of services provided by forests could have drastic effects on the cost-benefit considerations made prior to a land use decision, as previously unrecognized ecosystem services may now be valued and incorporated into decision making.

Here, I did not find evidence that intermediaries were explicitly responsible for increased resource salience, as projects in the absence of an intermediary may also increase environmental awareness. However, the lack of awareness of less-observable forest services before projects, highlights an important opportunity to incorporate awareness and education specifically about ecosystem services into intermediary roles to help inform and improve local decision-making.

Hypothesis 3a. Intermediary information sharing increases the salience of resources among project participants as compared to PES project without an intermediary.

Hypothesis 3b. Participation in PES projects increases the salience of resources among project participants.

In my sample, I do not have examples of participants who are not working with an intermediary, as intermediaries are a required component of PES projects under CONAFOR. Therefore, in future research, a population that has variation in intermediary-use, and a counterfactual for their role's effects on PES projects, would be necessary to test the hypotheses generated here.

4.6.2 *General Hypotheses*

In addition to generating hypotheses about the effect of the role of intermediaries, my results pointed to two hypotheses regarding PES program design more generally, as suggested by intermediaries. These could be tested in the context of any PES or REDD+ program and have the potential to inform program promotion more broadly.

Hypothesis 4. Sharing successes at the local level with potential participants increases their likelihood of PES project participation.

Hypothesis 5. Aligning the term length of the local governance body for a PES project with the length of the project, results in fewer projects that ultimately do not meet the terms of their contracts.

4.7 CONCLUSION

Mexico has the unique experience of being home to some of the longest-running PES programs in the world. Coupled with a historic trend towards decentralization and the promotion of social property, both allowing for better conditions for market-mechanism policy options, the country is an ideal testing ground for innovations in PES programs. In CONAFOR's PES programs local governance bodies retain decision-making power but independent intermediaries mediate their decision-contexts. Intermediaries play a role in the development of forest-use rules and the maintenance of CPR design principles. As Mexico seeks to advance its PES programs with the expansion of its matching-funds program, intermediaries may gain an expanded role in facilitating and mediating projects for both service-providers and service-user.

Based on the iterative qualitative analysis of interviews with PES project intermediaries and local project participants I develop three hypotheses related to intermediary roles. Broadly, the first focuses on how intermediary involvement in institutional design effects project outcomes, in Mexico all project are required to use an intermediary so currently there is no counterfactual to test this. Future research could endeavor to test this hypothesis in another country where there is variation in intermediary-use. This could provide valuable information to help improve PES and REDD+ programs and their use of intermediaries. The next hypothesis focuses on the effect of information-sharing by intermediaries and the transparency they encourage. There is evidence that these activities reduce corruption and project-related conflicts but this would need to be test to isolate this relationship. The third intermediary hypothesis focuses on the effect of PES participation on resource salience. PES projects may help participants to better understand the vast array of unobservable resources that forests provide. While participants reported ecosystem services that were exclusively provisioning services, intermediaries noted that through projects participants become more aware of ecosystem services. Improving awareness of the full suite of services that forests provide, and in particular those which are marketable in PES programs, could improve the bargaining positions of local forest managers in future REDD+ or PES programs.

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APPENDIX 2-1 MODEL SENSITIVITY ANALYSIS

By creating a dyadic-year data structure, the number of observations in the event history analysis model increased dramatically. The complete data included 128 countries, resulting in 16,384 dyadic pairs observed once for each of 9 years. This structure results in 147,456 observations, this creates a concern that the resulting standard errors are artificially low and creates added difficult in determining when a true convergence is met during maximum likelihood estimation.

The model was estimated in the lme4 package version 1.1-13 in R (Bates et al., 2017). Documentation for the package notes that large-sample-size models (where n is greater than 100,000) may return warning messages regarding non-convergence even in cases where the model appears to be well-behaved. In the case of my model, the default estimation process using the bobyqa optimizer returned a convergence-warning message (maximum gradient= 0.409, tolerance is = 0.001). The maximum gradient is larger than the 0.001 tolerance level guidance, however in simulations using lme4 estimation the gradient has been shown to scale with sample size, suggesting that this larger maximum may be a product of the larger sample size in this case.

In order to determine if this warning is legitimate or an artifact of the sample size, I ran the recommended troubleshooting protocol. To begin, I rescaled and centered all of the covariates using a built-in function can help improve estimates of standard errors. I then tested the model for singularity (when a constrained parameter of the random effects is equal or nearly equal to zero and therefore on a boundary) making model estimation inaccurate or in some cases impossible. The smallest matrix element was larger than zero, at 3, indicating that singularity is not a concern with this model. I next re-estimated the Hessian matrix using a computational more time-consuming but more precise Richardson extrapolation. The maximum-scaled gradient from this re-estimated matrix was 0.0007, and so did not make an improvement on my original estimation, which had a value of 0.019. A visual inspection of the two gradients found them to be very similar.

The last and best troubleshooting approach is to run the same model using a variety of estimation optimizers and compare the resulting fixed-effect estimates. Table A2-1 show that fixed-effect estimates of the model using four optimizers. As shown, the estimates are consistent and almost identical for most parameters. These results also show that the log likelihood does not change substantially across optimizers. Collectively, the results of non-convergence troubleshooting tests show that the model estimated using the bobyqa optimizer does not violate any of the mathematical rules of maximum likelihood estimation. This indicates that the maximum gradient being slightly larger than the threshold guideline is likely a product of the large sample size and does not indicate a poor estimate of the model. As such, I rely on the bobyqa optimizer for my model and subsequent analysis.

Table A2-1 Comparison of Fixed-Effects Estimates across Optimizers

Optimizer	**bobyqa**	**Nelder Mead**	**nlminbw**	**optimx.L-BFGS-B**
(Intercept)	-25.086	-25.188	-25.135	-25.121
Same Income Level	0.020	0.020	0.020	0.020
Same Region	-0.064	-0.062	-0.064	-0.064
Max 10-year deforestation rate	1.680	1.611	1.680	1.677
Gower similarity	0.099	0.097	0.099	0.099
Funding*Gower	0.003	0.002	0.003	0.003
Pilot*Gower	0.063	0.065	0.063	0.063
Total REDD+ funding (proportion of GDP)	0.623	0.617	0.624	0.622
AOSIS – Proportion with REDD program in time period	-0.248	-0.250	-0.248	-0.248
LDC – Proportion with REDD program in time period	0.084	0.082	0.084	0.084
CSN – Proportion with REDD program in time period	0.007	0.006	0.007	0.006
ACP – Proportion with REDD program in time period	-0.020	-0.025	-0.020	-0.020
COMESA – Proportion with REDD program in time period	-0.082	-0.087	-0.082	-0.082
ASEAN – Proportion with REDD program in time period	-0.001	-0.006	-0.001	-0.001
ECOWAS – Proportion with REDD program in time period	0.044	0.044	0.044	0.044
Time period control - 1	18.735	18.922	18.785	18.782
Time period control - 2	19.126	19.315	19.176	19.173
Time period control - 3	18.932	19.123	18.982	18.979
Time period control - 4	18.068	18.258	18.118	18.115
Time period control - 5	18.235	18.427	18.285	18.282
Time period control - 6	18.015	18.208	18.065	18.062
Time period control - 7	17.565	17.762	17.614	17.611
Time period control - 8	16.314	16.513	16.364	16.360
Log likelihood	- 10516	- 10516	- 10516	- 10516

APPENDIX 2-2 EXPERT SURVEY RECRUITMENT EMAIL[22]

«Name»
Dear «Name»,

I hope this letter finds you well. My name is Allison Kelly, I am a doctoral candidate at the Evans School of Public Policy and Governance at the University of Washington in Seattle, WA in the United States. I am writing to ask for your support with a research project focused on how reducing emissions from deforestation and forest degradation (REDD+) policies are being developed in various countries. I am conducting a brief survey on this topic as a part of my doctoral dissertation.

I am contacting you because I found your contact information as a UN-REDD programme focal point contact for «Country». Your role in developing the REDD+ policy for «Country» makes you an ideal participant in the survey.

In order to respect your busy schedule, I have designed the survey to be very concise; it can easily be completed in about 10 minutes. The survey can be completed through an online form. Survey topics cover questions about what influenced the country you represent to pursue a REDD+ policy strategy. All responses will be confidential and used only for academic purposes.

If you are able to participate, please follow the link here or copy and paste the complete link provided below to go to this short survey online. I would also welcome any referrals you may have for other colleagues working on REDD+ policy issues at the national level, who may be interested in participating. If you can provide me with their contact information, I would be happy to contact them as well.

Thank you,

Sincerely,

Allison C. Kelly
Ph.D. Candidate
Daniel J. Evans School of Public Policy & Governance
University of Washington
Link to survey:
https://docs.google.com/forms/d/e/1FAIpQLSfEOoSpuFwMmis12T3QmmJZiej0d3uZ3DEtx3LDhIXp-qj68Q/viewform?usp=sf_link

[22] Materials in Appendices 2-2 – 2-4 were also translated into Spanish and French.

APPENDIX 2-3 EXPERT SURVEY

Reducing Emissions from Deforestation and forest Degradation (REDD+) Policy Development Survey

Thank you for completing this survey. The questions are designed to be completed in approximately 10 minutes. Responses will be kept confidential and be used for academic purposes only. The goal of this survey is to inform a research project focused on how reducing emissions from deforestation and forest degradation (REDD+) policies are being developed in various countries.

Email Address

Which country do you represent?

What year did you first learn about REDD+?

Briefly, why did the country you represent decide to pursue a REDD+ program?

What are the benefits of REDD+ for the country you represent?

Please indicate your level of agreement with the following statements:

The decision of a country I consider a leader on environmental issues to start a REDD+ program increased the interest of the country I represent in starting a REDD+ program.

In developing the REDD+ program in the country I represent, the experiences and lessons learned in other REDD+ partner countries were considered.

The approach to REDD+ in the country I represent has been affected by success(es) in other countries.

The country I represent started a REDD+ program because a regional leader started a REDD+ program.

The country I represent has observed successful outcomes of REDD+ programs in other countries.

Countries the country I represent works with in other sectors of the UNFCCC starting REDD+ programs increased the interest of the country I represent in starting a REDD+ program.

Other countries requested that the country I represent start a REDD+ program.

The country I represent became more interested in starting a REDD+ program because regional leaders started REDD+ programs.

Many countries the country I represent considers peers have started REDD+ programs. Their participation increased the interest of the country I represent in starting a REDD+ program.

The country I represent has considered the possibility of a REDD+ program being used to contribute credits to a future global carbon market.

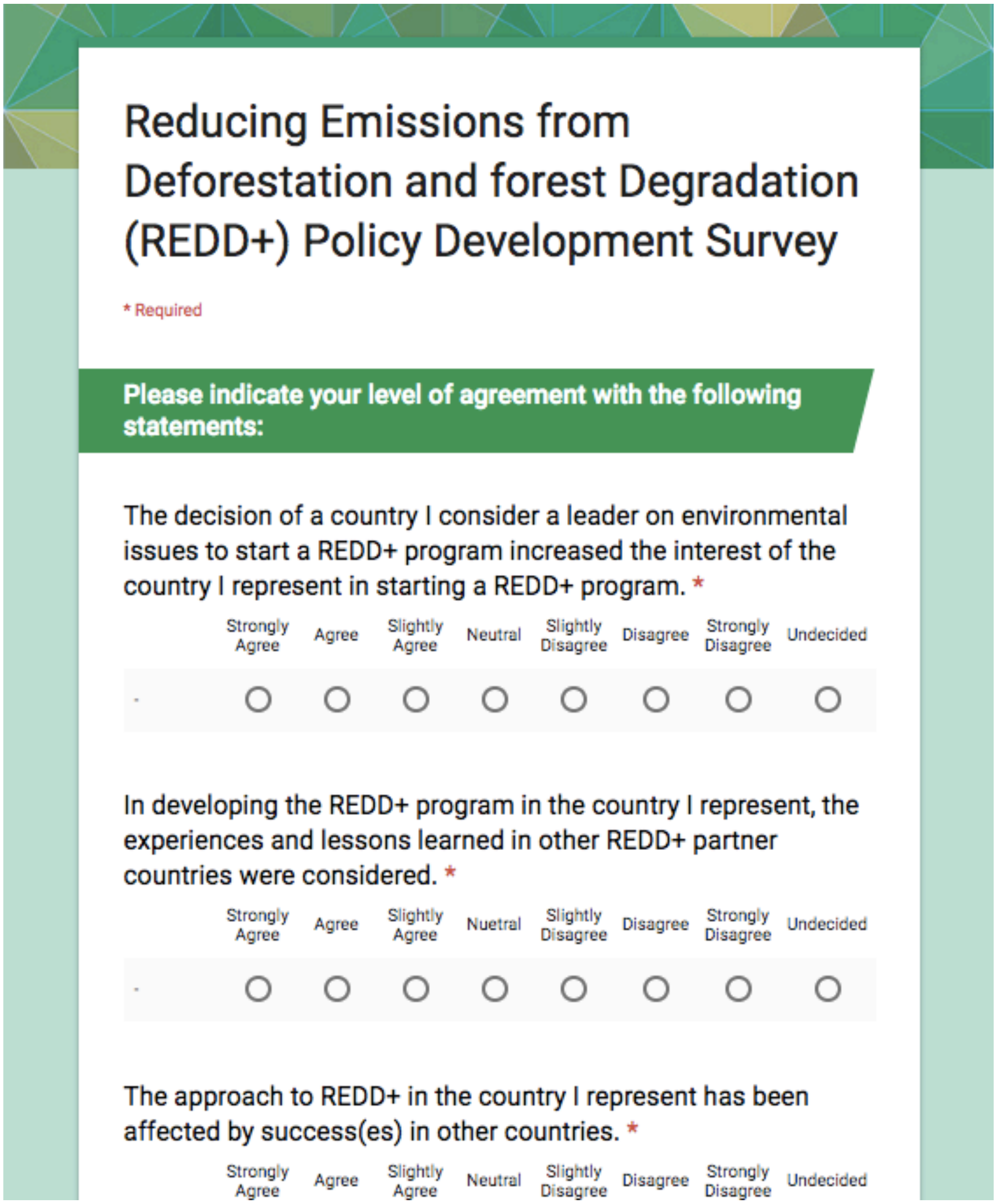
Because countries the country I represent works with in other areas started REDD+ programs, the country I represent also started a REDD+ program.

The need to be eligible for future international or bilateral foreign aid opportunities increased the interest of the country I represent in starting a REDD+ program.

National or international non-governmental organization requested that the country I represent start a REDD+ program.

Thank you very much for your support of this research. If you have any questions or concerns please email akelly11@uw.edu.

APPENDIX 2-4 IMAGE OF ONLINE SURVEY FORM



Reducing Emissions from Deforestation and forest Degradation (REDD+) Policy Development Survey

* Required

Please indicate your level of agreement with the following statements:

The decision of a country I consider a leader on environmental issues to start a REDD+ program increased the interest of the country I represent in starting a REDD+ program. *

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree	Undecided
-	○	○	○	○	○	○	○	○

In developing the REDD+ program in the country I represent, the experiences and lessons learned in other REDD+ partner countries were considered. *

	Strongly Agree	Agree	Slightly Agree	Nuetral	Slightly Disagree	Disagree	Strongly Disagree	Undecided
-	○	○	○	○	○	○	○	○

The approach to REDD+ in the country I represent has been affected by success(es) in other countries. *

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree	Undecided

APPENDIX 3-1 SUPPLEMENTARY MATERIALS

Table A3-1 Complete Definitions of Land Tenure Security

"The certainty that an individual's or community's rights to land will be recognized by others and protected in cases of specific challenges … land tenure security is what people and communities perceive it to be (Alden Wily et al., 2015)."
Land tenure security is the assurance that property rights will be upheld by society (Naughton-Treves & Wendland, 2014; Robinson et al., 2014)."
The confidence that rights can "provide that others will fulfill their duty to respect those rights (Meinzen-Dick, 2014)"
Land tenure security is also defined as "a process that allows rights holders to gain a social and legal recognition of their rights and to reaffirm it against challenging claims (Burnod et al., 2012)."
"tenure security refers to the assurance aspect of property rights, or the expectation that rights will be protected and renewed" or "a confident expectation that one's investments will be protected (Bruce et al., 2010)."
In van Gelder's tripartite view, tenure security is a composite constituted of "the perception of the dweller with regard to his situation, the legal status of his tenure and the *de facto* conditions (van Gelder, 2010)"
UN-Habitat states that secure land tenure exists when land users "are protected from involuntary removal from their land or residence, except in exceptional circumstance, and then only by means of a known and agreed legal procedure, which must itself be objective, equally applicable, contestable and independent (Payne, 2004)."
"Tenure insecurity is defined as the perceived probability or likelihood of losing ownership of a part or a whole of one's land without her consent. (Holden & Yohannes, 2001)"
"Land tenure security can be defined to exist when an individual perceives that he or she has rights to a piece of land on a continuous basis, free from imposition or interference from outside sources, as well as ability to reap the benefits of labor and capital invested in that land, either in use or upon transfer to another holder (Bruce & Migot-Adholla, 1994)."
"…depends less on the exact legal status and more on the occupants' perception of probability of eviction and demolition (Razzaz, 1993)"
In the context of *de jure* rights, "rights holders presume that if their rights were challenged in an administrative or judicial setting, their rights would most likely be sustained (Schlager & Ostrom, 1992).

Table A3-2 Elements of Tenure Security Definitions

Element of Definition	Reference:
right-holders: individual or communities	
by: society, the legal or administrative setting, social and public entities	
• upheld / respected / recognized	(Alden Wily et al., 2015; John W. Bruce et al., 2010; Meinzen-Dick, 2014; Naughton-Treves & Wendland, 2014)

• affirm against claims / protected against challenges / free from imposition or inference / if challenged their rights will be sustained	(Alden Wily et al., 2015; J. W. Bruce & Migot-Adholla, 1994; John W. Bruce et al., 2010; Burnod et al., 2012; Schlager & Ostrom, 1992)
• probability or likelihood of losing all or part /eviction / demolition	(Holden & Yohannes, 2001; Payne, 2004; Razzaz, 1993)
• perceived legitimacy of tenure	(Alden Wily et al., 2015; Razzaz, 1993; van Gelder, 2010)
• continuous rights / renewed	(J. W. Bruce & Migot-Adholla, 1994; John W. Bruce et al., 2010)
• able to reap benefits by hold or transfer / expectation that investments are protected	(J. W. Bruce & Migot-Adholla, 1994)
• right holders are aware of their rights and responsibilities	(Simbizi et al., 2014)
• congruence of plural systems	(Simbizi et al., 2014)
• public entities recognize the physical status of land	(Simbizi et al., 2014)
• land information systems are maintained	(Simbizi et al., 2014)

As summarized in Table A3-3 below, the proxies included in the GC-LTS index are positively correlated. The elements within the political economy component have correlations of between 0.75 and 0.91. Similarly, the elements within the formal institutional component have correlations of between 0.49 and 0.87.

Table A3-3 Correlation of Elements

	Political capacity	Political will	Conflict	Capacity to adjudicate	Exclusion authority/ ability	Governance capacity
Political Economy						
Political capacity	1.00					
Political will	0.91	1.00				
Conflict	0.75	0.76	1.00			
Formal Institutions						
Capacity to adjudicate	0.95	0.96	0.76	1.00		
Exclusion authority/ability	0.86	0.85	0.64	0.87	1.00	
Governance capacity	0.62	0.50	0.44	0.56	0.49	1.00

A.3.1.1 *Comparison to Existing Approaches*

Here, as a partial validation of the index results, I examine the relationship between the GC-LTS index and two other datasets that provide data on aspects of land tenure security at the national level. The approach used by the GC-LTS index, of relying on nationally comparable data selected to specifically represent land tenure security, improves on the existing indices. I expect the GC-LTS index to be positively correlated, but slightly different based on these improved construction methods. The first dataset I review is the Insecure Tenure and Property Rights index created by the USAID/ARD Inc. in 2005. This layer has been referenced and reproduced numerous times but lacks an available published methodology for users to reference (World Resources Institute, 2008). Through personal communications with the original authors, I gained access to and reviewed the employed methodology. The Insecure Tenure and Property Rights index is based on an extensive expert consultation process that utilized a ranking matrix of issue attributes. Given their goal of representing insecure tenure, researchers developing this index asked experts to rank the severity of known tenure security difficulties including poorly defined rights, inequality based on gender or marginalized populations, conflict over land, lack of recognition of common property rights, lack of enforcement, and legal pluralism. This focus is the inverse of the GC-LTS index construction approach and includes two issues that may explain divergence between the two. Experts' rankings on inequality and the recognition of common property tenure forms are not explicitly included in the GC-LTS index, in countries where these contribute significantly to tenure insecurity in the USAID/ARD rankings, the GC-LTS index may provide a higher estimate of the strength of the land tenure security context. The USAID/ARD method has the advantage of harnessing firsthand knowledge of a country's land tenure security contexts. However, the authors noted their employed methodology ultimately led to an index with limited ability to compare between countries and regions.

Figure A3-1 shows the relationship between the Insecure Tenure and Property Rights index and the GC-LTS index. The two are positively correlated with a correlation of 0.27, which is statistically significant at the 95% confidence level. On the graph, points that fall along the middle black line are countries for which the GC-LTS index and Insecure Tenure and Property Rights index exactly agree. The blue lines show countries where the values on the two indices are within plus or minus 0.1 of each other and the dashed lines show where the index values are within plus or minus 0.25 of one and other.

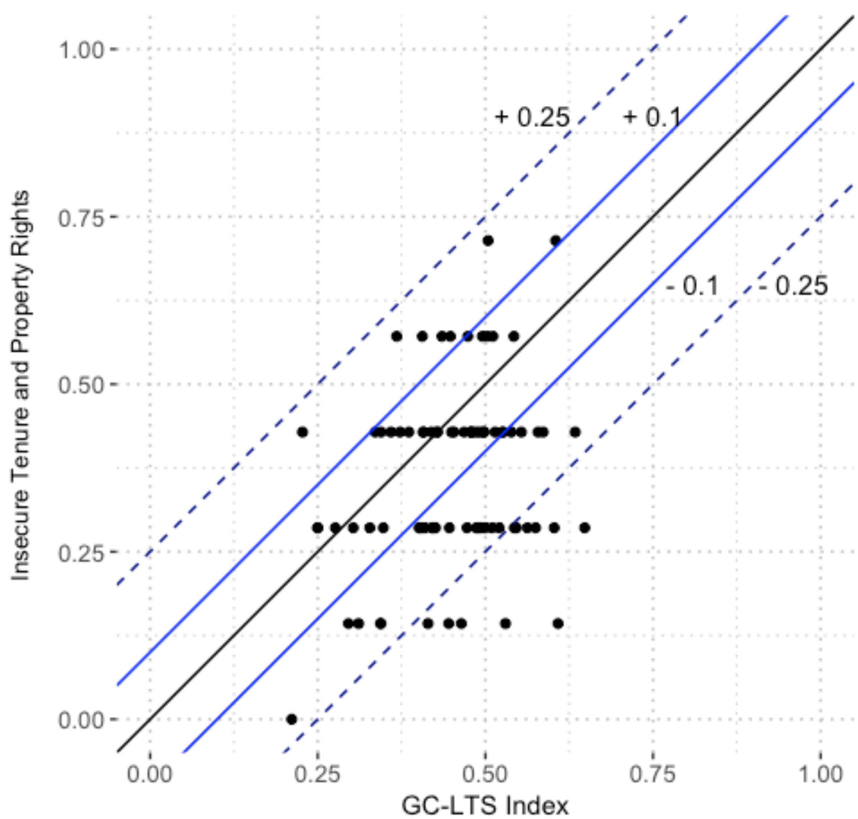


Figure A3-1 Agreement between the GC-LTS index and Insecure Tenure and Property Rights Values

I find that there is a level of agreement between the two indices, with about 44% of countries falling within the plus or minus 0.1 band. This agreement provides support for the GC-LTS index, as the older index was based on substantial expert consultation. However, as I have noted, the GC-LTS index is an improvement as it allows for cross-country comparisons and increases the coverage of the older index from 85 countries to 165 countries.

The second data set I compare with the GC-LTS index is the International Property Rights index (IPRI), an index meant to capture where property rights are most secure, which has been employed as a proxy for land tenure security (Property Rights Alliance, 2016). The construction of the IPRI is similar to the GC-LTS index with the exception of the IPRI's focus on intellectual property rights. For practitioners and policy-makers interested specifically in land tenure security the inclusion of this intellectual property rights component may results in a misinterpretation of the IPRI. The other two components of the IPRI include physical property rights and the legal and political environment. In the comparison of these two indices, I use a dataset requested from the Property Rights Alliance that allows us to disaggregate the three main components of the IPRI and exclude the intellectual property rights. Figure A3-2 shows the agreement between these two indices, which is quite high. But, as with the USAID/ARD Inc. ranking, given my methodological improvements of using data closely-linked to academic definition of land tenure security the GC-LTS is an improvement over the IPRI for applications seeking to represent land tenure security.

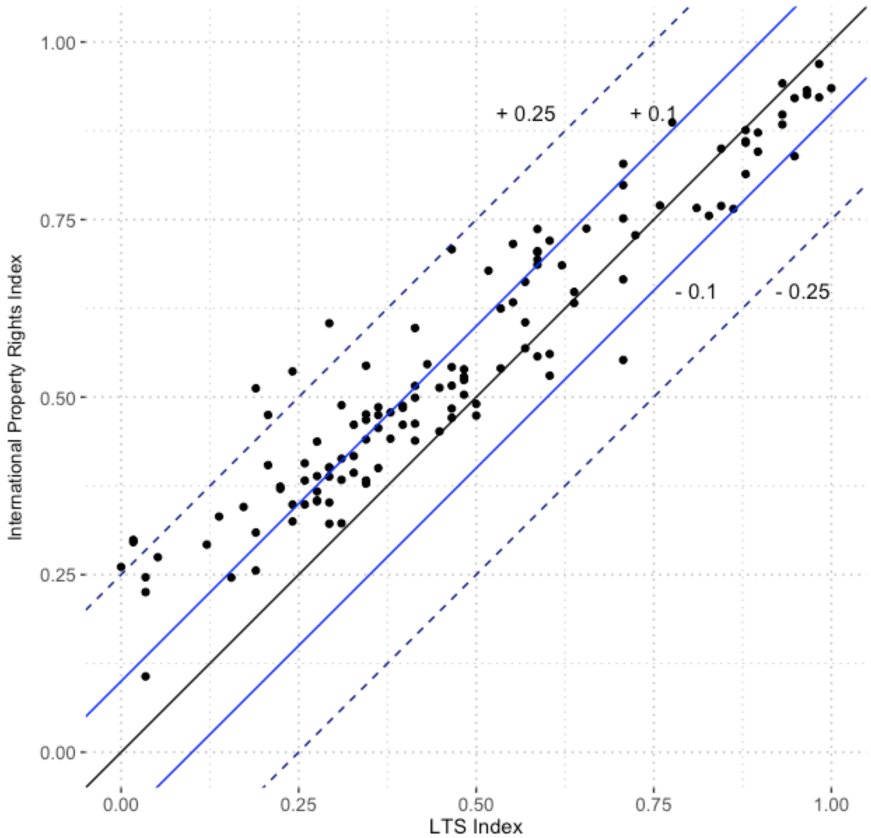


Figure A3-2 Agreement between the GC-LTS index and International Property Rights Index

APPENDIX 4-1 INTERMEDIARY RECRUITMENT EMAIL

Recruitment Email for Técnicos
Sujeto: Solicitud para su participación; compartir experiencias en los programas de pagos por servicios ambientales
Date: Febrero 24, 2016

Estimado/a técnico/a,
Soy una estudiante de postgrado de los estados unidos, mi nombre es Allison Kelly. Le escribo porque estoy haciendo un estudio académico sobre los programas de pagos por servicios ambientales. Voy a hablar con muchas personas sobre los programas y quisiera hablar con usted también. Quiero asegurarme que su voz no se ignora.

Encontré su correo en la lista de CONAFOR. Me gustaría realizar una entrevista con usted.

Una entrevista demora más o menos una hora y su participación sería totalmente voluntaria, puede elegir a no contestar cualquier de las preguntas y puede salir cuando necesita. Mis preguntas son generales sobre sus experiencias con los programas y como comunica con los ejidos en el programa. No preguntaré información personal, tampoco no represento a ninguna asociación del gobierno Mexicano ni lo de los estados unidos. No compartiré sus respuestas, ni su información, las entrevistas será totalmente confidencial y solo usaré la información para fines académicos.

Allison Kelly

PhD Candidate / Candidata a Doctorado
Evans School of Public Policy and Governance
Graduate Fellow in Environmental Politics and Governance, Center for Environmental Politics
University of Washington

allisonckelly@gmail.com

Cel. Mex. 44-26-04-69-35

APPENDIX 4-2 INTERMEDIARY INTERVIEW

1. With which payments for ecosystem services program have you worked? Since when?
2. What challenges or opportunities for improvement do you see in the programs?
3. What is your role in developing a project?
4. How do you begin work on a new project? Do you look for participants or do they look for you?
5. What characteristics do you look for in a new community or landholder?
6. In your experience, why do participants decide to become part of a project?
7. What information do you share with participants?
8. What benefits do participants receive?
9. Have you observed any conflicts over forests or land caused by a project? How have these been resolved?
10. Of the participants that are women, what is their role in a project?
11. With which ejidos or communities have you worked? Can you share their contact information with me?
12. Are there other people with whom you think I should talk?
13. Could you share copies of project contracts with me?
14. Do you have any other comments?

1. ¿Con cuales programas de pagos por servicios ambientales ha trabajado usted?

2. ¿Cómo es su rol en el desarrollo de un proyecto?

3. ¿Cuáles retos u oportunidades para mejorar vea usted de los programas?

4. ¿Cómo empieza para trabajar en un nuevo proyecto? ¿Usted busca los participantes o ellos buscan a usted?

5. ¿Qué características busca usted en un nueva comunidad?

6. ¿Si puede hablar en general, por que deciden los participantes a participar?

7. ¿Qué información comparte usted con los participantes?

8. ¿Cuáles beneficios reciben los participantes?

9. ¿Has observado conflictos sobre el bosque causado por un proyecto? ¿Cómo han resuelto esos?

10. ¿De los participantes que son mujeres, cómo son sus roles?

11. ¿Con cuales ejidos o comunidades? ¿Me puede compartir sus datos de contacto para que yo puedo continuar mi investigación?

12. ¿Hay otras personas con quien crea que yo debo hablar?

13. ¿Podría compartir las copias de los contratos?

14. ¿Tiene otros comentarios?

APPENDIX 4-3 COMMUNITY MEMBER INTERVIEW

1. How do people use the forest? [Make a list of uses additional to the ones recognized in the Ag. Census.; Follow up How do you use the forest?]

2. Who uses the forest? [Follow up if not mentioned: Is everyone that uses the forest from your community?]

3. How do members of your community know what areas of land they can use for their benefit?

4. Who makes decisions about the management of forests?

5. What information do they use to make these decisions?

6. When there is a conflict over the forest, how does your community resolve it?

7. How do members of your community become involved in the PES program?

8. What did [the decision makers] consider when deciding whether or not to participate in the PES program?

9. Of any of the information used, was anything unclear?

10. What were the changes you saw in community members after the PES program started? [Follow up if not mentioned: How did use of the forest change after the PES program started?]

1. Actualmente, ¿cómo utiliza la gente los bosques?
[Trate de hacer una lista de los usos forestales adicionales a los recogidos por el Censo Ag.; ¿Como usa el bosque usted?]

2. ¿Quién utiliza el bosque? ([Haga un seguimiento si no se menciona:] ¿Todos que usan el bosque son parte de su comunidad?)

3. ¿Cómo saben los miembros de su comunidad qué áreas de tierra pueden usar para su beneficio?

4. ¿Quién toma las decisiones sobre la administración de los recursos forestales?

5. ¿Qué información se utiliza para tomar esas decisiones?

6. Cuando hay un conflicto sobre el uso del bosque, ¿Cómo lo resuelve tú comunidad?

7. ¿Cómo se involucran los miembros de tú comunidad en el [programa de PSA específico]?

8. ¿Qué consideró [decisor por esta tierra] para decidir participar en el [programa de PSA específico]?

9. ¿De la información utilizada, cual de ella no fue clara? (¿Restricciones Desconocida de uso del suelo, la duración de la participación, o costos y beneficios de la participación?)

10. ¿Cuáles fueron los cambios que viste en los miembros de su comunidad cuando él [programa de PSA específica] comenzó? (Seguimiento si no se menciona: ¿Cómo cambió el uso de los bosques cuando comenzó el [programa de PSA específica]?)

APPENDIX 4-4 MUNICIPALITY TENURE DATA

Table A4-1 Tenure Breakdown by Municipality

Municipality	Total Area (Hectares)	Ejidal	Communal	Private	Public
Chalchicomula de Sesma	33,070	29,996	7	3,059	8
Chignahuapan	51,919	33,184	3	18,269	463
Izúcar de Matamoros	31,172	26,137	103	4,932	0
San Martín Totoltepec	995	2	224	769	0
Tehuacán	18,133	12,385	1,652	4,096	1
Tehuitzingo	28,991	15,395	84	13,511	0
Tlachichuca	22,129	18,923	82	3,123	1
Xochiltepec	1,964	3	565	1,395	0

APPENDIX 4-5 SUMMARY ANALYSIS OF THE LOCAL FOREST INSTITUTIONAL CONTEXT

IFRI Design Principle	Local Institution
DP - 1. the expected value of long-term use of a forest exceeds the expected cost of managing the forest;	*unclear – tenure laws regarding social property make the transaction costs high for many alternate uses*
DP - 2. local forest users participate in and have continuing authority to design the institutions that govern the use of a forest system;	*asamblea create their own rules and forest management plans* ***with the aid of intermediaries in some cases***
DP - 3. the individuals most affected by the rules that govern the day-to-day uses of a forest system are included in the group that can modify these rules;	*asamblea make management decisions including PES program participation*
DP - 4. the institutions that govern a forest system minimize opportunities for free riding, rent seeking, asymmetric information, and corruption through effective procedures for monitoring the behavior of forest users and officials;	*unclear - asymmetric information and corruption were both identified as challenges during interviews,* ***intermediaries play a large role in ensuring the transparency of PES program information***
DP - 5. forest users who violate rules governing the day-to-day uses of a forest system are likely to receive graduated sanctions from other users, from officials accountable to these users, or both;	*sanctioning via an appointed vigilance council or via the asamblea and local leadership*
DP - 6. rapid access is available to low-cost arenas for resolving conflict between users or between users and their officials;	*an asamblea of peers can be called at local meeting houses to resolve conflicts*
DP - 7. monitoring, sanctioning, conflict resolution, and governance activities are organized in multiple layers of nested enterprises; and	*-resolution through an asamblea is the first level; a regional office is the next level* *-forest monitoring is achieved both through local vigilance councils,* ***to a small extent program intermediaries****, and ultimately regional CONAFOR staff.*
DP - 8. the institutions that govern a forest system have been stable for a long period and are known and understood by forest users.	*- the ejido/comunidad system is well established*

VITA

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