Branching Out
Incentives & Disincentives to Agroforestry

CAPSTONE PROJECT PREPARED FOR The World Resources Institute

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About The World Resources Institute and the Capstone Project

The World Resources Institute (WRI), an international non-profit present in over 60 countries, is dedicated to researching solutions for sustaining the world’s natural resources. One area that WRI is focused on is advising national decision-makers on how they can increase the productivity of their land coverage to achieve various development goals. Land restoration is a key strategy to return degraded landscapes to economic and environmental productivity, so WRI has created the Global Restoration Initiative (GRI) focused on leveraging international partnerships to promote global land restoration and sustainable land-use. With this Initiative, WRI aims to create restoration diagnostic tools to assist decision-makers in their land restoration projects. By supporting the conversion of degraded landscapes through sustainable agriculture, agroforestry, and reforestation, WRI also supports the preservation of traditional livelihoods and climate adaptation and mitigation efforts (WRI, 2019).

To achieve its global impact, WRI has country offices across six continents. These offices support various projects in each national context.

Our capstone project seeks to aid WRI’s understanding of the political, social and economic aspects of agroforestry, which is a type of land-use and restoration strategy. The countries of interest are Brazil, India, and Mexico. We analyzed key trends and challenges in agroforestry implementation in each individual country context, with the goal of identifying common policy incentives that WRI can draw from when recommending decision-makers on future agroforestry projects.
Executive Summary

In recent decades, governments and international organizations have recognized that ending poverty requires strategies that improve health and education, reduce inequality, promote economic growth, and tackle climate change by preserving the environment (United Nations, 2015). Global land degradation is a problem negatively affecting all of these development goals. Agroforestry, a land-use strategy that combines trees and agricultural crops, has the potential to address this problem’s social, economic, and ecological aspects. Historically practiced at a small scale in areas around the world, agroforestry is now seen as a practice that can support national food sovereignty, economic development, climate change adaptation and mitigation, and overall landscape-level resilience (Montagnini, 2017; Moreno-Calles et al., 2016).

Through an analysis of the political economy of agroforestry in the countries of Brazil, India, and Mexico, and research into policies identified by the World Resources Institute (WRI), this report identifies various incentives and disincentives that work to either promote or impede the practice of agroforestry.

The report begins with an introduction to agroforestry and how it has evolved from being a traditional practice to a tool for achieving socio-economic and ecological objectives. After laying out the scope of the research as mandated by WRI, we list out the social science tools used to drive our research on agroforestry across the national contexts. The next section on political economy describes each country’s trends, stakeholders and selected policies in agroforestry. The specific policy mechanisms promoting agroforestry, as well as the formal and informal barriers challenging its potential to scale are analyzed in greater detail in the following section. To conclude, the report identifies similarities and differences in both approaches and barriers to agroforestry across the three countries.

We hope that this report will aid WRI in its understanding of policy mechanisms to promote agroforestry, so that it can better inform decision-makers in these countries and beyond on how to implement related projects.
Key Messages

Each country has different goals for agroforestry, the implementation of which is influenced by the administering institution.

Land tenure and ownership structures are crucial in determining the adoption of agroforestry, especially by smallholder or landless farmers.

Incentives must address the temporal lag between the initial tree planting period and the reaping of benefits.

Enhanced agroforestry extension services including capacity building and market access are important for farmers to adopt and practice agroforestry on a commercial scale.

Inclusion of local institutions, women, and indigenous groups in the planning and design of agroforestry projects is crucial for representation and knowledge-sharing.
**Acronyms**

**AFS:** Agroforestry Systems  
**BANSEFI:** Bank of National Savings and Financial Services (Banco del Ahorro Nacional y Servicios Financieros)  
**BIENESTAR:** Secretary of Welfare in Mexico  
**BMC:** Biodiversity Management Committees in India  
**CAC:** Peasant Learning Communities (Comunidades de Aprendizaje Campesino)  
**CAMTA:** Cooperative in Tomé-Açu (Brazil)  
**CBD:** Convention on Biological Diversity  
**CEPEA:** Center for Advanced Studies on Applied Economics (Brazil)  
**CGIAR:** Consultative Group for International Agricultural Research  
**CONAFOR:** National Forestry Commission of Mexico (Comisión Nacional Forestal)  
**CSOs:** Civil society organizations  
**DARPG:** Department of Administrative Reforms and Public Grievances in India  
**DDP:** Desert Development Programme in India  
**DFID:** Department of international Development  
**DoLR:** Department of Land Resources in India  
**DPAP:** Drought Prone Area Programme in India  
**EPA:** Environmental Protection Agency  
**ESALQ-USP:** Luiz de Queiroz College of Agriculture, University of São Paulo  
**FAO:** Food and Agriculture Organization of the United Nations  
**FSI:** Forest Survey of India  
**GDP:** Gross Domestic Product  
**GRI:** Global Restoration Initiative  
**GSWMA:** Gujarat State Watershed management Agency in India  
**IBGE:** Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística)  
**ICRAF:** International Council for Research in Agroforestry  
**ICRITER:** Indian Council for Research on International Economic Relations  
**IIED:** International Institute for Environment and Development  
**ILOSTAT:** International Labour Organization Database  
**INCRA:** National Institute of Colonization and Agrarian Reform (Instituto Nacional de Colonización e Reforma Agraria)  
**IPAM:** Amazon Environmental Research Institute (Instituto de Pesquisa Ambiental da Amazônia)  
**IPBES:** Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services  
**ISPN:** Institute Society Population and Nature (Instituto Sociedade População e Natureza)  
**ITPS:** Intergovernmental Technical Panel on Soils (FAO)  
**IUCN:** International Union for Conservation of Natural Resources  
**IUFRO:** International Union of Forest Research Organizations  
**IWDP:** Integrated Wasteland Development Programme in India  
**IWMP:** Integrated Watershed Management Programme in India  
**KVKs:** Krishi Vigyan Kendras or Farmer Science Centres in India  
**LR:** Legal Reserves in Brazil  
**MAIF:** Milpa Interspersed Between Fruit Trees (Milpa Intercalada entre Árboles Frutales)  
**MOEF:** Ministry of Environment and Forests of India  
**NBA:** National Biodiversity Authority in India  
**NDC:** Nationally Determined Contribution  
**NGO:** Non-governmental organization  
**NMSA:** National Mission for Sustainable Agriculture  
**NPF:** National Policy for Farmers (India)  
**NTFP:** Non-Timber Forest Product  
**NWDA:** National Water Development Agency of India  
**OECD:** Organisation for Economic Co-operation and Development  
**PAA:** Food Acquisition Program (Brazil)  
**PRBRs:** People’s Biodiversity Registers in India  
**PES:** Payment for Environmental/Ecosystem Service  
**PPA:** Permanent Preservation Areas (Brazil)  
**PRONAF:** National Family Farming Program (Brazil)  
**RFA:** Recorded Forest Area (India)  
**SAF:** Agroforestry System (Sistema Agroforestal)  
**SAGARPA:** Mexican Secretariat of Agriculture and Rural Development (Secretaría de Agricultura y Desarrollo Rural)  
**SBBs:** State Biodiversity Boards in India  
**SEMARNAT:** Mexican Secretariat of Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales)  
**SHGs:** Self Help Groups (India)  
**SLNA:** State Level Nodal Agencies in India  
**SMAF:** Sub-Mission on Agroforestry  
**SV:** Sembrando Vida (agroforestry/welfare program implemented in Mexico since 2019)  
**TOF:** Trees Outside Forests  
**UER:** Rural Economic Unit (Mexico)  
**UNEP:** United Nations Environment Programme  
**UNSSC:** United Nations System Staff College  
**WDC:** Watershed Development Component (India)  
**WDC-PMKSY:** Watershed Development Component of Pradhan Mantri Krishi Sinchayee Yojana in India, watershed Development Component of the PMKSY Policy  
**WHO:** World Health Organization  
**WRI:** World Resources Institute  
**WWF:** World Wildlife Fund  

**Note on currencies:** In a few areas of the report, we provide conversion between different currencies and USD (e.g. rupees, Mexican peso). Conversions are calculated with exchange rates as of May 2020.
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I. Introduction

THE PROBLEM OF LAND DEGRADATION

Natural landscapes support the physical, chemical, and biological interactions that shape life on Earth. From a human perspective, land-based ecosystems provide us with food, clothing, and energy, as well as cultural and spiritual value. However, unsustainable agricultural and forestry practices, urban expansion, and extractive industry are destroying landscapes and the services they provide at a global scale (IPBES, 2018). This land degradation affects 23% of the world’s terrestrial area, and is increasing at a rate of 5-10 million hectares per year (IUCN 2019). In monetary terms, the International Union for Conservation of Nature estimates that global land degradation costs between $6.3-$10.6 trillion in loss of biodiversity and ecosystem services (IUCN, 2019). Yet, under the pressures of population growth, unsustainable consumption, and climate change, this problem is expected to increase.

Two main solutions to land degradation exist: restoration and the promotion of sustainable land-use practices (UNEP, 2017). Restoration is broadly defined as the rehabilitation of a degraded site back to environmental and economic productivity (WRI, n.d.). Sustainable land-use, on the other hand, refers to natural resource management practices that meet both current and future human needs by maintaining the landscape’s ecological functions (FAO, 2017).

WHAT IS AGROFORESTRY?

Origins and Development

Agroforestry is a livelihood practice of cultivating tree species and agricultural crops together that has been a part of human cultures throughout history. Ancient farming systems around the world—from Western Europe and Latin America to Sub-Saharan Africa and Southeast Asia—were often complex and involved multiple crop species integrated with forested areas to support food production. However, the growth of plantation monocultures due to the expansion of colonial power in the 19th century disrupted these food systems. Over time, agricultural and forest systems grew increasingly separated at large scales (World Agroforestry Centre, 1987).

In the late 20th century, a new interest in agroforestry as a tool for food production and environmental conservation was born amidst increasing food insecurity in the developing world and global ecological degradation (World Agroforestry Centre, 1987). To address these problems, scholars wanted to better understand the function of these food production systems and improve existing practices (Nair, 1993; IUFRO, 2005). A growing field of scientific research began to investigate aspects of agroforestry systems such as beneficial crop combinations and soil productivity. In 1983, Lundgren and Raintree standardized the definition of agroforestry to be “a land-use system that combines woody perennials, agricultural crops, and/or animals on the same land management” (Nobre, 1998).

Multilateral institutions such as the World Bank and the Food and Agricultural Organization of the United Nations grew interested in the potential for agroforestry to address hunger in the developing world (World Agroforestry Centre, 1987). This led to the founding of The International Council for Research in Agroforestry (ICRAF, now known as the World Agroforestry Centre) in 1978 to support agroforestry research and projects around the globe.

From this period to the present, agro-
forestry implementation methods shifted from a top-down academic approach to a farmer-designed approach based on local knowledge (IUFRO, 2005). Moreover, quantification measures have expanded beyond system productivity to include economic measures and the valuation of social and environmental services.

**Benefits of Agroforestry**

Today, agroforestry is widely used as a tool to advance sustainable development goals. Indeed, the practice can yield timber, food, and cash products while improving environmental services. The benefits of agroforestry can be loosely categorized as environmental and socio-economic.

- The presence of trees and multiple crop species improves nutrient cycling, soil quality, and water retention (Nair, 1993). The latter is especially important for food systems in drier regions (Ribaski & Meneses, 1994; Mazumdar-Shaw, 2019).

- In some instances, trees act as windbreaks and prevent erosion (Nair, 1993).

- Agroforestry systems also provide habitats that preserve and/or enhance biodiversity.

- At a global scale, agroforestry systems contribute to carbon sequestration by preserving woody biomass and increasing organic carbon stored in soils, but the amount of carbon sequestered is largely context-dependent (Yale Global Forest Atlas, n.d.).

- Increased woody biomass is also a source of timber, fodder, and fuel commodities, which can be a profitable venture when demand is high (World Agroforestry Centre, 1987).

- Agroforestry serves as a link between communities and their surrounding environment and also holds cultural, religious, and spiritual significance through its intimate engagement of people and nature (Vallejo et al. 2015; FAO, 2015).

For this project, the World Resources Institute (WRI) tasked us with analyzing the incentives and disincentives that affect the implementation and scaling of agroforestry in Brazil, India, and Mexico. WRI is currently leading land restoration efforts in these “mega-di-
verse nations” that hold substantial portions of the world’s biological wealth (IUCN, 2013). Yet, in each country, land degradation has impacted this biodiversity while driving food and economic insecurity for many dependent rural communities.

We worked with WRI’s offices in São Paulo, New Delhi, and Mexico City and with their headquarters team in Washington, D.C. to analyze policy incentives that aim to improve farmer livelihoods, provide market access for agroforestry goods, and compete against the short-term profits of other land-uses, among other targets. This report presents the political economies that influence the implementation of agroforestry systems in the three countries and concludes by identifying overarching trends WRI can use for future work.

The question that guided our research was:

What is the political economy around agroforestry in Brazil, India, and Mexico, and how does it contribute to the incentives and disincentives for the implementation of agroforestry policies to achieve economic, social, and environmental goals?

This project scope is based on a selection of policies that the WRI country offices identified (Figure 2). In Brazil and Mexico, we used a national lens. For India, we were asked to look at the policies at the level of three states: Telangana, Karnataka, and Gujarat.

We produced three deliverables:

1. A report: This includes the full political economy and incentives/disincentives analysis across the three countries.

2. A briefing presentation: this highlights our key cross-country findings.

3. A framework spreadsheet of select policies and the incentives and disincentives for agroforestry embedded therein, as requested on behalf of WRI India (Appendix 5).

Figure 2. Policies of Interest in Brazil, India and Mexico
II. Methodology

OVERVIEW

WRI set out two distinct research goals to assess how agroforestry can address land degradation in Brazil, India, and Mexico: first, to orient agroforestry within each country’s political and socio-economic landscapes, and second, to analyze the incentives supporting and the disincentives impeding agroforestry implementation. We bounded the incentives analysis by the specific policies of interest in Figure 2, but considered other policies and/or informal mechanisms that could disincentivize agroforestry implementation (see Appendix 1 and 2). To create a comparative analysis of cross-country findings, we developed frameworks inspired by the work of WRI and other literature.

The methodology for this report is outlined in Figure 3.

LITERATURE REVIEW AND DATA COLLECTION

We first conducted a literature review and held primary interviews with a variety of experts.

Brazil:

In Brazil, we reviewed government documents and political science research. We examined the government structure, policy history, current policies, and policy implementation on issues related to agroforestry, including agriculture, environmental protection, forest conservation, commodity trading, indigenous communities, and climate change. At the time of research, the national government of Brazil’s websites for maintaining documents and records on agroforestry and environmental regulations frequently led to in-

<table>
<thead>
<tr>
<th>LITERATURE REVIEW AND DATA COLLECTION</th>
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<tbody>
<tr>
<td>Review agroforestry practices and policies of interest in each country</td>
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<tr>
<th>DATA ANALYSIS</th>
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<tr>
<td>Create framework for political economy analysis to organize key issues and stakeholders by country</td>
</tr>
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</table>

<table>
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<tr>
<th>IDENTIFICATION OF COMMON ISSUES AND RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highlight areas of improvement and make policy recommendations for better facilitation of agroforestry</td>
</tr>
</tbody>
</table>

Figure 3. Outline of Methodology
active links and unavailable pages. As a result, we relied on policy papers and law reviews to gather this information over the past 10 years through 2019.

Subsequent research focused on interviews with in-country experts to gather information on stakeholders, policy implementation, farmer perspectives, political priorities, and industry best practices. WRI’s Brazil team in São Paulo provided contacts of agroforestry practitioners, particularly farmers and agricultural researchers, who in turn provided us with information about their current practices. This was helpful considering the dearth of published information caused by a lack of established farming associations and research organizations for Brazil’s small farmers.

**Mexico:**
In Mexico, the policy of interest, Sembrando Vida, was only established in 2019, so limited literature was available. We focused our literature review on the history of land tenure, community forestry, and agroforestry practices utilized in Mexico prior to the introduction of the policy. We also reviewed the operational documents establishing the guidelines for implementation of Sembrando Vida (literally, “Sowing Life”), and the periodic progress documents released by the Ministry of Welfare.

We interviewed academic experts to gain more understanding about the landscape of agroforestry and community land management in Mexico, experts from WRI to gain insight on the relationship between development and environmental protection, and experts on the ground (including government employees and representatives of NGOs and cooperatives) to learn about the practical aspects of implementation, and the impacts on the ultimate beneficiaries.

**India:**
In India, the scope of the research, in terms of the selected policies and states, was decided with the intention of expanding on WRI India’s existing work. WRI India provided us with a research framework to build on with additional incentives and disincentives identified through our research. The Excel framework consisted of two sheets regarding, first, the policy of interests’ details on, but not limited to, departments and agencies, relevance to agroforestry, extension services, and financial outlay, and second, the policy of interests’ incentives and disincentives relevant, but not limited, to livelihoods, markets, gender, and access to materials.

In order of priority, we used the following types of literature: official government documents, peer-reviewed papers, and news articles. Government documents included policies, amendments, operational guidelines, committee reports, and financial reports. We also conducted a brief literature review on the classification of incentives related to restoration and sustainable land-use.

For primary interviews, we spoke to experts on agroforestry, conservation, agriculture, women’s land rights, and integrated watershed management in India. We located these experts through our Columbia University network, our professional network, and WRI India’s connections from their ongoing agroforestry research. Our interviewees in turn connected us with other experts. Since interviewees were mostly from civil society organizations and academia, we were therefore careful in addressing that through corroboration with our literature review.

**DATA ANALYSIS**

For our analysis, we developed research frameworks to facilitate the identification of commonalities and differences across
**Box 1. Sustainable Land-Use Terminology**

<table>
<thead>
<tr>
<th>Land degradation</th>
<th>The reduction in the quality of soils and land utility, which negatively impacts food production, livelihoods, and the production/provision of other ecosystem goods and services (WHO, 2012).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land restoration</td>
<td>The ongoing processes that attempt to restore the ecological productivity of a degraded landscape, in order to achieve benefits for people and the environment (Bonn Challenge, n.d.).</td>
</tr>
<tr>
<td>Sustainable land-use practices</td>
<td>Natural resource management practices that meet both current and future human needs by maintaining the landscape’s key ecological functions.</td>
</tr>
<tr>
<td>Agroforestry</td>
<td>A land-use system that combines woody perennials, agricultural crops, and/or livestock animals on the same land management, with the potential to provide economic, social and environmental benefits.</td>
</tr>
</tbody>
</table>
| Characteristics of a smallholder, small scale farmer, family farmer | The definition of a “small farmer” varies from country to country, but **landholding size** of 2 hectares or less is used by the World Bank to identify smallholder farmers. In the world, there are approximately 500 million farmers and they produce 80% of the world’s food (Graeub et al., 2016).  
**Brazil:** “Fiscal modules” are used to compare farmers. These weigh the type of exploitation in a farm and its proceeds (IPAM, 2018). Small farms can have up to 4 fiscal modules. Depending on the municipality, the size of one module can range from Sha to 100ha each (INCRA, 2020).  
**India:** medium-sized farms are between 2-10 hectares, and large farms are above 10 hectares.  
**Mexico:** According to Graeub et al., Mexico’s definition includes heavy use of family labor and limited access to capital as a component of the family farm. |

**Box 2. Broad Stakeholder Categories**

<table>
<thead>
<tr>
<th>National Government</th>
<th>This category concerns all government agencies (federal, state, municipal) administering agroforestry policies and projects, or whose policies can affect agroforestry outcomes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers and cooperatives</td>
<td>Farmers are the target stakeholder of agroforestry policies (Rahnman, 2018). In this category, we include farmer associations that represent these stakeholders’ interests.</td>
</tr>
<tr>
<td>Civil society organizations (CSOs), non-governmental organizations (NGOs), and other local institutions</td>
<td>These include non-governmental organizations with an interest in local agroforestry projects, or with experience in related fields of agriculture, rural institutions, watershed development, etc.</td>
</tr>
<tr>
<td>Private sector and agribusinesses</td>
<td>While the private sector is most relevant in Brazil, we include the stake of larger landowners when relevant as their land-use practices impact what land and/or techniques are used for agroforestry.</td>
</tr>
<tr>
<td>Indigenous communities</td>
<td>Across all three countries, the knowledge that traditional and indigenous groups have of local biodiversity and farming techniques is an important resource for agroforestry projects.</td>
</tr>
</tbody>
</table>
each national context.

**Framework for the political economy analysis**

Political economy analysis is a tool for understanding how power and resources are distributed in different contexts, and how those dynamics affect development outcomes (Denney, 2016; DFID, 2009; Kempster, 2015). We used this approach to identify the three countries’ practices and stakeholders in relation to agroforestry as it is currently practiced.

First, we drew from a number of political economy analysis toolkits to develop a series of key questions on agroforestry in each country context. To easily visualize and compare the answers to these questions, we created three issue matrices inspired by the United Nations System Staff College (UNSSC, 2016) (Appendix 3).

Second, we performed a stakeholder analysis to identify and “account for” the actors with a stake in current agroforestry implementation in each country (World Bank, 2001). In order to facilitate cross-country comparison, we considered the following stakeholder groups in Box 2.

Using the method developed by the World Bank (2001), we organized the results of our expert interviews and secondary research on stakeholders into a power-interest matrix. This provided us with an overview of the level of priority stakeholder groups attached to the policies under discussion (Figure 4) (interest), and the impact of each stakeholder group on the implementation of the policies (power). The matrix delineates four types of stakeholders:

- **Promoters:** Stakeholders who attach high priority to agroforestry policy/program and whose actions can impact the implementation of the policy
- **Defenders:** Stakeholders who attach high priority to agroforestry policy/program but whose actions cannot have an impact on policy implementation
- **Apathetics:** Stakeholders whose actions cannot affect the implementation of the agroforestry policy/program and who attach a low priority to this policy
- **Latents:** Stakeholders whose actions can affect the implementation of the agroforestry policy/program but who attach a low priority to this policy

![Figure 4. Power-interest Matrix (Adapted from the World Bank)](image)

**Framework for the incentives and disincentives analysis**

In public policy, incentives are the mechanisms that influence behavioral changes to achieve stated policy goals.

We used two main sources to create a framework to analyze incentives: Kothari’s Incentives for Biodiversity Conservation at the Local Community Level (1999), and WRI’s study on incentives for land restoration. The former is an overview of incentives developing countries can use to conserve and use their resources more sustainably (Kothari, 1999). Kothari categorizes incentives that target local communities, like traditional farming groups who live in areas important for biodiversity conservation. This lens maps well onto agroforestry in Brazil, India, and Mexico whose main practitioners are small-scale farmers (Rahman, 2018). Additional sub-points to the table were drawn from a 1999 FAO study on enhancing agroforestry in Asia (FAO, 1999).

To complement our analysis of policy incentives, we created a disincentives frame-
work summarizing mechanisms that impede agroforestry outcomes. This was also inspired by the above-mentioned work on incentive categories. Further sub-points were drawn from a study of agroforestry in Bolivia (Jacobi et al., 2016) and work by the International Union for Conservation of Nature (IUCN) on incentives to conserve biological resources (McNeely, 2006).

It is important to note that we distinguish between perverse incentives and disincentives in our analysis. We define:

- **Perverse incentives** as mechanisms put in place to advance agroforestry but that have an unintended negative or contrary impact (IPBES, 2018).

- **Disincentives** are separate mechanisms already in place that perpetuate the problems agroforestry attempts to solve and/or that overpower existing policy incentives. We also include informal mechanisms that affect the behavior of stakeholders in agroforestry.

**IDENTIFICATION OF COMMON ISSUES AND RECOMMENDATIONS**

The frameworks (Appendix 1 and 2) allowed us to compare and contrast the current status of agroforestry implementation in each country. Figure 27 (page 40) summarizes the identified incentives categories for agroforestry. Team discussions on issues and practices as well as expert interviews in Brazil, India, and Mexico also helped determine key trends and challenges.

**LIMITATIONS**

Given the limited timeline for this project, our study was framed by specific policies of interest in each national context. Further work could use specific incentive mechanisms as a jumping off point for deeper research as well as consider additional policies. Moreover, the difference in units of analysis across the three countries (national in Brazil and Mexico, sub-national in India) made it challenging in some cases to directly compare and contrast research findings. Future research could reconcile these scales. For the stakeholder matrix, we were not in a position to rank/weigh them relative to each other. Lastly, we used qualitative methods to analyze the incentives and disincentives. Further work could include a quantitative analysis of financial or socio-ecological variables to inform these results. As such, our findings can help WRI identify relevant target areas for future research and analysis.
III. Political Economy Analysis

In the following chapter, we provide an overview of agroforestry in Brazil, India, and Mexico. First, we looked at background information on agroforestry in each country. For this, we developed a series of questions to gain key information on each country’s context, drawing from political economy analysis toolkits. Example questions include:

- **Land use.** How is land used in each country? See Figure 5 for broad trends in forest cover and agricultural land cover.
- **Agricultural population.** How much of each country’s population is involved in agriculture? See Figure 6 for broad trends in each country’s proportion of its rural population.
- **Institutional framework.** What are the institutional structures governing agriculture, forestry, and other land uses?
- **Policy landscape.** Which policies are directly targeted at promoting agroforestry? Which policies have only indirect effects?
- **Stakeholders.** Who are the main stakeholders in each country’s context? How do they interact with each other? How are they affected by agroforestry policies and programs?
- **Implementation priorities.** What are the political priorities in agroforestry implementation? In stated policy goals, is agroforestry linked to protecting the environment, promoting social welfare, or stimulating new markets?
Figure 5. Evolution of the Percent Land Cover of Agriculture and Forest (data from the World Bank)

Figure 6. Evolution of the Proportion of Rural Population Over Total Population (data from the World Bank)

Figure 7. 2016 Gender Distribution of Land Ownership (data from the World Bank)
The structure of land ownership is the most essential element to appreciate the challenges faced by each of the three countries in implementing agroforestry:

- **Mexico**: three-quarters of farms under 20 hectares are ejidos, a collectively-managed entity. On the other hand, three-quarters of farms over 100 hectares are private (note that 2.2% of farms are over 100 hectares).

- **India**: 86.2% of farmers own land of 2 hectares or less. This translates to an aggregate ownership of crop area under 50% for small farmers. Meanwhile, the minority of medium-sized farmers (13.2%) with 2-10 hectares together own an equal amount of crop area (Bera, 2018). Note that the remaining 0.6% of farmers own farms above 10 hectares.

- **Brazil**: crop area ownership is concentrated in the hands of agro-industrialists: the top 1.5% of land-owners occupy 53% of crop land (Gross, 2019). Nonetheless, smaller farmers make up the majority of agricultural operations.

Figure 8 shows a comparative overview of land ownership structures in Brazil, India, and Mexico. Figure 7 shows the ratio of women owning agricultural land.

**Figure 8. Proportion of Farmers (in percentage) Owning Farms of Different Sizes (in hectares)**

How to interpret Figure 8: e.g. in Mexico, 43.5% of farmers own land of 2 hectares or less; 22.9% own land between 2-5 hectares; 22.4% own land between 5-20 hectares; 10.2% of farmers own land larger than 20 hectares.
After gaining background understanding of the countries, we introduce the policies of interest as well as the stakeholders involved using the World Bank’s methodology (2001). Below is a summary of all of the policies and their goals:

<table>
<thead>
<tr>
<th>POLICY</th>
<th>GOALS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WDC-PMKSY</strong></td>
<td>Conserve soil, water, and vegetative cover</td>
</tr>
<tr>
<td>National Policy for Farmers</td>
<td>Improve net income of farmers</td>
</tr>
<tr>
<td>National Biological Diversity Act</td>
<td>Develop inclusive definition of “farmer”</td>
</tr>
<tr>
<td>Amendments to Transit Rules</td>
<td>Reclaim wastelands through restoration</td>
</tr>
<tr>
<td>National School Feeding Program</td>
<td>Provide food security to schools</td>
</tr>
<tr>
<td>Food Acquisition Program</td>
<td>Provide healthy nutrition education</td>
</tr>
<tr>
<td>Brazil Forest Code</td>
<td>Purchase from family farms to improve their livelihoods</td>
</tr>
<tr>
<td>National Family Farming Strengthening Program</td>
<td>Credit lines to family farms to improve their production and income</td>
</tr>
<tr>
<td>Sembrando Vida</td>
<td>Improve livelihood of smallholder farmers through agroforestry</td>
</tr>
</tbody>
</table>

![Figure 9. Combined States Goals of the Policies of Interest](image)

**BRAZIL**

**BACKGROUND**

Forests are integral to the identity of Brazil. Considering that two-thirds of the land of Brazil is covered by forests (World Bank, 2015), it is easy to understand how this biome is not only important to the country’s culture, but also its economy.

The majority of Brazil’s population lives in rural areas, but urbanization is increasing rapidly. As a consequence, Brazil’s forests are jeopardized by land clearing for urban expansion. In this context, the practice of agroforestry is becoming even more important to the health and well-being of Brazil’s environment, people, and economy.

Vegetation in Brazil is divided into 6 biomes (Figure 10), but for the purpose of this study we will focus on the following in Box 3:
The uniqueness of Brazil’s biomes can be appreciated in the diversity of vegetation, soil characteristics, rainfall patterns, and land degradation drivers.

The country’s ecological diversity, coupled with its socioeconomic complexity, determine the need to tailor agroforestry to the unique socio-ecological conditions of each region. This is reflected both in the selection of plant species and in the choice of economic incentives to agroforestry (for example, credit lines).

**Agriculture, economy, and land tenure**

Agribusiness represented 21.4% of the national GDP in 2019. This percentage is the sum of four components (CEPEA/ESALQ-USP, 2019):

- Inputs for agricultural production
- Primary agricultural production
- Agro-industry
- Agro-services

The agribusiness employs 19.54% of the total labor force (Barros et al, 2019), with a gender ratio of 69% men to 31% women (CEPEA/ESALQ-USP, 2019); within the primary agricultural production sector, the proportion is 80% to 20%. For reference, the entire labor force’s national average ratio is 56% men to 44% women (CEPEA/ESALQ-USP, 2019).

---

**Box 3. Brazil’s Biomes Analyzed in this Report**

**AMAZON:** 60% is located in Brazil; 40,000 catalogued plant species; hot and humid climate all year; environmental degradation from agriculture and livestock, infrastructure development, logging, land grabbing, and urban expansion (WWF Brasil, Ministerio de Meio Ambiente)

**CERRADO:** occupies 24% of Brazil; grasslands and dense forests; variable rainfall with a wet summer season and dry winter season (ISP, 2015); threat of deforestation from soy and eucalyptus plantation and livestock; only 55% of natural vegetation remains (Miccis et al, 2019)

**ATLANTIC FOREST:** only 29% of original cover remains because of human activity; one of the most biodiverse regions in the world; deforestation from sugarcane and coffee plantations, urban expansion, natural resource exploitation, and human pollution (SOS Mata Atlantica, Ministerio de Meio Ambiente)

**CAATINGA:** biome is exclusive to Brazil; trees, shrubs, and herbaceous vegetation adapted to arid conditions; experiences wet and dry seasons; environmental degradation from firewood and charcoal production for energy

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**Figure 10. Ecoregions of Brazil (with Biome Names)**
On the other hand, **family farms make up 85% of all agricultural operations** (Gross, 2019). In the 2017 agricultural census, they generated almost 23% of Brazil’s total production value. This number greatly varies in each state, reaching over 65% in the Amazon and as little as 6% in Mato Grosso do Sul (IBGE, Agriculture census, 2017).

Since 2016, **farm aid to large-scale agribusinesses increased, while federal support to family-farming policies decreased** (Gross, 2019). In 2017, the government invested six times more money to support large farmers than small farmers. Because of the sector’s successful export-oriented system, there is a positive narrative around agribusiness; according to this narrative, the sector is bringing growth, prosperity, and food to the nation and the world.

The **growth of agribusiness is part of a recent modernization of Brazil’s latifundia**, or large, private estates with colonial origins (FIAN, 2000). This process highlights the strong relationship between concentrated land ownership and capitalist development.

During the military dictatorship (1964-1985), there was a strong push for agricultural and technological modernization (Barros, 2019). This included the **expansion of rural credit, minimum market prices, fiscal benefits to exports, subsidies to agriculture inputs, and infrastructure development** (Grisa and Schineider, 2014). These policies selectively benefited medium and large producers of export commodities and paved the way for the agriculture industrial complex (Muller, 1989).

Today, Brazil has one of the **highest rates of land ownership inequality in the world**, with a small proportion of agro-industrialists (1.5%) owning 53% of the country’s total crop land (Gross, 2019).

For decades, the uneven distribution of land has been accompanied by the struggles and **movements of landless farmers** (also known as peasants); this group has been excluded from access to land as well as civil, social, and political rights (Daniel and Bega, 2018). The peasant movement for land access contests an historically unequal power structure: the prevalence of latifundia over small farms is rooted in colonial uptake and slavery. In more than one instance, land-related conflicts ended in loss of life. For example, the Corumbiara massacre (Rondonia State, 1995) resulted in 12 dead and 64 injured after military police confronted a landless workers’ occupation (Mesquita and Oliveira, 2001).

Brazil recognizes the rights of farmers on both private and public lands. Public land can be occupied through arrangements such as rural and indigenous settlements and sharecropping (Damasceno et al., 2017). However, land rights are not always secure because of the limited capacity of the government to properly register land, prevent overlapping titles for the same parcels, and protect landowners who hold formal titles to the land yet face eviction (LandLinks, n.d.).

**Land degradation**

There are multiple laws to support both the logging activities and environmental protections of Brazil’s forests (Land Links, n.d.). However, **current land-use practices and deforestation are driving high rates of landscape degradation**, biodiversity loss, changes in rainfall patterns, desertification, and reduced water quality. Agribusiness is also driving unemployment as it is highly mechanized, creates few jobs, and land conversion triggers population displacement (Gross, 2019).

Deforestation has been increasing since 2012, despite forest policy reforms in the 2000s attempting to preserve the Amazon.
Between 2018 and 2019, Brazil experienced a 30% increase in deforestation, linked to the anti-environment rhetoric and dismantling of environmental agencies conducted by the current administration (Escobar, 2019). Other biomes in Figure xx are also threatened by land degradation caused by agribusiness, ranching, and other human activities.

Tenure insecurity is one of the main drivers in the complex landscape of deforestation in Brazil. Landowners clear forests to protect their land rights and landless farmers clear underdeveloped landholdings as proof of land development (Land Links, n.d.).

**Agroforestry in Brazil**

Brazil struggles to reconcile economic development, environmental conservation, and poverty reduction. In The State of Family Farms in the World, Graeub et al. point to the insufficient federal support to family farms, despite this group’s higher per-hectare production and contribution to the domestic food supply (2016). The public policies that indirectly support the development of agroforestry systems at the family farm level are underfunded due to changes in governmental politics, leaving the country without a distinctive policy or directive on agroforestry (A. Miccolis, personal communication, February 27, 2020; V. Ortega, personal communication, March 23, 2020).

In this context, there is no consensus on a standard definition of agroforestry in Brazil. At the time being, the practice pertains primarily to small-scale farmers, but there are avenues in which large-scale farmers may incorporate agroforestry into their practices. In light of the land degradation tied to agribusiness, agricultural researchers and experts believe agroforestry systems can serve as an alternative strategy that can support food security, generate financial income, aid environmental conservation, increase resilience to external inputs, and promote adaptation to climate change (Miccolis et al., 2016; Hoffmann, 2013).

![Plant Combinations used in CAMTA (Amazon)]

<table>
<thead>
<tr>
<th>Cocoa</th>
<th>Açaí Palm</th>
<th>Yellow Mombin</th>
<th>Andiroba*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ipê*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mahogany*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Black Pepper</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Squash</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Passion Fruit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rice</td>
</tr>
</tbody>
</table>

![Other Family Farm Species](

| Cassava | Beans | Pineapple | Banana |

![Top Export Commodities](

| Sugarcane | Soybeans | Coffee | Beef | Corn | Poultry | Eucalyptus | Cotton |

* Non fruit-bearing trees

Figure 11. Contrast of Species Used for Agroforestry and Export Commodities. Family farms produce 87% of cassava and 70% of beans consumed domestically (Gross, 2019).

The development of agroforestry in Brazil faces multiple structural barriers such as inadequate/inexistent logistical infrastructure, issues regarding access to knowledge and education, lack of technical assistance, access to credit lines, and access to a stable market that accommodates the diverse species and cycles of agroforestry systems. Financial institutions lack the technical and financial knowledge to successfully analyze and conduct risk assessments on agroforestry projects. In addition to these barriers, there is also a political and cultural preference for the powerful agribusinesses.
POLICIES OF INTEREST

Starting in the 1990’s, the Brazilian government shifted away from robust subsidies and price controls for agricultural commodities and liberalized trade to increase agricultural outputs, opening up to Foreign Direct Investments. During this time period, the government stopped price controls on agricultural commodities; this corresponded to a rise in agribusiness (World Bank, 2017). Currently, agricultural subsidies in Brazil are considered low, with only 8% of farm production being subsidized (Haupt, 2015). The shift away from agricultural subsidies might be due to fiscal constraints. While subsidies do not directly promote environmentally-degrading farming practices, they do not support the development of environmentally beneficial ones either (A. Miccolis, personal communication, February 27, 2020; V. Ortega, personal communication, March 23, 2020).

The main policies that currently indirectly support the development of agroforestry are:

**Food Acquisition Program (PAA)**

With resources from the Ministry of Citizenship, the government purchases food produced by family agriculture (with the exemption of legal requirements) and allocates them to people in situations of food insecurity and beneficiaries of public social assistance (Law n. 10,696/2003). The United Nations Food and Agriculture Organization considered the PAA a successful example of a program that promotes family farming while reducing food and nutritional insecurity (Gross, 2018).

**National School Feeding Program (PNAE)**

Financial resources are passed from the Federal Government to the State, municipal, and federal schools. A minimum of 30% of resources must be used for the direct purchase of food from family farms or their organizations, prioritizing indigenous and quilombola (groups of descendants of runaway slaves)1 communities. “PNAE aims to contribute to the growth and biopsychosocial development, learning, school performance and the formation of healthy eating habits of students, through food and nutritional education actions and the provision of meals that cover their nutritional needs during the school year.” (Law n. 11,947/2009). Although not directly aimed at promoting agroforestry, the program is considered to have a positive impact across Brazil. In

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1 This definition is from Branford, S. and Torres, M. (2018). Brazilian Supreme Court ruling protects Quilombola land rights for now. Mongabay. The legal definition is provided in the Glossary.
a comparative analysis of 5 study cases across Brazil, all cases mentioned the PNAE as a pro-

moter of agroforestry (ICRAF, 2011).

National Family Farming Strengthening Program (PRONAF)

This policy provides low interest loans to family farms. Interest rates vary according to loan size and type of activity. Within this program, there are specific credit lines to “Forests and Agroecology”.

The Brazilian Forest Code

This law presents an important factor for agroforestry and ecological services. The amendments made in 2012 regulate the legal requirement of privately owned rural properties to hold parcels of land as Permanent Preservation Areas (PPAs) and Legal Reserves (LRs) (Law 12.651/2012), allowing preservation/restoration to be integrated with economic activity through sustainable management. The Code classifies land properties based on fiscal modules that weigh the type of exploitation practiced and its proceeds (IPAM, 2018). Small farms are properties with up to 4 fiscal modules, and medium farms have 4 to 15 fiscal modules. The size of these modules varies depending on the municipality and range from 5ha to 100ha each (INCRA, 2020).

The size of the Legal Reserves varies depending on the biome, and can reach up to 80% of the total property. Since the ratio of land ownership across the country between latifundia and small farms averages 80-to-20 (respectively), no significant ecological performance would result from agroforestry systems at the smaller property level unless the larger producers at least comply with the law (V. Ortega, personal communication, March 23, 2020). Through their forthcoming VERENA project, WRI Brazil is analyzing the returns of employing agroforestry on Legal Reserves to show that it is a worthy and viable economic use of the land.

STAKEHOLDERS

Family farms and traditional communities are the most impacted by public policies on agricultural production, market regulations, and land rights legislation. However, they hold the least power to influence such reforms. As discussed in section IV (Incentives in Brazil), family farms also lack the economic resources and knowledge necessary to establish and maintain new agroforestry systems.

Experts in agroforestry who have the knowledge to teach these practices are in the nonprofit, farm science, and academic space,

<table>
<thead>
<tr>
<th>POLICY</th>
<th>MINISTRY</th>
<th>GOALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>National School Feeding Program (1976)</td>
<td>Federal government, states, and municipalities</td>
<td>Provide food security to schools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide healthy nutrition education</td>
</tr>
<tr>
<td>Food Acquisition Program (2003)</td>
<td>Ministry of Citizenship</td>
<td>Purchase from family, indigenous, and quilombola farms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide food security to underserved</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Purchase from family, indigenous, and quilombola farms</td>
</tr>
<tr>
<td>National Family Farming Strengthening Program (1995)</td>
<td>Ministry of Agricultural Development</td>
<td>Credit lines to family farms to improve their production and income</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Private rural properties required to preserve parcels</td>
</tr>
</tbody>
</table>

*Figure 13. Summary of Policies of Interest in Brazil*
and are driven by environmental conservation. **Cooperatives** can help address the needs of farmers and act as an accelerator for agroforestry systems, when there is previous knowledge and interest (V. Ortega, personal communication, March 23, 2020).

**Indigenous communities** practice agroforestry as a part of their culture. Yet, they are present in the agroforestry conversation in a very marginalized manner. They are seen as guardians of biodiversity, which can generate value as genetic banks to support agroforestry (V. Ortega, personal communication, March 23, 2020). Indigenous groups are probably the most obvious target for agroforestry policies, but are difficult to reach because of their lack of access to social organizations and other institutions (A. Miccolis, personal communication, February 27, 2020).

Finally, government bodies in forestry and agriculture hold immense influence over agroforestry reforms, but have been characterized by experts as more concerned about driving economic growth than long-term social and environmental impacts. This is demonstrated by actions such as deforestation and burning parts of the Amazon Rainforest for farmland (Machado, 2019). In a World Bank analysis of Brazilian agriculture policies, the environment was not mentioned as a policy driver, instead acknowledging macro-economics, market incentives, infrastructure, labor, and education (World Bank, 2017). This view is in part supported by uneven federal support for agribusiness versus small farmers. In addition, in 2019, President Bolsonaro attempted to transfer powers over indigenous lands to the Ministry of Agriculture (which would have benefitted agribusiness); this action was blocked by the Supreme Court (Machado, 2019).

Experts and the literature note that improving the involvement of **financial institutions** holds great impact potential: these institutions can provide farmers with the economic incentives necessary to transition to an agroforestry system. However, financial institutions have no incentive to give credit to agroforestry projects, due to their lack of understanding of how agroforestry systems work. Moreover, the lack of standardized financial information about integrated and successive systems results in the unwillingness to conduct risk assessments. However, there are existing publications detailing the technical steps needed to conduct a study of financial viability and risk assessment that can be adapted to each biome specificity (Arco-Verde & Amaro, 2014).

**Figure 14.** Power-interest Grid of Stakeholders Surrounding the Policies of Interest and the Current Agroforestry Scene in Brazil
BACKGROUND

Agriculture, economy, and land tenure

Even though the share of agriculture in GDP has been declining to 17.4% in 2016, India remains an agrarian nation. The agriculture sector employs almost half of the country’s labor force (estimates range between 42% (ILOSTAT, 2020) and 47% (OECD/ICRIER, 2018)).

More than 85% of farmers in India are categorized as small and marginal farmers (who own 2 hectares or less of agricultural land). This majority of farmers own less than 50% of the total crop area (Bera, 2018).

Land reforms in the 1950s (post-independence era) aimed to curtail colonial practices of exploitative land leasing and tenant farming. However, landlessness persists among farmers to date (Hanstad, 2016). In 2016, the Government of India enacted the Model Agricultural Land Leasing Act to include tenant farmers in welfare schemes that are linked to land ownership. The specific objective of the policy is to improve security of tenure for tenants for the agreed lease period (OECD/ICRIER, 2018).

Land is largely governed by the states, which means that there are different tenancy and land leasing practices in different states. In our analysis, we will focus on the states of Gujarat, Telangana, and Karnataka, as outlined in the map (Figure 15).

Land degradation

With a population of 1.35 billion, India is the second most populous nation in the world (World Bank, 2020). After a spate of famines and crop failures, the country achieved food security and food self-sufficiency only through the Green Revolution in the 1960s and 1970s.

Innovations such as high-yielding crops, mechanized irrigation, and heavy use of chemical fertilizers and pesticides have ensured that total cultivable land remains nearly constant at 54.5 million hectares through the years (OECD/ICRIER, 2018).

However, these practices resulted in land degradation and the depletion of water resources. The decline in water quality and quantity was also fueled by the improper management of surface and groundwater as well as power subsidies. The situation was made worse by a framework of poor access to agricultural extension services for subsistence farmers and fragmented land holdings.
Despite the trend of higher agricultural productivity, it is estimated that the land productivity for some crops will decrease by 10-40% by the end of the century as a result of rising temperatures and increasingly erratic weather patterns caused by climate change (OECD/ICRIER, 2018).

Land degradation not only compromises agricultural outputs, but also impacts the food and livelihood security of communities that are dependent on trees outside forests (TOF), as they are an important source of timber and non-timber forest products (NTFPs) (FSI, 2019). In fact, 65% of India’s timber requirement comes from TOF (Sub-Mission on Agroforestry (SMAF): Operational Guidelines, 2016). The Forest Survey of India defines TOF as “all tree patches occurring outside the recorded forest area (RFAs)” irrespective of patch size (FSI, 2019). Therefore, this technically includes trees on agricultural plots, community lands, and even scattered trees along roads, highways, canals, and urban colonies (Ghosh & Sinha, 2019).

Unlike forests, TOF are not protected by any regulatory framework. This lack of regulation might result in the decline in the TOF population and by extension, a decline in their contribution to supporting community requirements of food, timber, traditional medicine, improved soil quality, etc.

Furthermore, declining tree cover (both RFAs and TOFs) reduces the ability to sequester carbon. While 24.4% of land in India is covered by forests and trees, only 13% qualify as dense forests. The rest is either degraded or open forests or moderately dense forests (Sharma, 2019).

**Agroforestry in India**

In this challenging context, agroforestry has emerged as an important practice. The predominant incentives for India to improve agroforestry include diversifying farm output, increasing land productivity to enhance farmer livelihood, increasing sustainable timber production, moderating microclimate to reduce climate vulnerability, and contributing to climate change mitigation and adaptation. For instance, commercializing agroforestry in tandem with the wood-based industry has immense potential to meet demands for related products (Dagar, 2014), while diverting demand for timber away from natural forests. Agroforestry can contribute to India’s goals under its forest-related policies at the national and international levels. For example, as per

![Figure 16. Historical Evolution of Forestry and Agriculture-related Policies in India](image-url)
the National Forest Policy, 1988, India aims to bring the country’s forest and tree cover to 33% of its total geographical area (FSI, 2019). Under the Bonn Challenge, India made a pledge to restore 21 million hectares of degraded land by 2030. As part of its Nationally Determined Contribution (NDC) to the Paris Agreement, India also aims to sequester an additional two to three billion tonnes of CO2 equivalent (Panda, 2018).

In 2014, India adopted the National Agroforestry Policy under the Ministry of Agriculture and Farmers’ Welfare with the above objectives in mind. This is a first-of-its-kind policy that formalized agroforestry systems that were hitherto being traditionally practiced by communities—growing trees on homesteads and farms has been a common practice in rural India (Ghosh & Sinha, 2019). As per the recommendation of the policy, the Sub-Mission on Agroforestry (SMAF) was set up under the National Mission for Sustainable Agriculture (NMSA) with the primary objective of expanding the practice of agroforestry and ensuring complementarity with other agricultural crops (Sub-Mission on Agroforestry (SMAF): Operational Guidelines, 2016). Other aims of the policy include: simplifying regulations around felling and transportation of trees grown on farmland, ensuring security of land tenure, access to institutional credit and insurance, and investing in research and extension services.

<table>
<thead>
<tr>
<th>BIOME</th>
<th>GUJARAT</th>
<th>KARNATAKA</th>
<th>TELANGANA (state created in the year 2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Generally arid in the north and more wet and fertile in the south</td>
<td>• Comprises of Tropical &amp; Subtropical Moist and Dry Broadleaf forests in the Western Ghats - a biodiversity hotspot that covers 60% of forest area (FSI, 2019); dry /thorny scrub vegetation in the east</td>
<td>• Thorny vegetation and dense woodlands; forests are moist/deciduous and dry savanna vegetation (Encyclopaedia Britannica)</td>
</tr>
<tr>
<td></td>
<td>• Forest cover: 7.57% (FSI, 2019)</td>
<td>• Forest cover: 20.11% (FSI, 2019)</td>
<td>• Forest cover: 18.36% (FSI, 2019)</td>
</tr>
<tr>
<td></td>
<td>• TOF cover: 6.11%; Most abundant TOF species: Azadirachta indica (Neem tree) (FSI, 2019).</td>
<td>• TOF cover: 11.7%; Most abundant TOF species: Azadirachta indica (Neem tree) (FSI, 2019)</td>
<td>• TOF cover: 4.31%; Most abundant TOF species: Mangifera indica (mango tree) (FSI, 2019).</td>
</tr>
<tr>
<td>AGROFORESTRY</td>
<td>• Exempt trees: Eucalyptus, Casuarina equisetifolia and Prosopis juliflora exempt from restrictions (Chavan et al., 2015)</td>
<td>• Exempt trees: Eucalyptus casuarina, subabul, rubber, coconut, arecanut, orange, Erythrina, Gliricidia, Sesbania and Silver oak (Chavan et al., 2015)</td>
<td>• Other exempt trees for erstwhile Andhra Pradesh: Casuarina equisetifolia, Acacia nilotica, Syzygium cumini, Psidium guajava, Azadirachta indica, Anacardium occidentale, Cocus nucifera, Ficus religiosa, eucalyptus and subabul (Chavan et al., 2015)</td>
</tr>
<tr>
<td></td>
<td>• BAIF successfully implemented an agri-horticulture-forestry programme called WADI for smallholder farmers in dry areas (Chavan et al., 2015)</td>
<td>• Bund based agroforestry is the most common, particularly on dry land tracts (Konwar et al.)</td>
<td>• Implemented ‘Telangana ku Haritha Hāram’ programme to increase tree cover to 33% of State’s land area (The New Indian Express, 2020).</td>
</tr>
<tr>
<td></td>
<td>• Low forest cover but high share of TOF. Latter was promoted through pioneering social forestry initiatives</td>
<td>• Relevant programmes include: Krishi Aranya Prothsaha Yojana, Raising of Seedlings for Public Distribution, Mahatma Gandhi Rural Employment Guarantee Scheme (EMPRI-ENVIS, 2018)</td>
<td>• Recent examples of cotton and maize farmers adopting mango plantations (Bahuguna, 2020)</td>
</tr>
</tbody>
</table>

Figure 17. States of Interest in India

POLICIES OF INTEREST

The section below is a brief overview of policies whose objectives could support the goals of the National Agroforestry Policy (2014). These policies were selected by WRI India with the aim of contributing to their existing and ongoing research. The four policies are:

- The National Policy for Farmers (2007);
- The Watershed Development Component (WDC) of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) (2015);
- The National Biological Diversity Act (2002);
• The amendments to State Transit Rules (issued under Indian Forest Act, 1927)

While these policies were not exclusively designed to improve agroforestry, they constitute part of the larger agroforestry landscape in India, and can influence outcomes.

**National Policy for Farmers (2007)**

The National Policy for Farmers aims to improve the economic condition of farmers by increasing their net income. It defines ‘farmer’ as a term including landless farmers, tribal families, and persons engaged in agroforestry, among other categories. This is important because it recognizes that categorization as a farmer cannot solely be linked to land ownership, and hence, welfare schemes for farmers must also include the landless laborers (tenant farmers, sharecroppers, etc.).

The policy has important outcomes for agroforestry as it aims to:
• Improve farmer welfare through financial and land ownership-based interventions;
• Improve land, water and biodiversity, including to support productivity; and
• Reclaim wastelands through efficient restoration. The implementation of this policy lies primarily with the states.


In 2015, Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), an amalgamation of
various water management schemes, took on the Integrated Watershed Management Programme IWMP as one of its four components to create the Watershed Development Component of PMKSY (WDC-PMKSY). IWMP, which had already been established since 2009-2010, consisted of the following Department of Land Resources’ (DoLR) schemes:

- Drought Prone Area Programme (DPAP)
- Desert Development Programme (DDP)
- Integrated Wasteland Development Programme (IWDP)

The objectives of WDC-PMKSY are “harnessing, conserving, and developing degraded natural resources such as soil, vegetative cover and ground water table; preventing of soil run-off; rainwater harvesting and recharging of ground water table; increasing the productivity of crops; introduction of multi-cropping and diverse agro-based activities; promoting sustainable livelihoods and increasing the household incomes” (Lok Sabha Secretariat, 2017).

**National Biological Diversity Act (2002)**


Consequently, India enacted the National Biological Diversity Act (2002) to focus on the sustainable utilization and equitable

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**Figure 18. Summary of Policies of Interest in India**

<table>
<thead>
<tr>
<th>POLICY</th>
<th>MINISTRY</th>
<th>GOALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amendments to Transit Rules</td>
<td>Ministry of Environment, Forest and Climate Change</td>
<td>In the Indian Forest Act - regulates transit and felling of trees</td>
</tr>
<tr>
<td>National Policy for Farmers (2007)</td>
<td>Ministry of Agriculture and Farmers’ Welfare</td>
<td>Relaxed restrictions to encourage farmers to meet demand for timber</td>
</tr>
<tr>
<td>WDC-PMKSY (2015)</td>
<td>Ministry of Rural Development</td>
<td>Improve net income of farmers</td>
</tr>
<tr>
<td>National Biological Diversity Act (2002)</td>
<td>Ministry of Environment, Forest and Climate Change</td>
<td>Develop inclusive definition of “farmer”</td>
</tr>
<tr>
<td>National Agroforestry Policy (2014)</td>
<td>Established State Level Nodal Agencies and Watershed Committees</td>
<td>Reclaim wastelands through restoration</td>
</tr>
<tr>
<td></td>
<td>Ministry of Environment, Forest and Climate Change</td>
<td>Conserve soil, water, and vegetative cover</td>
</tr>
<tr>
<td></td>
<td>Established National and State Biodiversity Boards, Biodiversity Management Committee</td>
<td>Increase agroforestry and harvest crops</td>
</tr>
<tr>
<td></td>
<td>Ministry of Agriculture and Farmers’ Welfare</td>
<td>Increase household incomes</td>
</tr>
<tr>
<td></td>
<td>Sub Mission on Agroforestry setup under the National Mission on Sustainable Agriculture</td>
<td>Respond to UN Convention on Biological Diversity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Promote sustainable utilization and equitable sharing of biological resources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Document traditional knowledge of biodiversity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increase local-level participation in management of resources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Simplify rules for harvesting, felling, and transit of trees on farms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upgrade land records and ensure security of land tenure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Complement achieving the target of increasing tree cover</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve extension services, like quality plant material and access to credit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strengthen marketing information system for tree/ agroforestry products</td>
</tr>
</tbody>
</table>
sharing of biological resources as well as to promote conservation and local knowledge relating to biological diversity.

The National Biological Diversity Act mandates the establishment of a decentralized three-tier system of governance with the National Biodiversity Authority (NBA) at the national level, State Biodiversity Boards across the 29 states, and Biodiversity Management Committees (BMC) in local bodies.

This structure ensures the inclusion of self-governing institutions such as the Panchayats and municipalities in pursuing the goals of the legislation (Press Trust of India, 2016). This policy is relevant to agroforestry since it creates regulations around biological resource utilization and benefit-sharing, as well as documents traditional knowledge of biological diversity in a participatory manner through the People’s Biodiversity Register.

Amendments to Transit Rules

As stated in the Indian Forest Act of 1927, states are given authority over the transit and felling of trees (Forest Legality Initiative, 2014). This established state-level regulations that mandate transit permits for selected species. This report will focus on transit rules...
for tree species on non-forest lands, given the recent relaxation of transit rules for the purpose of scaling up agroforestry in these areas. In 2014, the Ministry of Environment, Forest, and Climate Change issued the Model Guidelines for Liberalizing Felling and Transit Regime for Tree Species Grown on Non-forest/Private Land, which advised states to exempt 11 popular agroforestry species from transit rules.

STAKEHOLDERS

The important stakeholders to analyze are those who hold the most power, and those who are the most impacted but do not have enough power. For instance, there are tenant farmers and agricultural laborers who would greatly benefit from an agricultural scheme, but would not be able to participate because it depends on land ownership. Meanwhile, India’s institutions, such as the Forest Department, operate in a top-down manner and have strong control over forest resources (Shug, 2000).

India is trying to address the lack of participation and inclusion of the landless and assetless, women, Scheduled Castes and Scheduled Tribes (official terms to designate the lowest caste and indigenous people, respectively), and Self-Help Groups (small collective of people working together to tackle common challenges). Many of the recent policies make room for inclusion of marginalized groups at the implementation stage as a requirement. While attention is given to state-level implementation of each policy, we also looked at the cooperation and relationship between stakeholders at the ministry level, project level, and village or field level.

Figure 19. Power-interest Grid of Stakeholders Surrounding the Policies of Interest in India
Background

Agriculture, economy, and land tenure

Agriculture is a fundamental part of the culture and livelihood of the rural population of Mexico. About 17% of the total land in the country is agricultural; primary agricultural activity (food and beverage production) represents about 7.5% of GDP. One of the main characteristics of the agribusiness is the high degree of fragmentation of agricultural land, where about 81.3% of agricultural units are less than 5 hectares and are used by small farmers for the production of low-value traditional products such as corn, wheat, and beans (World Bank, 2018).

Even though agriculture in Mexico has competitive advantages linked to its geographical diversity, strategic location, and availability of labor, productivity has been strongly affected by factors such as the fragmentation of land and the lack of economy of scale, increased crime in some states, geographic differences in infrastructure, limited access to markets, and the vulnerability of crops to weather extremes (World Bank, 2018).

In terms of land tenure, there are three types of ownership in Mexico: private, public, and communal. In turn, communal ownership can be divided in community and ejido ownership. Among these groups, about 43% is private property, 47% is ejidos and only 9% is community property (World Bank, 2019). These last two types of ownership were created after the Mexican Revolution. While community ownership was a way to give the land back to communities based on their customary occupation, ejidos were created as a way to achieve a fair distribution of land and can contain land commonly owned by groups and land owned by individuals (Guerra, 2015). In 1992, communities obtained a nearly full bundle of rights through the agrarian reform process. Legally, communities and ejidos are not allowed to sell their land or forests, preventing the parceling off of land (Bray et al., 2006).

Out of the 196 million hectares of territorial extension of Mexico, 112 million hectares are rural economic units (UER, Unidad Económica Rural), which amount to a total of between 5.3 and 5.4 million units. One of the things that most characterizes these UERs is the wide diversity in terms of production and sales that they generate in agricultural products. That is why the Mexican government...
through the Secretariat of Agriculture and Rural Development (SAGARPA, 2012), and with the help of FAO, defined **five strata** in rural economic units.

In Box 4, the main characteristics of these strata are shown (SAGARPA, 2012).

**Land degradation**

70% of Mexico is classified as forested land, but over half of native forests have been lost due to poverty, poor management practices, illegal logging, and a lack of technical
Deforestation rates are high in the tropical regions of the country (see Figure 20) where the loss of tree canopy leads to decreased organic carbon stored in soils, increased water erosion, and decreased soil fertility and biodiversity. Desertification has affected nearly 50% of the country’s dry and semi-arid regions which have suffered high rates of land use conversion for cropping and cattle grazing (SEMARNAF, 2008; FAO and ITPS, 2015). Mexico has a goal to reach zero deforestation by 2030 as part of its Nationally Determined Contribution (NDC) under the Paris Agreement and recognizes the importance of improving forest and soil management to further reduce net emissions (Gobierno de México, 2014).

**Agroforestry in Mexico**

Mexico is socio-culturally diverse, with 9% of the total population self-identifying as belonging to an indigenous ethnic group. Nearly one-fifth of the country’s indigenous population are monolingual and non-Spanish speaking (Barbary, 2015). The practice of agroforestry in Mexico stems from the local ecological knowledge of indigenous communities. Plant resources in forests are historically dependent on human management, and agroforestry practices mirror this traditional socio-ecological system (Vallejo et al., 2015). Despite this tradition, high rates of extreme poverty in rural communities have resulted in a lack of technical capacity for agroforestry production.

Agroforestry systems are increasingly
recognized as important tools in meeting national reforestation goals as well as driving rural development in Mexico. The mixed land-use of an agroforestry system can produce commodity crops, animal products, timber, fruit, cacao, or coffee from the interspersed trees. When paired with access to local markets, the practice of agroforestry can address issues of land degradation and carbon sequestration while achieving sustainable development goals (Foroughbakhch et al., 2001; Montagnini & Metzel, 2017; Soto-Pinto et al., 2009).

Mexico has never implemented a coordinated agroforestry program at the federal level.

With the agrarian reform of 1992, *ejidos* and communities were free to choose how to farm their agricultural land and were encouraged to take part in the modern agricultural system. Additionally, the forestry law of 1993 reduced governmental control on forested land managed by communities and *ejidos*. Given the lower requirements, the law, and subsequent amendments, these policies ended up causing massive deforestation. There has also been a history of agricultural subsidies for cattle and maize (for example) incentivizing larger-scale monoculture cropping (Eakin et al., 2018). These subsidies combined with free trade policies have disincentivized small-scale agricultural production over the past three decades (Carlsen, 2011; Keleman, 2010; Wise, 2009).

At various points in time, there have been attempts to introduce agroforestry programs in various states (Ford, 1997) and at the national level (Comisión Nacional Forestal, 2012), but they have never been implemented. However, farmers in Mexico have traditionally planted agroforestry systems, such as using milpa, pineapple and terraces (Moreno-Calles, 2016). Additionally, CONAFOR set the goal of planting 250 million trees in one year through the ProÁrbol reforestation program in 2007.

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**Figure 23.** Historical Evolution of Forestry and Agriculture-related Policies in Mexico
POLICY OF INTEREST

The policy analysed for Mexico is the Sembrando Vida (SV) program, which was established in 2019 at the national level. As shown in Figure 25, at its inception, the program targeted nineteen states with eight prioritized for implementation in 2019 and the rest for the subsequent year (Secretaría de Bienestar, 2019). Navarit was subsequently added to the program for a total of twenty targeted states in 2020 (Secretaría de Bienestar, 2020).

The SV program has a declared **double objective to improve the livelihoods of smallholder farmers and to restore one million hectares of forest land** (Secretaría de Bienestar, 2019). SV is currently the only implemented policy in Mexico with a specific agroforestry objective.

However, the program is implemented by the **Ministry of Welfare (Secretaría de Bienestar)**; environmental and forestry agencies in the country (such as the Comisión Nacional Forestal, CONAFOR, or National Forestry Commission) do not have purview. For this reason, it can be concluded that the primary objective of the program is development, while the environmental aspect comes second. In fact, even the distribution of crop species is based on their potential to provide food or income more than their role in improving biodiversity (E. Esquivel, personal communication, March 24, 2020). Nonetheless, through an increase in tree coverage, SV will most likely also produce positive environmental impacts such as an increase in biodiversity and carbon sequestration.

SV, at least in its intended framework, also has a **gender-equality perspective**, as it promotes the participation of women (in particular indigenous) by prioritizing them in the transfer award. A special program for women (Sembrando Igualdad) was established to provide specific support through “affirmative actions” (Secretaría de Bienestar, 2019).
STAKEHOLDERS

The governance structure of Mexico consists of a national, federal government, 32 states, and 2,457 smaller municipalities (OECD, 2017). The federal government dictates land and water policy for the nation. The Sembrando Vida program is implemented using an organizational structure of regional facilitators and pairs of local technicians who work directly with CACs (Comunidades de Aprendizaje Campesino), or community learning centers, of 25 individual producers. The skill and interest of locally-hired technicians in advancing the goals of the program is largely tied to the capacity of local institutions. Regions with strong social organization tend to have greater local expertise and community relations that federal employees can leverage to meet program goals (H. Caamal, personal communication, March 23, 2020; J. I. Zuñiga, personal communication, March 10, 2020).

Since 2018, the administration of President Andrés Manuel López Obrador, commonly known as AMLO, has transferred budgetary and political resources to the Secretaría de Bienestar (BIENESTAR) from other federal agencies tasked with the management and protection of the natural environment (CONAFOR, SEMARNAT, etc.). The administration has sought to elevate the status of campesinos, or peasants or small-scale farmers, by focusing on improving rural livelihoods as a tool to achieve other environmental and political ends. Civil society organizations (CSOs) and NGOs involved with community forestry initiatives and environmental restoration have found their work marginalized by the federal government as it prioritizes direct governmental engagement with producers (G. Sánchez & T. Fausto, personal communication, March 23, 2020; J. I. Zuñiga, personal communication, March 10, 2020). Considering the central role played by these organizations in supporting farmers in the past, their marginalization could weaken local communities and hinder the long-term sustainability of agroforestry initiatives.

![Power-interest Grid of Stakeholders Surrounding the Sembrando Vida Program Under President Andrés Manuel López Obrador’s (AMLO) Administration](image-url)
IV. Framework for Analyzing the Policies of Interest and their Incentives

Successful incentives are based on an understanding of the causes behind the problem (i.e. land degradation) that a governing body wants to minimize, halt, or change (IPBES, 2018). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) distinguishes between regulatory and economic instruments to promote sustainable land-use practices (IPBES, n.d.). On the one hand, regulations are key for framing and enforcing environmentally-conscious practices; some examples are performance standards on the environment or defined land tenure. On the other hand, market-based incentives such as Payments for Ecosystem (or Environmental) Services (PES) (IIED, 2010), tax rebates, or credit lines use monetary means influence the behavior of landowners (EPA, 2004).

This section delves into the incentives provided by the policies of interest, and looks at disincentives that can impede the achievement of the desired policy objective.

Figure 27 summarizes some of the incentives that can be encountered in agroforestry reforms. In particular, security of land tenure, access to a broad variety of economic/financial incentives, local involvement in decision-making, and socio-ecologically appropriate extension services were highlighted by research and experts as key factors of a successful agroforestry system.
This figure builds upon WRI’s classification of incentives for restoration and is adapted for agroforestry in our three country cases. Incentives are divided between regulatory (part of general governing principles that influence behaviors), and economic (ways that influence behaviors with monetary or financial means). This figure adds another category “Other”, for all the accompanying mechanisms needed to implement an agroforestry project and ensure its long-term development at the local level. According to IPBES’ classification (n.d.), “Other” could also be “Social and Cultural Instruments”, which include enhanced local participation, biodiversity registers (like in India), awareness raising etc.

Figure 27. Policy and Informal Incentives for Agroforestry
**Box 5. Incentives Categories**

<table>
<thead>
<tr>
<th>Incentive</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanisms</strong></td>
<td>Mechanisms that influence behavioral changes to achieve a policy goal. There are two main types of incentives: regulatory and economic. Regulatory incentives shape the legal framework in a system, while economic incentives influence behavior through financial/monetary means (IPBES, n.d.).</td>
</tr>
<tr>
<td><strong>Perverse</strong></td>
<td>Incentives that attempt to achieve the stated policy goal, but instead have an unanticipated negative or reverse effect.</td>
</tr>
<tr>
<td><strong>Disincentive</strong></td>
<td>Existing incentives that are preventing the goals of the stated policy to be reached, because they are driving antithetical behaviors.</td>
</tr>
</tbody>
</table>

**Figure 28. A Comprehensive Supporting System for Agroforestry**

The mentioned incentive mechanisms address these key aspects of an integrated agroforestry system. Local involvement can contribute to adequate agroforestry inputs to the given ecosystem. Training and economic incentives can help farmers transition to agroforestry systems more easily. Lastly, providing farmers with access to markets is key for agroforestry to generate income and overall economic development.

**BRAZIL**

**INCENTIVES**

Small-scale farmers and rural communities can benefit from agroforestry practices both through improved environmental quality and economic gains. However, the situation is slightly more complicated in Brazil, where agroforestry includes a mix of small producers and large producers (V. Ortega, personal communication, March 23, 2020).

**National School Feeding Program (PNAE)**

With the National School Feeding Program (PNAE), the Federal Government provides direct funding to states and municipalities for food and nutrition provision and education in public schools. 30% of the funds passed on by the PNAE are to be used to purchase directly from family farms, preferably using sustainable practices, and prioritizing indigenous communities.

**Food Acquisition Program (PAA)**

This policy aims for rural productive inclusion of the poorest families, promotes
access to food, and encourages family farming. The PAA is funded by the Ministry of Citizenship, which buys food produced by family agriculture without legal public biddings requirements and allocates them to people in food insecurity situations or under social assistance networks. The program also values biodiversity and organic, agroecological food production.

**The Brazilian Forest Code**

As mentioned earlier, the Forest Code is Brazil’s landmark environmental legislation that sets protection requirements of land to maintain rural vegetation. This law only applies to private landowners and holds them responsible for violations. Yet, self-reporting with weak oversight can give legitimacy to illegally grabbed land (Damasceno, 2020). The Forest Code is enforced by the Ministry of Environment (Azevedo et al., 2017).

**National Family Farming Strengthening Program (PRONAF)**

PRONAF provides lines of credit to family farmers, land reform settlers, and traditional communities. However, farmers report the usage of these credits are very low.

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<table>
<thead>
<tr>
<th>INCENTIVES POLICY</th>
<th>Security of tenure/ Rights to resources</th>
<th>Economic/ Financial and Market-Based incentives</th>
<th>Social recognition and intellectual property rights</th>
<th>Capacity enhancement, Livelihood &amp; development inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>National School Feeding Program (PNAE)</td>
<td>Government prioritizes organic, agro-ecological production to incentivize farmers to improve practices</td>
<td>30% of funds from federal government to feed public schools used to buy from family farms</td>
<td>Focus on purchasing from indigenous or quilombola (Afro-Brazilians living in remote hinterlands) communities</td>
<td></td>
</tr>
<tr>
<td>Food Acquisition Program (PAA)</td>
<td>Government prioritizes organic, agro-ecological production to incentivize farmers to improve practices</td>
<td></td>
<td>Focus on purchasing from indigenous or quilombola (Afro-Brazilians living in remote hinterlands) communities</td>
<td></td>
</tr>
<tr>
<td>Brazil Forest Code</td>
<td>Land preservation requirements for private owners. Has more impact on larger landowners</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Family Farming Strengthening Program (PRONAF)</td>
<td>Credit lines to family farmers and traditional communities, but come with strict requirements</td>
<td>Cultivation of tropical fruits preserves &amp; recognition of SAFTA, agroforestry system in Amazon biome</td>
<td>Network of knowledge and assistance, and infrastructure to increase sustainable use of land</td>
<td></td>
</tr>
<tr>
<td>CAMTA (Cooperative in Tomé-Açu)</td>
<td>Guaranteed link between producers part of the cooperative and markets (including international ones)</td>
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<td></td>
</tr>
</tbody>
</table>

*Figure 29. Summary of the Incentives in Brazil’s Policies of Interest*
Many of the lines are earmarked or come with strict structural constraints (Gonçalves, 2018).

**Cooperatives (for example, the CAMTA cooperative)**

The work of cooperatives such as CAMTA exemplify local-level efforts towards agroforestry in Brazil that incentivize agroforestry practices. Other organizations/companies run similar sustainable land-use operations, which are increasingly regarded as viable business opportunities in Brazil.

These organizations help farmers with a network of support and infrastructure, including access to markets.

**General incentives to promote agroforestry in Brazil**

**Credit lines** are considered the most important and promising incentive for farmers. Access to credit can help farmers cover the large upfront costs of an agroforestry system. WRI Brazil and other private and academic actors are contributing to financial analyses of investments in agroforestry systems to show that they are viable alternatives to land-use for food and income production.

In Brazil, most small-scale farming operations handle their products from seed to customer. There are both benefits and drawbacks to the involvement of farmers in the entire lifecycle of a product. While farmers’ involvement ensures the quality of their product, the lack of specialization or large-scale tools may also lead to inefficiencies (D. Cesano, personal communication, February 28, 2020). In addition, an established, stable market only exists for agricultural commodities. There is a need for a market for multiple smaller batches of products with different cycles so that producers can feel safe investing in an agroforestry system.

Agroforestry experts in Brazil identify **technical access and training as key to success**. However, there are not many specialists in the private, nonprofit, or public sector who can provide farmers with technical assistance in agroforestry techniques. This assistance is needed to ensure that farmers can reap the intended long-term benefits of an agroforestry system (V. Ortega, personal communication, March 23, 2020).

A grassroots approach to technical assistance and training programs was identified as most beneficial to ensure the buy-in of farmers and leverage their understanding of the ecological conditions on the ground. Furthermore, through a grassroots approach, rather than a top-down approach, farmers will have a sense of ownership over the programs, ensuring commitment and equity.

Lastly, **indigenous communities** - who are often the practitioners of agroforestry-like farming methods that rely on local biodiversity - are not sufficiently included into the planning process for modern agroforestry schemes. Agroforestry in Brazil is more of an industrial agriculture effort and is therefore less focused on the traditional agricultural practices of indigenous groups.

**ISSUES AND DISINCENTIVES**

The World Bank identifies **inadequate infrastructure** as a bottleneck to agricultural development. Poor road conditions, heavy rains and flooding make it difficult to move crops across the country’s expansive surface. The World Bank estimates that soy transportation costs 7 times more in Brazil than in the US. This mainly impacts commercial-farm exported crops that must travel to coastal ports (World Bank, 2017). **High transportation costs are also a market access barrier for poorer and smaller farms.** As a result, the majority of
food produced in Brazil is consumed locally.

Despite their environmental impacts, monoculture production systems with high-value crops like soy are developed and well-viewed as an activity producing high output and profit. The government has supported these systems through agricultural subsidies. In 2018, the agriculture sector grew 13 percent, as compared to the GDP, which grew only one percent (FAO, 2018).

Subsidies increased rapidly and reached approximately 58 billion US dollars in the 2018/2019 fiscal year (FAO, 2018). The government has focused specifically on controlled interest rates and rural credit to support farmers’ livelihoods. Agricultural subsidies have been generally earmarked for specific sectors and farm types (World Bank, 2017).

On the other hand, agroforestry products (usually native trees) do not have strong existing markets. Currently, native trees do not have a resale market value, making them economically undesirable to plant. An interview with an agroforestry expert in Brazil suggested that careful research into the profitability and uses of native, environmentally-friendly plants is key to encourage farmers to plant these species and improve biodiversity (A. Miccolis, personal communication, February 27, 2020). Nonetheless, traded crops are responding to the international market trend of socio-environmental certifications based on sustainability principles (The Nature Conservancy, 2014). This will require increased transparency into the environmental impacts of crops. Agroforestry could potentially play a role in this new business environment.

To transition from a simple agricultural model to a more complicated multi-species one, careful farm management skills are required. A lack of technical knowledge at the farmer, government and financial institution level is the most significant barrier to successfully implementing existing programs. For instance, in the ABC Plan, the primary policy to reduce GHG emissions in the agricultural sector, farmers were unfamiliar with the agroforestry technologies and practices they were to employ (Newton et al., 2016).

Government action surrounding agroforestry in Brazil is focused on economic development. To address this, “the Government of Brazil started to introduce policies and pro-
grams designed to encourage the uptake of improved smart agriculture” (World Bank, 2017). These programs focused on financial support for farmers, but many of these financial mechanisms are underutilized. Moreover, some of the funds set stringent requirements for eligibility and usage. For instance, the majority of smallholder farmers are unable to meet specific environmental requirements at each stage of the production chain, and as a consequence are unable to access credit (Gonçalves, 2018). This mismatch between fund requirements and market reality showcases the lack of knowledge held at the government level.

Lastly, small farmers are not currently an organized body engaged in politics. This is due to a range of causes, including vast country size, variable climates (and therefore farming types), farmers’ poverty, and the large number of farmers (D. Cesano, personal communication, February 28, 2020). Farmer organizations and cooperatives could play a key role in streamlining demands and concerns to improve access to credit lines and to assistance for sustainable agricultural practices.

Even if bottom-up efforts were scaled up, interviews with industry experts suggested an additional barrier: agroforestry-related programs are not a priority of the current administration. Rather, research and development of agroforestry is currently conducted at the academic, private, and industry level (A. Miccolis, personal communication, February 27, 2020).
In the short term, agroforestry will rely on existing agricultural and forestry institutions. However, these institutions present their own challenges. For example, regulations and guidelines around felling and transit for specific tree species, and ambiguity around land records and land ownership will also apply to agroforestry. The virtual absence of well-defined market linkages for timber from TOFs will also affect agroforestry products. In this light, the following section delves into the incentives and disincentives for agroforestry under the four selected policies.

<table>
<thead>
<tr>
<th>Security of tenure/ Rights to resources</th>
<th>Economic/ Financial and Market-Based incentives</th>
<th>Material benefit-sharing measures</th>
<th>Involvement in decision-making</th>
<th>Social recognition and intellectual property rights</th>
<th>Capacity enhancement, Livelihood &amp; development inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Policy for Farmers</td>
<td>Inclusive definition of “farmer” to support rights of small &amp; landless farmers “Joint pattas” so that women can access credit</td>
<td>Income transfers, interest subsidy on certain crop loans, crop insurance scheme, minimum support price</td>
<td>Calls for institutional convergence for water conservation and land-use &amp; more power to Panchayats</td>
<td></td>
<td>Strengthening of Farmer Science Centres for extension services Setting up farm schools</td>
</tr>
<tr>
<td>WDC-PMKSY</td>
<td>At least 10% of funds to benefit asset-less, landless, &amp; women in Gujarat</td>
<td></td>
<td>Watershed Committees with women, indigenous, &amp; assetless participation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Biological Diversity Act</td>
<td></td>
<td>Provides local communities claim to a percentage of revenues on commercial transactions</td>
<td>3-tier institutional framework for sustainable management of biological resources</td>
<td>Documenting local biodiversity and traditional knowledge in consultation with local people</td>
<td></td>
</tr>
<tr>
<td>Amendments to Transit Rules</td>
<td>Relaxing permits for managing tree species encourages agroforestry uptake</td>
<td>Elimination of transit and felling fees; more diverse market opportunities for farmers</td>
<td></td>
<td>Services to ensure fair benefit-sharing + technical and financial support for documenting local biodiversity</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 30.** Summary of the Incentives in India’s Four Policies of Interest.

Note that bureaucratic/political will is not included here as it can be understood from the amount of policies that there is a strong push from the government to use agroforestry to restore land and improve farmer livelihoods.
The National Policy for Farmers 2007

The National Policy for Farmers, 2007 (NPF) defines the term farmers in a manner that is inclusive of agricultural laborers, sharecroppers, tenant farmers, tribal families engaged in the sale and use of minor and non-timber forest goods, as well as persons engaged in agroforestry, among others. It aims to improve farmer well-being while recognizing and supporting the rights of small and marginal farmers, including women. For example, it calls for women to be granted “joint pattas” or joint ownership of homestead and agricultural land to enable access to credit and kisan (farmer) credit cards. It also reiterates the maintenance of People’s Biodiversity Registers (documents that contain information on local biodiversity, recommended under the National Biological Diversity Act of 2002), while acknowledging that women hold much of the traditional knowledge regarding bio-resources.

Multiple national-level schemes and programs promote the achievement of farmer well-being through financial and market incentives, contributing to the goals of the National Policy for Farmers:

- **Prime Minister’s Kisan Samman Nidhi (PM-KISAN):** This scheme was launched in 2019 and provides financial support to the farmers by transferring them an income of Rs 6,000 per year (around 80 USD), over three installments of Rs 2,000 each, for procurement of agricultural inputs.

- **Interest Subsidy Scheme on crop loans:** This scheme offers a 2% interest subsidy to farmers for short-term loans up to Rs 300,000 (around 4,000 USD). An additional 3% is provided contingent on timely repayment (within a year).

- **Prime Minister’s- Fasal Bima Yojana (PM-FBY):** This crop insurance (fasal bama) scheme covers all farmers (including tenant farmers and sharecroppers) who are required to grow certain notified crops in notified areas.

- **Minimum Support Price:** The national government offers a minimum support price to farmers on certain crops which is equivalent to 1.5 times their production cost.

Box 7: NPF IMPLEMENTATION EXAMPLES

The implementation of the NPF itself lies with the states. A few examples of state level farmer welfare schemes include:

- **Bhoochetana:** The state of Karnataka implemented this program for revival of soil in two phases between 2009-2018. The program provided 50% subsidy on micronutrients, seeds and other material for seed treatment, and was lauded for its effectiveness. The program provided millions of farmers with increased crop yields (20-66%) and USD $453 million in net benefits (ICRISAT, 2018).

- **Rythu Bandhu:** The state of Telangana implemented a scheme of income transfer which turned out to be more popular than the PM-KISAN scheme. It offers Rs 4,000/acre (around 53 USD) per season to every land holding farmer for the purchase of seeds, fertilizer, labour, etc (Lasania, 2019). However, it leaves out tenant farmers from this scheme.

The NPF calls for institutional revamping as well. It recommends updating state land use boards and linking them to district-level land-use committees. These committees will be constituted by state governments, to enable provision of quality and proactive advice to farmers on land-use.
This policy also promotes **water-use efficiency and water conservation** by calling for a convergence of efforts across authorities such as the National Rainfed Area Authority, the National Rural Employment Guarantee Program, the National Horticulture Mission, etc.

Under the NPF, state governments are encouraged to strengthen the *Krishi Vigyan Kendras* (KVKs or Farmer Science Centres), that provide agricultural **extension services**. State governments are also supported in setting up farm schools to encourage farmer-to-farmer learning that would speed up technological upgrading of crop and animal husbandry, fisheries, as well as agroforestry. The policy also gives more prominence to the *Panchayats*¹, since they are responsible for agriculture, including agricultural extension services.

**Watershed Development Component of Pradhan Mantri Krishi Sinchayee Yojana (WDC)**

WDC attempts to address the concerns and expertise of local people with its **Watershed Committee**. The Watershed Committee is the village-level authority consisting of 10 members, who represent diverse groups that are often left out of the policy-making process yet may be affected most by the policy. At least half of the members should be women or landless or representatives from Scheduled Tribes, Scheduled Castes and self-help groups (SHGs). With guidance from non-governmental entities, the committee could achieve local participation.

**The National Biological Diversity Act, 2002**

This Act was instituted to incentivize biodiversity conservation, the **safeguarding of traditional knowledge**, sustainable utilization and equitable sharing of biological resources. As mentioned above, it is implemented through a three-tiered institutional framework with the National Biodiversity Authority (NBA) at the center, State Biodiversity Boards (SBBs) at the state level, and Biodiversity Management Committee (BMC) at the local level (including self-governing institutions such as the *Panchayats* and municipalities). By promoting inclusion and representation of local communities, the Act strengthens their negotiating power in commercial transactions. It mandates the BMC to prepare People’s Biodiversity Registers (PBRs) in consultation with the local people to document and store information regarding local biological resources, traditional knowledge, and practices. These registers are considered legal documents that solidify the rights of local communities over the biological resources and associated traditional knowledge.

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¹ Form of local self governance system at the village level
tions between the local communities, traders and manufacturers. For example, when a transaction is made for the first time, the benefit-sharing obligation will be 1-3% of the purchase price for a trader, and 3-5% for a manufacturer. If similar prior transactions have been made, the above figures will be at least 3% and at least 5% respectively for a trader and manufacturer. Biological resources with high economic value (e.g. sandalwood and its derivatives) can provide an upfront payment over 5% of the proceeds or sale amount. The successful bidder will pay the amount to a fund at the national- or state-level as mandated by the Act. It also recommends that 10% of the revenue from commercial product development should go towards the SBB and another 10% for the local community for conservation.

In addition, the act mandates the NBA to formulate guidelines and extension materials to promote access to biological resources as well as ensure fair and equitable benefit-sharing among stakeholders. The NBA is also required to provide technical and financial support to BMCs in preparing the PBRs for areas under the latter’s jurisdiction.

Amendments to Transit Rules

Transit permits have been a disincentive for farmers to take up agroforestry. The process of acquiring transit permits can take over 60 days and requires that the farmer pays a fee and submits a lot of paperwork to local authorities and the Forest Department. According to guidelines by the Ministry of Environment and Forests, states have exempted a number of species from transit rules. Gujarat has seen positive progression in agroforestry due to the removal of transit rules from short rotation crops that are fast growing and offer quick returns (Dhyani, 2013). Some experts insist that relaxation of transit rules was the primary factor in increase of agroforestry in

Haryana and Punjab (MOEF, 2018).

Box 9: TRANSIT RULES STATUS

• **Gujarat**: 26 species require felling permission. Reserved species (e.g. teak, sandal, blackwood, mahua and khair) require written permission and farmers must pay Rs. 2 in royalty per tree for domestic use, or half the sale value for commercial use. Subabul, eucalyptus and saru are among those exempt from transit permits (WWF, 2012).

• **Karnataka**: 11 species are exempt from felling permits and 7 species are exempt from transit permits. Only 4 of the 7 transit-permit-exempt species overlap with the felling-exempt species (Karnataka Forest Department).

• **Telangana**: 20 Schedule II (trees) and Schedule III (seeds, fruits etc.) species are exempt from transit permits under Transit Rules. In 2017, the state increased this number to 40 (Anonymous, 2017).

ISSUES AND DISINCENTIVES

WRI India’s Restoration Opportunities Atlas estimates that the potential for agroforestry interventions is 87Mha of land. However, the multiplicity of policies, programmes, schemes, and authorities in the agriculture and related sectors, and the quasi-federal nature of governance in India challenges the seamless adoption and promotion of agroforestry in the country.

The National Agroforestry Policy (2014) falls under the mandate of the Ministry of Agriculture and Farmers Welfare. Its implementation at the state level, however, can be carried out by a department or agency chosen by the state government (Chavan et al., 2015), and hence may not be uniform across states.
Agroforestry calls for the integration of policies and programs across the value chain; this is currently lacking in India (S. Oza, personal communication, April 25, 2020). The need for labor, access to credit, appropriate equipment and quality plant material, agro-processing facilities, market access and other support services, warrants an integration of programs such as Rashtriya Krishi Vikas Yojana (RKVY), Mahatma Gandhi National Rural Employment Act (MGNREGA), PMKSY, and PM-KISAN, among others, which currently make no mention of agroforestry.

At the same time, systemic bureaucratic delays can affect the outcomes of projects. For example, delay of wage payments under MGNREGA is a real concern for wage earners who rely on daily or weekly wages, and could affect their decision to stay employed in projects such as watershed development, or tree plantation. Other examples include inconsistent land records across states (with Telangana doing comparatively better than other states), which impacts access to credit. This could mean that smallholder farmers are still considered large farmers on paper because the land record still indicates the pre-fragmented version of the property, most likely when it belonged to someone in their family. Additionally, the absence of required technology or internet in certain areas can prevent updates of land records. This is a major hindrance for income transfer schemes like PM-KISAN, where benefit transfers are calculated based on land records.

Box 10: NEED FOR UNIFORMITY AND SIMPLICITY OF TRANSIT RULES

State-specific transit rules are important given the diverse ecoregions across the nation. However, the varying rules complicate inter-state transportation of natural resources. For example, a transit-permit-exempt species in one state would still require a transit permit if transported into another state where it is not exempt. To improve coordination regarding transit rules for popular agroforestry species, states could consider implementing a Pan India Card, a national permit for a species’ transportation, as already suggested for bamboo.

Transit rules are sometimes confusing for farmers, as a species could require a felling permit but not a transit permit. Furthermore, translation of new amendments into layman language for farmers takes time and may still be perceived as carrying conditionalities (A. Oza, personal communication, April 29, 2020). The simplification of transit rules, starting with popular agroforestry species, would create clarity for farmers.

Box 11: SHORTFALL OF FUNDS

One of the key issues in the WDC-PMKSY is the shortfall of funds from the Department of Land Resources. In 2016, the funding pattern for the scheme changed from 90:10 centre-to-state to 60:40 (NWDA, 2018). Despite the new financial management scheme, unreliable allocation of funds from the DoLR still persists and transfers more financial responsibility to the states. Furthermore, once projects are completed, the financial responsibilities required to maintain and conserve the projects are left to the communities (FAO, 2005).

Box 12: WDC-PMKSY PROJECTS’ STATUS

Since 2016, DoLR has not sanctioned any new WDC projects (Lok Sabha Secretariat, 2018).

As of 2017, out of 610 WDC-PMKSY projects in Gujarat, 36 have been completed (5.9%). Karnataka has completed 125 projects out of 571 (2.2%) and Telangana has completed 0 projects out of the sanctioned 330 projects (0%) (Lok Sabha Secretariat, 2018).
While increasing tree cover is important, the government must be careful not to measure success merely on the number of saplings planted, but also on their survival rate. Telangana’s Haritha Haram program, for example, was not considered successful because it underperformed in terms of planted saplings. However, the state government decided to make local governments responsible for the scheme and measure the survival rate of the saplings to get a better picture.

The selection of agroforestry tree species is equally important. As exemplified by the curious choice of eucalyptus, a water guzzling tree species seems to be a perverse choice in the predominantly arid state of Gujarat. Similarly, the tradeoff between using land for trees or for agricultural crops must be studied further to avoid perverse outcomes. For instance, agroforestry could negatively impact agricultural yields, as trees can decrease the cultivated area, affect light intensity or change the microclimate (Dhanya et al., 2013). Additionally, agroforestry models like horti-agriculture that require intensive care and irrigation facilities may deter small and marginal farmers.

Generally, projects are most sustainable and beneficial when the community has ownership throughout the process, from development to implementation. The involvement of local people, consideration of their challenges, and assessment of available natural resources will likely mean that the community will be self-motivated to ensure the project’s success and sustainability (R. Joshi, personal communication, April 28, 2020).

According to locals, the effort to include representatives from minority and local groups is not effective. Government-formed interest groups, like the Watershed Committee, are often corrupt, undemocratic, and disorganized (R. Rathod, personal communication, April 18, 2020). For the most part, committees are only productive in ensuring participation of minority groups when NGOs are involved (S. Vasavada, personal communication, April 25, 2020) or when land ownership in the community is relatively equitable.

Box 13: NGO INVOLVEMENT IN WATERSHED PROJECTS

In Karnataka, the NGO Myrada was a partner of the ‘Sujala’ watershed management project. This project was a state initiative (not under WDC) assisted by the World Bank. Myrada was essential in enrolling vulnerable families into self-help groups (SHGs) and securing their involvement (Myrada, 2016). A few years ago, the Gujarat government worked closely with NGOs, but now it rarely assigns projects to these organizations (S. Vasavada, personal communication, April 25, 2020).
INCENTIVES

The Sembrando Vida (SV) program encourages the establishment of agroforestry systems on unutilized parcels of land in Mexico. It has a double objective to improve the livelihoods of smallholder farmers and to restore one million hectares of forest land (Secretaría de Bienestar, 2019). The exclusive use of unutilized land plots is an important factor towards both of these objectives, as it enables the creation of income, and the growing of trees that were not previously present.

The agroforestry systems to be introduced are defined as a combination of traditional crops with fruit and timber trees (also known as SAF, Sistema Agroforestal), as well as the typical practice of alternating maize and fruit trees (Milpa Intercalada entre Árboles Frutales, MIAF).

Prerequisites to access the program are the availability of a small plot of unutilized land (2.5 hectares) for the farmer to cultivate and income below the rural poverty level. The condition to receive the transfer is that farmers plant trees on their land plots; and that they work on the maintenance of those trees, as well as on their own crops, Monday through Saturday (Secretaría de Bienestar, 2019). Lack of compliance with these conditions might result in the exclusion from the program.

The program is based on a package of economic incentives to smallholders; these subsidies primarily aim to supplement the livelihood of farmers, while they contribute to increasing the tree coverage of Mexico. The package has a cash component, a saving component and an in-kind component, as well as an indirect market incentive.

The cash component of the incentive consists of a 5,000 Mex$/month transfer through a plastic bank card (equivalent to around 250USD/month). This is quite a large income supplement for most farmers, considering that the rural poverty line is just above 2,000 Mex$/month (around 80USD) (Gobierno de México, 2020) and that the income of an average family in Mexico is less than 850US$/month (EFE, 2015). Hence, the transfer can translate in a reduction of farmers below the poverty line and improved food security for many families. The program might also indi-
rectly result in a reduction of unemployment, as for many farmers this might be the only income source and primary occupation.

Part of the economic package is a **saving incentive** to encourage farmers to have funds set aside for unexpected expenses and to avoid a poverty spiral due to unforeseen circumstances. To achieve this objective, the program requires that farmers deposit 500 Mex$/month out of the monthly transfer in a savings account, which cannot be withdrawn for at least three years. Additionally, the Ministry of Welfare introduced a special fund to improve financial inclusion and literacy, and for future support of agricultural communities. These initiatives were undertaken by the Ministry of Welfare in cooperation with the national development bank (Banco del Ahorro Nacional y Servicios Financieros, BANSEFI) (Secretaría de Bienestar, 2019).

Farmers are also supported with an **in-kind incentive** as the program provides the tree seedlings (Secretaría de Bienestar, 2019). However, one of the drawbacks is that the type of crops and trees to be planted depend on the government’s ability to acquire certified seeds and grow them in the nurseries, and this reduces the opportunities for farmers to obtain crops and trees that might adapt better to their specific soil and micro-climatic conditions (J. I. Zuñiga, personal communication, March 10, 2020).

For this reason, the provision of seedlings might actually result in a **disincentive** to participate in the program, as farmers might fear having to devote a lot of resources to tending to plants which are not optimal for the specific territory.

Finally, on top of the economic incentives, farmers can also benefit from an **indirect market incentive** as they can harvest and sell forestry-related products; or alternatively, they can use the crops for self-consumption.

The sustainability of the program is promoted by a large **capacity building component**. To ensure correct implementation and monitoring of the program, the central government provides technical assistance to farmers through on-the-ground technicians who work in pairs and are supervised by a learning center. Each pair of technicians advises around 200 producers, and each learning center is responsible for 5 pairs of technicians (hence for around 1000 producers).


ISSUES AND DISINCENTIVES

Given the ratio of technicians to farmers, it is unsurprising that **field capacity is currently considered insufficient** by many stakeholders. Several actors also considered the roll-out of the program to be too rushed: seedlings were grown too quickly, and technicians hired without appropriate screening processes. These two components contributed to some difficulties in implementing the program, although success varies across regions due to the strength of pre-existing social and physical infrastructure. For example, Quintana Roo, despite its poverty, is reportedly more successful than Chiapas in achieving program goals (H. Caamal, personal communication, March 23, 2020; E. Esquivel, personal communication, March 24, 2020). This could be partly due to lower pre-existing deforestation because communities had land-use plans and adhered to them (J. I. Zuñiga, personal communication, March 10, 2020).

Another drawback of the program is the frequent **de-facto exclusion of cooperatives and smallholder organizations**, which do not qualify for SV as the incentive is only intended for individual farmers (J. I. Zuñiga, personal communication, March 10, 2020). This mechanism might lead to the diversion of funds and consequent weakening of those local organizations, which have been instrumental for decades in improving the livelihood of farmers, and which could greatly contribute to the sustainability of agroforestry practices in the long term (F. Montagnini, personal communication, March 2, 2020). Community forest management could also be strengthened, both for the positive local-level economic impact it was able to achieve in the past, and for broader environmental benefits such as carbon capture and the provision of ecological services similar to those of agroforestry (Bray et al., 2006; Merino, 2020).

Although the program is well-structured in removing subsidies for large producers, and providing incentives directly to smallholders, there are quite significant entry-barriers for farmers to access the program considering that they need to have access to a minimum of 2.5 hectares of land. This could represent a disincentive. While ownership is not required, and the land can also be lent by relatives, or by the community, this might exclude people who are really poor and have no social safety net (J. I. Zuñiga, personal communication, March 10, 2020). Those people usually would work as seasonal farmers, making anywhere between 5US$/day (minimum wage) and 16US$/day (which can only be achieved by workers paid by the piece of harvested produce for high-value commodities) (Migration
Therefore, the access criteria to the program may represent a **pervasive incentive** that prevents true poverty reduction; however, providing landless farmers with a land plot might require excessive financial resources. Acceptance requirements might also result in a pervasive incentive from the environmental perspective and promote forest land clearings in order to claim it as “unutilized” and obtain the monetary transfer (J. I. Zuñiga, personal communication, March 10, 2020).

In conclusion, potential improvements to the program could be the increased consultation of the communities, and increased involvement of local organizations (as recommended by Bottoud, 2015). **Better participatory processes** could improve capacity building for farmers, and provide better-tailored seedlings that respond to the ecological specificities of the territory, as well as the needs of the local market (G. Sánchez & T. Fausto, personal communication, March 23, 2020; Suárez et al., 2012; J. I. Zuñiga, personal communication, March 10, 2020).

Another potential improvement of the program could be to focus more on environmental impacts, including their measurement and monitoring. Currently, the policy focuses mostly on improving farmers’ welfare; potential climate change mitigation benefits might therefore be overlooked. **More environmental focus** could be achieved through a stronger link with agencies such as CONAFOR and SEMARNAT. These agencies would be well-placed to monitor the effectiveness of SV in terms of biodiversity and carbon sequestration.

On a more general note, there is a question of whether this program is the most effective use of funds to improve tree cover and related ecosystems. As such, consulting/involving farmers and local organizations can help ensure the sustainability of agroforestry initiatives.

**Figure 32.** Summary of Policy Challenges and Other Barriers to Achieving These Aspects of an Agroforestry Supporting System

**Brazil:** challenge to have farmers transition from simple farming system to AFS, need widespread tools/training
**India:** training of women and SHGs needed to improve local involvement; need to ensure local biodiversity registers are accurate
**Mexico:** technician-to-farmer ratio considered insufficient

**Brazil:** existing credit eligibility requirements are stringent due to inadequate knowledge from government
**India:** access to credit dependent on land tenure; critique of insufficient cash transfer in farmer scheme
**Mexico:** cash transfer dependent on having 2.5 ha of unutilized land; part of the cash must be saved by farmer

**Brazil:** more research needed in profitability of native plants to promote their adoption
**India:** relaxing of Transit Rules needed to promote agroforestry
**Mexico:** rollout of SV considered rushed in terms of seedlings supply and technicians selection

**Brazil:** low prevalence of organized farming groups, creates disconnect between farms and the financial institutions, agroforestry experts, and government
**India:** lack of community involvement and ineffective implementation of such efforts despite policy guidelines
**Mexico:** lack of producer and community involvement, as well as the national forestry department (CONAFOR)

**Brazil:** difficult to include AFS goods in markets by financial institutions; high crop transportation costs
**India:** potential for AFS goods to meet rising demand in timber + other goods, but farmers need to first be self-sufficient
**Mexico:** farmers have access to markets, but sometimes the seedlings provided by SV might not be marketable
V. Cross-Country Comparison

**Figure 36.** Summary of the Main Actors Identified in Agroforestry Implementation

The top box represents the policies of interest’s active agencies. The bottom box shows other actors previously engaged or encouraged to engage in agroforestry implementation. The arrows represent the ongoing or shift in power and/or interest.

**Figure 37.** Summary of Agroforestry Benefits Identified in the Policies of Interest
The policies selected for analysis show that interventions in forestry and agriculture can enhance agroforestry outcomes across the country.

The three policies of interest in Brazil are administered by the federal government but have been weakened from recent cuts in funding and weak implementation (A. Miccolis, personal communication, February 27, 2020). Moreover, the national administration’s perception of environmental protection has changed: it is now seen as an obstacle to economic growth (Casado & Londono, 2019). Despite this, WRI Brazil has highlighted the importance of agroforestry in the country’s sustainability policies, including the Forest Code (Law 12,651/12), the Paris Agreement, and other international commitments like the New York Declaration on Forests, and the Bonn Challenge. Given the narrative around the agribusiness, Brazil’s agroforestry conversation focuses on promoting economic development for both smallholders and larger landowners, but in a more sustainable way than the current monoculture system. In contrast to the other countries where the public sector is a main actor in present agroforestry practices, one expert noted that the private sector could play an important role in implementing agroforestry in the short-term (V. Ortega, personal communication, March 23, 2020).

In India, agroforestry schemes are likely to follow a top-down approach to implementation, especially if state forest departments are the main implementers. The quasi-federal nature of governance in the country means that agroforestry outcomes will be different across individual states. However, there is immense opportunity to harmonize goals in the state policy landscapes for agriculture, forestry, and allied sectors to further support agroforestry. India recognizes the role agroforestry can play in farmer welfare. This is contingent on overcoming administrative hurdles, such as access to quality planting material and appropriate extension services. The country’s agroforestry policy also responds to its national goals of increasing national tree cover to 33% and international commitments toward the Paris Agreement targets and the Bonn Challenge.

Mexico’s Sembrando Vida is also administered at the federal level, with the Ministry of Welfare seeking to use agroforestry as a tool to increase social welfare. While the program also aims to restore tree cover, the priority is largely on improving rural livelihoods. Although Mexico does have a few other examples of national-level restoration initiatives, Sembrando Vida by-passes the country’s existing community land management structures in favor of providing direct assistance to farmers from the federal government. This lack of partnership with local institutions has led to a failure to harness existing social capital and local networks to achieve program goals. In addition, the bottlenecked provision of seedlings appropriate for the soils and microclimates of certain areas impacts the long-term ecological as well as social goals of agroforestry systems (J. I. Zuñiga, personal communication, March 10, 2020).
All three countries have unique land ownership environments that make the approach to agroforestry implementation different.

The concentration of latifundia in Brazil creates a power structure that connects land ownership to GDP, thus driving agriculture policies that prioritize economic growth (V. Ortega, personal communications, March 23, 2020). Agroforestry is considered unconventional by the farming community (especially large scale agribusinesses), and is associated with the vision of family farms with low productivity. Despite this social division of farm types, small farmers actually produce around 70% of food consumed domestically using much less land than the large-scale commodity growers (Gross, 2019). Nonetheless, implementing agroforestry policies at the small farm level constrains the potential ecological impact of also including large farms. Some of the interviewed experts highlighted the need for public-private partnerships or innovative business models (like impact investments) to integrate the efforts of both small producers and large properties (D. Cesano, personal communication, February 28, 2020; V. Ortega, personal communication, March 23, 2020).

India has a vastly different agricultural land ownership structure. Close to 90% of farmers in India own 2 hectares of land or less (Bera, 2018), and agriculture is still the largest employer in the country. Landlessness is a major issue in the country (Mohanty, 2018), which explains the explicit inclusion of asset-less, landless individuals in the policies of interest. For instance, in the state of Gujarat, at least 10% of the funds received for the Integrated Watershed Management Programme must benefit land-less and small farmers (DARPG, n.d.). However, the small holdings and inconsistent provision of extension services to such a large number of farmers is driving insufficient returns and farmer distress (Bera, 2018). In this scenario commercial agroforestry is seen as a way to increase farm income and productivity by serving the increasing national demand for diverse products like wood, pulp and paper industry, food, medicine, and other commodities (NRCAF, 2013; Chavan et al., 2015).

Similarly to India, Mexico’s agroforestry systems are generally not held by large producers. This is due to the country’s semi-collective ownership structures for land and forests (ejidos) that have contributed to a history of community forest and land management practices (Bray et al., 2006; Buys, 2007).

Certain approaches to land tenure can undermine the potential for agroforestry to impact those most in need. For example, in Brazil, people who do not have land tenure security are disincentivized to invest in long-term projects for their land such as agroforestry systems (A. Miccolis, personal communication, February 27, 2020). In India, poor land records make it difficult for farmers to participate in programs as benefits typically accrue to farmers with secure and/or proven land rights. The state of Telangana claims to have updated most of its land records before implementing its cash compensation scheme for agroforestry practices (Lasania, 2018), but at the same time excludes tenant farmers from the scheme, highlighting equity issues. The states of interest in India are also addressing the issue of transit permits that dissuade farmers from taking up agroforestry by exempting certain tree species.
from formerly restricted transport and felling. In Mexico, the minimum requirement for Sembrando Vida participants to have at least 2.5 hectares of unutilized land is an entry barrier for many seasonal farmers who do not own land and cannot get it loaned or leased.
In agroforestry systems, there is an inherent temporal lag between the planting period and the reaping of benefits. Planting agroforestry systems can require considerable upfront resources and work hours. These factors make agroforestry difficult for farmers already facing economic strain (USDA, 2019).

Several incentives we explored attempt to compensate for this challenge by providing farmers with upfront cash to pursue agroforestry while developing savings. Brazil’s PAA and PNAE programs adopt interventionist approaches as the government purchases the output of family farmers, with a preference for farmers using agro-ecological practices and for traditional and quilombola communities. In Brazil’s current agroforestry research, credit lines are considered a more promising incentive to engage smallholders. However, the issue is that there is a severe lack of information on local and regional prices for agroforestry products, which is a disincentive to the development of financial models to evaluate agroforestry systems (V. Ortega, personal communication, March 23, 2020). Without this information, banks are unable or unwilling to provide loans. Furthermore, credit systems are designed for specific crops, which does not match the multiple crop aspect of agroforestry (V. Ortega, personal communication, March 23, 2020).

Financial incentives must be able to compete with the short-term profits from high-input agriculture (Montagnini, 2017). For Brazil’s agribusinesses making high profits, regulatory measures like the Brazilian Forest Code that oblige the restoration of parcels through sustainable practices like agroforestry could have more impact (Law 12.651/2012). However, the Forest Code’s self-reporting system risks legitimizing illegally grabbed land (Damasceno, 2017). Lastly, the international market trend of socio-environmental certifications is pushing corporations to adopt more sustainable practices (The Nature Conservancy, 2014).

In India, the PM-KISAN farmer well-being scheme provides income on an annual basis. However, the amount provided was criticized for providing only 6% of the targeted farmers’ annual income (Jha, 2019). This is much lower than Sembrando Vida’s direct cash transfer to farmers amounting to ~30% of an average household’s income in Mexico. Analysis across the three selected states in India illustrated that state-level schemes that provided more money per acre proved to be more popular. Besides cash transfers, the Indian government provides a minimum support price to ensure that farmers generate income from certain notified agriculture outputs. This approach can be more sustainable as it provides more reliable income from marketing of products than in Mexico. With Sembrando Vida, the income of farmers depends mostly on the monthly monetary transfer, but despite access to local markets, the products they grow are not always marketable. However, it is important to note that the government of Mexico recently addressed the free-market policies that are believed to have failed farmers by fixing new prices for corn, beans, rice, milk, and wheat to ensure steady income for farmers (Belmont, 2019; Hansen-Kuhn, 2019).

Both smallholders and large landowners are similar in their prioritization of “short-term” gains. Whether it is the need for imme-
mediate income to support one’s livelihood or the pressures to continue as business-as-usual in a highly structured supply chain, the transition to agroforestry needs to be supported by incentives that supersede the status-quo. Financial incentives can encourage smaller farmers to adopt agroforestry while regulations can ensure that bigger landowners comply with environmentally-sound practices. At the same time, structural changes must occur so that smallholders can access markets to generate income from selling agroforestry goods (V. Ortega, personal communication, March 23, 2020; Montagnini, 2017).

Enhanced agroforestry extension services including capacity building and market access are important for farmers to adopt and practice agroforestry on a commercial scale.

Agroforestry is a much more complex practice than conventional single-crop farming. Appropriate livelihood inputs and capacity enhancements are needed to complement the initial financial incentives mentioned above.

The Sembrando Vida program provides farmers with tree seedlings and material resources as well as technical assistance. In India, agriculture extension services come from the KVKs (Krishi Vigyan Kendras, or Farm Science Centres), which exist to bridge the gap between technology developed at research institutions and its adoption at the field level. Chavan et al. (2015) suggest establishing Krishivaniki Vigyan Kendra as the agroforestry equivalent of this system. Experts in Brazil underlined the need for technical access and training to ensure that farmers can reap the long-term benefits of agroforestry (A. Miccolis; V. Ortega, personal communications, February and March 2020). The need for technical assistance is also a challenge for Brazilian private companies whose main suppliers are small producers who need assistance on how to improve the environmental impact of their activity (D. Cesano, personal communication, February 28, 2020).

Despite the prevalence of local-level actors in India like village self-help groups, farmer cooperatives, district seed stores, and district watershed development units, agroforestry has not been adopted to the desired extent because of a lack of participation (Singh and Dhyani, 2014). For instance, a lack of information exchange between the federal government and the lower levels that implement the National Agroforestry Policy, as well as a lack of integration of policies and programs across the agroforestry value chain, has caused uneven progress across local areas (Singh and Dhyani, 2014; S. Oza, personal communication, April 25, 2020). We also found that the top-down approach of the Forestry Department weakens the sense of ownership from local and marginalized groups, which can be a disincentive to implementation (R. DeFries, personal communication, March 28, 2020). In this regard, it must be noted that the public-private partnership model in wood-based industries has been successful in providing...
farmers an established value chain and access to markets across India (Chavan et al., 2015). This can be explored further to aggregate agroforestry outputs from small farms.

In Brazil, the government does not have the administrative capacity to tend to the large quantity of farmers if they were to each apply for an agroforestry-related loan. At the same time, there is not a prevalence of local farmer groups to streamline general demands and/or concerns to the government. As such, developing and strengthening local organizations is considered a crucial aspect in improving access to credit and knowledge (A. Miccolis, personal communication, February 27; V. Ortega, personal communications, March 23, 2020). One unique example of a local cooperative called CAMTA (Cooperativa Agrícola Mista de Tomé-Açu) in the Amazon shows that networks of knowledge sharing and assistance for agroforestry can lead to a sustainable use of parcels and a guaranteed link between products and markets (Canopy Bridge, 2017; V. Ortega, personal communication, March 23, 2020).

As for Mexico, Sembrando Vida’s direct relationship between the government and individual farmers is fraying local networks of cooperatives and associations (E. Esquivel, personal communication, March 24, 2020; J. I. Zuñiga, personal communication, March 10, 2020). Leveraging the networks and knowledge base of local organizations can further improve agroforestry outcomes.

Even when top-down government agroforestry programs are implemented closer to the ground, progress can be stalled without capacity building at the community levels. All of these points underline the need for improved bottom-up participatory processes to ensure that agroforestry inputs coincide with local ecologies and markets.
Inclusion of women and indigenous groups in the planning and design of agroforestry projects is essential as they not only benefit the most from agroforestry policies, but also contribute valuable knowledge.

It is important to adopt a gendered perspective in agroforestry because women often hold the most knowledge of these traditional production systems (Fortmann & Rocheleau, 1985). Yet, women are underrepresented in forest user groups and have unequal access to extension services (CGIAR, 2017). Research shows that closing the gender gap is key to achieving sustainable and equitable development in tree-based landscapes (CGIAR, 2017).

In an attempt to empower women, who have historically not held land titles but have played a large role in agriculture, India’s National Policy for Farmers 2007 recommended the introduction of “joint pattas” or joint ownership of plots to couples (National Policy for Farmers, 2007; Dagar, 2014). However, this leaves women vulnerable in the event that their husband dies, remarries, or divorces. Issuing individual land titles to women exists and may have more impact, but there is a need to raise significant awareness to make sure they are known and accessible (Rosenberg, 2016) and that social norms do not prevent women from applying for rights. For instance, a local group in Gujarat has been leading workshops to raise the awareness on the rights of daughters to inherit agricultural land (Rosenberg, 2016). Women landowners are also not prevalent in Mexico and Brazil, which makes it difficult for even gender-focused land use programs to have an impact if they rely on land tenure records or do not address embedded cultural norms (Chaves, 2018; Gonçalves & Vivan, 2015).

Indigenous agroforestry systems are the result of an accumulation of knowledge on ecosystems and their services (Miller & Nair, 2006). The literature in agroforestry research emphasizes the need for decision-makers to consider the opinions of both scientists and communities who practice local ecosystem management (Vallejo et al., 2015). The policies of interest pay particular attention to leveraging such know-how for scaling up agroforestry projects.

One component of Sembrando Vida, Sembrando Igualdad, promotes the participation of women farmers and indigenous peoples in the program. Money transfers are allocated through a point system which gives priority to specific marginalized groups (Secretaría de Bienestar, 2020). In India, the National Biological Diversity Act records the flora and fauna of each state, and requires the documentation of traditional knowledge on biological resources in ‘People’s Biodiversity Registers’. While the focus in Brazil is to integrate agroforestry systems into modern markets, experts acknowledge the need to use the indigenous knowledge of fruit tree cultivations.

However, indigenous communities are marginalized in Brazil’s agroforestry conversation (V. Ortega, personal communication, March 23, 2020). According to one expert, indigenous communities can gain substantially from reforms that rely on their valuable knowledge, and so they should be the first target of such policies (A. Miccolis, personal communication, February 27, 2020). The rights and voices of indigenous groups must therefore be strengthened to maximize their participation in agroforestry development.
Lessons Learned

In Brazil, there is potential to develop value chains for agroforestry products that could promote both economic growth and more sustainable land-use practices. While agroforestry projects are developing at the private and academic level, governmental policies could be strengthened by focusing on small farmers and their practices.

**Key lesson from Brazil:** the focus on analyzing the financial returns of agroforestry systems to engage both public and private actors; leveraging the country’s native resources for new and/or diversified markets.

By contrast, various government agencies in India are leading programs that can promote agroforestry, and result in improved farmer welfare and environmental conservation/restoration. However, agroforestry in India is hindered by administrative hurdles that slow down project rollout and weaken local-level participation.

**Key lesson from India:** the inclusion of marginalized stakeholders in policies as well as the public-private partnership model in wood-based industries (which could incorporate agroforestry outputs).

Lastly, in Mexico, Sembrando Vida is an example of a strong mobilization of resources to promote agroforestry. However, improving the participation of other government agencies and local groups could greatly improve the design of the program so that it can tailor to different regions' socio-environmental conditions.

**Key lesson from Mexico:** the capillary and structured approach to capacity development at the local level.
VI. Conclusion

Our analysis emphasized that ensuring access to training, credit, and markets for agroforestry products is conducive to successful agroforestry projects. However, existing regulations must be able to support these economic incentives and capacity building practices. For instance, secure land tenure, environmental regulations on land-use, and rights to resources are often a prerequisite for farmers to access credit or for agribusinesses to improve the sustainability of their operations. To ensure the equity of economic or regulatory incentives, additional efforts are needed to address socio-cultural inclusiveness, for example by ensuring that women and indigenous persons truly have access to incentives.

To provide stakeholders with incentives to engage in or support agroforestry policy reforms, research is still needed to quantify the financial and environmental benefits at larger scales and over longer time frames.

Finally, one huge challenge is increasing the land acreage devoted to agroforestry and integrating the resulting products into modern markets while retaining the practice’s sustainability. Greater collaboration across government agencies and with local-level actors is key to scale up agroforestry in an effective and sustainable manner.
VII. Next Steps

The analyzed policies contribute to the WRI Global Restoration Initiative’s goal of creating diagnostic tools to assist stakeholders in the planning of forest and landscape restoration projects. By identifying the general enabling conditions for a successful agroforestry system, WRI can better aid decision-makers in breaking down what success factors in a specific context are present and/or missing.

WRI is also working on a Policy Accelerator, a program similar to its existing Land Accelerator that aims to empower entrepreneurs involved in restoring degraded lands (WRI, n.d.). Our analysis can contribute to the Policy Accelerator as it identifies the mechanisms policies use to promote agroforestry development as well as address implementation barriers.
Glossary of Terms

**Agroforestry:** A land-use system that combines woody perennials, agricultural crops, and/or livestock animals on the same land management (Lundgren and Raintree, 1983).

**Disincentives:** Existing incentives that are preventing the goals of the stated policy to be reached, because they are driving antithetical behaviors.

**Ejidos (Mexico):** Traditional system of Indian land-tenure in Mexico where land is held in common by the community with some reappportionment to individuals for subsistence farming. Some were expropriated after the Amortization Law of 1856 and during the Porfirio Díaz dictatorship. But the 1917 Mexican Constitution provided for the restitution of ejidos and formed the basis of Mexico’s agrarian reform (Ejido, 2018).

**Incentives:** Mechanisms that influence behavioral changes to achieve a policy goal. There are two main types of incentives: regulatory and economic. Regulatory incentives shape the legal framework in a system, while economic incentives influence behavioral changes through financial/monetary means (IPBES, n.d.).

**Landscape:** The characteristics that distinguish a certain geographic area including its physical environment, biological composition, and anthropogenic activities (USDA, 2020).

**Land degradation:** The reduction in the quality of soils and the land’s utility to provide food, livelihoods, and the production/provision of other ecosystem goods and services (WHO, 2012).

**Land restoration:** The ongoing processes that attempt to restore the ecological productivity of a degraded landscape, in order to achieve benefits for people and the environment (Bonn Challenge, n.d.).

**Latifundia (Brazil):** In Brazil, a system of land dominated by large, private agricultural estates with colonial origins operating with a commercially exploited labour force (FIAN, 2000). These estates stand in stark contrast to the amount of small farmers and landless.

**Livelihood:** A means of living or securing the necessities of life. It could be a job, work, source of income, or even what someone gets as support from any organization, group, or any other means, that support their daily needs (Uprety, 2004).

**LR - Legal Reserve (Law 12.651/2012, BRAZIL):** Area located within a rural property, which varies according to biome, delimited according to the terms of Article 12, with the function of assuring sustainable economic use of natural resources on rural properties, aid in conserving and rehabilitating ecological processes and promoting biodiversity conservation, as well as shelter and protection for wildlife and native plants.

**Panchayat (India):** A middle-level unit of rural local government existing prior to 1986, made up of the heads of the village Panchayats (Debroy & Kaushik, 2005). In “Panchayati raj”, the word “Panchayat” means assembly (ayat) of five (panch) and raj means “rule”. Traditionally Panchayats consisted of elderly and wise people chosen by the local community, who used to settle disputes between individuals and villages (Pria, n.d.).

**Perverse incentives:** Incentives that attempt to achieve the stated policy goal, but instead have an unanticipated negative or reverse effect.
**PPA - Permanent Preservation Area (Law 12.651/2012, BRAZIL):** A protected area, covered or not by native vegetation, with the environmental function of preserving water resources, the landscape and geological stability and biodiversity, facilitating gene flows of fauna and flora, protecting the soil and ensuring the well-being of human populations.

**Quilombola:** According to Decree No. 4887 of 20 November 2003, quilombola are considered to be “remnants of quilombo communities, the racial and ethnic groups according to self-attribute criteria, with their own historical trajectory, endowed with specific territorial relations, with presumption of black ancestry related to the resistance to the suffered historical oppression”.

**Smallholder, or small-scale, family farmer:** There is no universal definition for this term. It varies from country to country, but landholding size of 2 hectares or less is used by the World Bank to identify smallholder farmers. In the world, there are approximately 500 million small farmers and they produce 80% of the world’s food (Graeub et al., 2016). See Box 1 p.13. for more country-specific details.

**Sustainable land-use/management:** Refers to natural resource management practices that meet both current and future human needs by maintaining the landscape’s ecological functions (FAO, 2017).

**Sustainable management in the Brazil Forest Code (Law 12.651/2012, BRAZIL):** Administration of natural vegetation to obtain economic, social, and environmental benefits, respecting the mechanisms of support of the ecosystem and considering, cumulatively or alternatively, the use of multiple species of wood or not, multiple products or by-products of the flora, as well as the use of other goods or services.

**Trees Outside Forest (TOF):** The Forest Survey of India defines TOF as “all tree patches occurring outside the recorded forest area (RFAs)” irrespective of patch size (FSI, 2019). Therefore, this technically includes trees on agricultural plots, community lands, and even scattered trees along roads, highways, canals, and urban colonies (Ghosh & Sinha, 2019).

**UER (Rural Economic Unit):** In Mexico is a physical or moral person, linked or not to a property, who carries out agricultural, fishing, aquaculture and other productive, industrial, commercial and service activities in rural areas (SAGARPA, 2019).
The government has monopoly over popular tree species; farmers must sell at fixed prices (Ghosh and Sinah). Strict and complicated transit permits dissuade farmers from taking up agroforestry. Lack of access to credit against agroforestry plantations (Dagar et al.) makes large up front purchases unfeasible. In order for farmers to participate in agroforestry practices they would have to make significant investments. The government supports farmers by providing seedlings and access to agroforestry resources to help small and marginalized farmers (Singh and Dhyani, 2014). However, due to insufficient consultation with technicians on the ground, there is a lack of effective support for agroforestry development inputs.

Access to markets is dependent on pre-existing social and economic infrastructure. One problem facing farmers is access to market and selling their goods. Most small scale farmers and their rural communities would be the beneficiaries of incentives and efforts to build local markets. Consumer-producer links could be strengthened by improving access to local markets. After 1992 reforms, communities (ejidos and comunidades) began working with local businesses to encourage “biomasa” production and to establish local market infrastructure (Bray et al., 2006).

The Brazilian Forest Code legally requires privately owned properties to conserve 25% of their land in forest. In practice, this is interpreted as “Campesino forest” (TOF) land which is available for agroforestry. Trees available on agricultural land, along road side, railways, and in the vicinity of residential areas can be used for agroforestry. For example, araucaria trees are a popular choice for agroforestry practitioners (Chavan et al.). There is a Minimum Support Price for publicly procured agricultural produce (1.5x the cost of production). This price is aimed at ensuring farmers a fair return for their produce. The government supports farmers by providing seedlings and access to agroforestry resources. One problem facing farmers is access to market and selling their goods. Most small scale farmers and their rural communities would be the beneficiaries of incentives and efforts to build local markets. Consumer-producer links could be strengthened by improving access to local markets. After 1992 reforms, communities (ejidos and comunidades) began working with local businesses to encourage “biomasa” production and to establish local market infrastructure (Bray et al., 2006).

<table>
<thead>
<tr>
<th>Country</th>
<th>Local Incentives</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>PM Fasal Bima Yojana (crop insurance)</td>
<td>covers all “farmers”, including tenant farmers and sharecroppers.</td>
</tr>
<tr>
<td></td>
<td>Interest Subsidy Scheme on crop loans</td>
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<td></td>
<td>PM KISAN</td>
<td>annual income support for procuring agricultural inputs</td>
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<td></td>
<td>Doubling of Farmers’ Income</td>
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<td></td>
<td>Remunerative Approach for Agriculture and Allied sector Rejuvenation</td>
<td></td>
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<tr>
<td></td>
<td>Soil Health Card Scheme</td>
<td></td>
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<tr>
<td></td>
<td>National Rainfed Area Authority</td>
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<tr>
<td></td>
<td>National Bank for Agriculture and Rural Development (NABARD)</td>
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<td></td>
<td>Ministry of Agriculture and Farmers’ Welfare</td>
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<td></td>
<td>Ministry of Tribal Affairs</td>
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<tr>
<td></td>
<td>Ministry of Environment, Forests and Climate Change</td>
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<tr>
<td></td>
<td>Forest Survey of India</td>
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<tr>
<td></td>
<td>MINISTRY OF TRIBAL AFFAIRS</td>
<td></td>
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<tr>
<td></td>
<td>National Agroforestry Policy</td>
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</tr>
<tr>
<td></td>
<td>Rights to tree felling and transit are different in different states, which might affect incentivize agroforestry. The government (State Forest Department) has a monopoly over popular tree species; farmers must sell at fixed prices (Ghosh and Sinah).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Like the states of interest have already done, relaxing transit and felling permits would address in National Agroforestry Policy:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Necessity of security of land tenure for farmers in decision to take up agroforestry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Appropriate livelihood and environmental incentives</td>
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<tr>
<td></td>
<td>There is a Minimum Support Price for publicly procured agricultural produce (1.5x the cost of production). This price is aimed at ensuring farmers a fair return for their produce. The government supports farmers by providing seedlings and access to agroforestry resources. One problem facing farmers is access to market and selling their goods. Most small scale farmers and their rural communities would be the beneficiaries of incentives and efforts to build local markets. Consumer-producer links could be strengthened by improving access to local markets. After 1992 reforms, communities (ejidos and comunidades) began working with local businesses to encourage “biomasa” production and to establish local market infrastructure (Bray et al., 2006).</td>
<td></td>
</tr>
</tbody>
</table>
Lots of power in these roles (J Zuñiga, Personal Communication Apr, 19, 2020)

coordinator controls more than what the states have for their own agricultural programs. They provide connections, and they can control a lot of money going to the producers. Each Technician is paid around 4x the monthly subsidy. Working with the government, they support the rollout. Lack of seedlings and other supplies (e.g. mesh netting for nurseries) due to speed of implementation, coming at the expense of natural forest cover, which undermines increasing tree cover through land under plantations or agroforestry systems. There have been reports of new deforestation in areas in order to qualify land for new programs and for the program and in garnering political goodwill, but arguably environmental outcomes that are not necessarily in line with the program’s aims.

When farmers don’t have necessary supplies or technical support, they plant what they have available or what they can grow based on past experience or local knowledge. This can lead to the selection of crops or practices that may not be sustainable or environmentally friendly. Farmers may choose to plant crops that are easier to grow and require less input, even if they are not the most productive or environmentally friendly options.

There is a knowledge gap on the ground as Indigenous communities are not incorporated into the planning process. When included, they are marginalized and not taken seriously. Indigenous knowledge is not really incorporated because agroforestry in Brazil is more seen as a type of traditional agriculture, but not necessarily agro-ecological systems. The program would benefit from more participatory processes as the initial rollout was too ambitious to allow for producer input to properly guide plant selection, cultivation, and management.

Successful implementation of the program is largely tied to the strength of preexisting social infrastructure. For example in Quintana Roo, despite its poverty, the region is successful and has seen positive outcomes due to strong community involvement. Indigenous communities are represented in the agroforestry planning process. When included, they are marginalized and not taken seriously. Indigenous knowledge is not really incorporated because agroforestry in Brazil is more seen as a type of traditional agriculture, but not necessarily agro-ecological systems. The program would benefit from more participatory processes as the initial rollout was too ambitious to allow for producer input to properly guide plant selection, cultivation, and management.

Regional facilitators support CACs and help to coordinate activities between local people. Each regional facilitator supports 5 pairs of technicians (so 40 CACs and 1000 social workers) and works with local producers to provide education/support to producers (J Zuñiga, Personal Communication Apr, 19, 2020; G. Sánchez & T. Fausto, Personal Communication, March 23, 2020). Some unique case studies like the CAMTA cooperative provide education/support to producers (J Zuñiga, Personal Communication Apr, 19, 2020; H. Caamal, personal communication, March 23, 2020). The program would benefit from more participatory processes as the initial rollout was too ambitious to allow for producer input to properly guide plant selection, cultivation, and management.

Social infrastructure is key for the success of agroforestry programs. Indigenous knowledge is not really incorporated because agroforestry in Brazil is more seen as a type of traditional agriculture, but not necessarily agro-ecological systems. The program would benefit from more participatory processes as the initial rollout was too ambitious to allow for producer input to properly guide plant selection, cultivation, and management.
Appendix 1 (a and b) categorizes the current status of incentive measures by country as they relate to achieving agroforestry outcomes. Note the specific impact of relevant formal institutions (including the specific policies/programs each country team is focusing on), the role of informal institutions, and any conflicts/disincentives that are generated by misaligned stakes/goals (see also the final set of mechanisms “Perverse Incentives”).


Appendix 2. Disincentives Table

<table>
<thead>
<tr>
<th>LOCAL DISINCENTIVES INVENTORY</th>
<th>BRAZIL</th>
<th>INDIA</th>
<th>MEXICO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land-use subsidies</td>
<td>Agriculture was heavily subsidized in the past but due to fiscal constraints, this is not currently the case. As such, this change does not promote environmentally-damaging crops/practices, however it also does not support environmentally-beneficial practices (World Bank).</td>
<td>Schemes like Panchayat in Telangana may adversely incentivize farmers to adopt unsustainable crops to the extent that they are covered by investment support schemes like it.</td>
<td>There has been a history of agricultural subsidies for cattle and maize incentivizing larger-scale monoculture cropping. Sembrando Vida removes those disincentives for agroforestry systems by transferring cash directly to small producers.</td>
</tr>
<tr>
<td>Infrastructure subsidies</td>
<td>There could be potential competition over conversion of non-agricultural or degraded land to commercial and via a vice restoration through forestry/ agroforestry.</td>
<td>Increased demand for pulp incentivizes plantations on tree outside forests, which was used as an argument for an increase in tree cover or agroforestry systems could overstate the true value of these changes (Defries, pers comm, March 24, 2020).</td>
<td>Farmers have access to markets and full ability to market agroforestry products from their land. However, due to lack of consultation with farmers, the crops they grow are not always the most marketable.</td>
</tr>
<tr>
<td>Market disincentives</td>
<td>There is not a strong market for agroforestry positive products. Most products in Brazil are cash crops for local food production (Miccotis, pers comm, February 27, 2020). Financial institutions currently support this cash crop model.</td>
<td>Restrictions on tree felling and transit are the biggest hindrance in planting trees on farmlands.</td>
<td>Land rights are secure due to ownership structure in Mexico. However, the minimum requirement to participate in the SV program is to have of 2.5 ha of uncultivated land, which is an entry barrier for many seasonal farmers who don’t own land and cannot get it leased/leased (Zúñiga, pers comm, April 19, 2020).</td>
</tr>
<tr>
<td>Regulatory disincentives</td>
<td>The Forest Code is Brazil’s landmark environmental legislation that sets protection requirements of land to maintain rural vegetation. This only applies to private landowners and holds the landowner responsible for violations. However, self-reporting with weak oversight can give legitimacy to illegally grabbed land (Damasceno).</td>
<td>Tenant farmers and women farmers stand to lose from schemes that make land ownership the basis for any benefit transfers.</td>
<td></td>
</tr>
<tr>
<td>Administrative disincentives</td>
<td>Financial institutions have no standardized financial information to properly analyze and assess the risk of the agroforestry projects in order to give credit.</td>
<td>There is a concern of alienation of local people from decision processes due to hierarchical structures of policies and lack of communication.</td>
<td>This disincentive exists in the form of the administrative hierarchy in each state implementing Sembrando Vida. Some facilitators and technicians were hired without the requisite skill set (Zúñiga, pers comm, April 19, 2020), but this is very regionally dependent.</td>
</tr>
<tr>
<td>Political will/ bureaucratic will</td>
<td>There is a lack of subject matter knowledge within the government. Current administration has been systematically dismantling and defunding sustainable agriculture projects (Miccotis, pers comm, February 27, 2020). Our research found that the majority of government websites did not have comprehensive information and lots of links were dead.</td>
<td>The program was rolled out very quickly, so there is a gap in the provision of seedlings and supplies. The technicians hiring process was also rushed, resulting sometimes in non-optimal selection. (Zúñiga, pers comm, April 19, 2020).</td>
<td>The program’s heavy focus on improving social welfare may detract from ensuring ecological benefits. WRI Mexico has been helping evaluate the environmental benefits of the program.</td>
</tr>
<tr>
<td>Informal disincentives</td>
<td>At the local and government levels, Brazil is oriented towards the intensive monoculture production model. This creates a strong cultural barrier to any other production model like agroforestry systems that differ from it (Oliveira, pers comm, March 23, 2020).</td>
<td>Despite progressive laws for women’s right to land tenure, cultural norms make change difficult to implement.</td>
<td>Marginalized groups (women, indigenous persons) are given priority in the program; however, cultural and social norms still prevent them from fully participating.</td>
</tr>
</tbody>
</table>
Appendix 2 categorizes the disincentives to agroforestry implementation.

**Based on**: WRI India’s Excel sheet; WRI’s classification of incentives for restoration and IPBES’ classification. Further points drawn from: Jacobi et al. (2016), Agroforestry in Bolivia: opportunities and challenges in the context of food security and food sovereignty, Environmental Conservation; Cambridge Vol. 43, Iss. 4: 307-316. DOI:10.1017/S0376892916000138; FAO (1999), POVERTY ALLEVIATION AND FOOD SECURITY IN ASIA Enhancing Forestry and Agroforestry Contributions; J. McNeely (2006), A new approach to Incentives under the Convention on Biological Diversity, 8th meeting of the Conference of the Parties to the Convention on Biological Diversity (COP8), Curitiba, Brazil, 20-31 March 2006.

**Appendix 3.a. Issue Matrix Brazil**

<table>
<thead>
<tr>
<th>ISSUE MATRIX: BRAZIL</th>
<th>Political</th>
<th>Economic</th>
<th>Social</th>
<th>Environment</th>
<th>Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>International</td>
<td>Trade liberalization since the 1990’s has caused commercial agricultural export growth (World Bank, 2017).</td>
<td>Dichotomy in Brazilian agriculture. Half are small scale family farms, and the other half are large commercial output farms (Haupt, 2015).</td>
<td>Different regions and different biomes require specific planning and financial analysis. South has higher agricultural productivity. North has less favorable agro-ecological conditions and lower productivity requiring more technology and inputs. (World Bank, 2020).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional/ sub-regional</td>
<td>Disproportionate ratio of land ownership between latifundia and small farmers (FIAN, 2000).</td>
<td>Lack of established market for different crops with lower output and multiple cycles (other than the national commodities). South home to large scale farms concentrated in the Cerrado region. Northern Brazil is mostly comprised of small scale farmers who produce food for local consumption (Haupt, 2015).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National</td>
<td>Due to political interest of the current federal government, existing projects (i.e. PAA, PNAE) are being further underfunded.</td>
<td>Financial institutions have no standardized financial information to properly analyze and risk assess the agroforestry projects in order to give credit.</td>
<td>Cultural barrier – national mindframe of the agribusiness as large intensive monoculture with high output. (Gross, 2019)</td>
<td></td>
<td>Lack of technical assistance in the definition and planning of the agroforestry system.</td>
</tr>
<tr>
<td>Sub-national</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td>The majority of family farmers live in poverty as their small farms have low productivity. Increasing profitable output and incomes is the most important issue to farmers. (World Bank, 2020).</td>
<td></td>
<td>Indigenous people, when included in the conversation, are so in a very marginalized way.</td>
<td></td>
<td>Majority of Brazil’s population lives in urban areas. (World Bank, 2020).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Very weak law enforcement that allow for prevailing loopholes in the expansive country (Haupt, 2015).</td>
</tr>
</tbody>
</table>
### Appendix 3.b. Issue Matrix India

<table>
<thead>
<tr>
<th>ISSUE MATRIX: INDIA</th>
<th>Political</th>
<th>Economic</th>
<th>Social</th>
<th>Environment</th>
<th>Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>International</td>
<td>India’s emissions reductions targets set out in international climate pledges (Watson et al., 2013)</td>
<td>Country with one of the largest populations of absolute poor (World Bank, 2020)</td>
<td>India’s NDC (National Determined Contribution) for carbon sequestration (Ministry of Environment, Forest, and Climate Change, 2018)</td>
<td>National timber demands drive forest exploitation and illegal timber imports, which could be answered by agroforestry (Mazumdar-Shaw, 2019)</td>
<td>Increasingly erratic monsoon patterns as a result of land-use and human activity (energy sources) in India and other Asian countries (Arendt, 2019)</td>
</tr>
<tr>
<td>Regional/ sub-regional</td>
<td>National timber demands drive forest exploitation and illegal timber imports, which could be answered by agroforestry (Mazumdar-Shaw, 2019)</td>
<td>Demographic pressure of 43% of employment within agriculture (World Bank)</td>
<td>Increasingly erratic monsoon patterns as a result of land-use and human activity (energy sources) in India and other Asian countries (Arendt, 2019)</td>
<td>National timber demands drive forest exploitation and illegal timber imports, which could be answered by agroforestry (Mazumdar-Shaw, 2019)</td>
<td>Forest stress due to unpredictable precipitation trends induced by climate change (rainfall dependence), widening gap between supply and demand, poor water resource management (IECCD)</td>
</tr>
<tr>
<td>National</td>
<td>Small and marginal farmers with less than 2 hectares of land make up &gt;85% of farmers in India, so they own less than 50% of crop area. (Bera, 2018).</td>
<td>8.2% of country land area is under agroforestry (includes both irrigated and rainfed systems) (Dagar, 2014).</td>
<td>Agroforestry seen as a way to protect critical watersheds that can meet demands of a rising population for food and energy (Dhyani et al)</td>
<td>Demographic pressure of 43% of employment within agriculture (World Bank). High rates of farmer suicide from lack of safety nets and poor yields (in Karnataka especially)</td>
<td>Forest department does plantation drives to increase forest cover, but not forest longevity (DeFries, pers comms, March 28, 2020)</td>
</tr>
<tr>
<td>Sub-national</td>
<td>Small and marginal farmers with less than 2 hectares of land make up &gt;85% of farmers in India, so they own less than 50% of crop area. (Bera, 2018).</td>
<td>Small landholdings are providing the bulk of the country’s domestic wood products (NRCAF).</td>
<td>Demographic pressure of 43% of employment within agriculture (World Bank). High rates of farmer suicide from lack of safety nets and poor yields (in Karnataka especially)</td>
<td>Small landholdings are providing the bulk of the country’s domestic wood products (NRCAF).</td>
<td>Tradeoff between water for crops and for trees (DeFries, pers comms, March 28, 2020)</td>
</tr>
<tr>
<td>Local</td>
<td>Lack of access to extension services by farmers (Bhushan, 2018).</td>
<td>Potential of corporate sector to get involved in agroforestry and provide employment (with bioenergy) (NRCAF)</td>
<td>Significant spatial and temporal variation in rainfall and water availability (IECCD)</td>
<td>Lack of access to extension services by farmers (Bhushan, 2018).</td>
<td>Agroforestry products consumed locally in a highly unorganized market, but commercial agroforestry in tandem with wood-based industry has immense potential (Dagar, 2010)</td>
</tr>
</tbody>
</table>

- Poor land records in rural land markets
- Limited availability of credit (OECD)
- Exploitation and illegal timber imports
- High rates of farmer suicide
- Agricultural failure linked to increased rate of farmer suicides
- Conflict over scarce agricultural land
- Lack of access to extension services by farmers
- Limited availability of credit
- Exploitation and illegal timber imports
- High rates of farmer suicide
- Agricultural failure linked to increased rate of farmer suicides
- Conflict over scarce agricultural land

**Note:** The table above provides a matrix of issues across different levels (International, Regional, National, Sub-national, Local) and domains (Political, Economic, Social, Environment, Security). Each issue is classified based on its impact and is linked to relevant data and references cited in the text.
### International

- **Political**: Failure of global community to set carbon price, rendering local payment for ecosystem services (PES) projects somewhat ineffective (D Bray, Personal Communication, Mar, 24, 2020).

### Regional/sub-regional

- **Social**: Strong network of community-based organizations in region advocating for rights of indigenous persons and of small-scale producers (E. Sanchez, Personal Communication, Mar, 23, 2020).

### National

- **Economic**: Agricultural subsidies of maize, cattle, and other monocultures from the free trade policies of the past ~30 years disincentivize small-scale agroforestry practices.

- **Social**: Community relations have been withering in recent years. The SV program has increased the trends of cultural individualism contributing to this decline (E. Esquivel, Personal Communication, Mar, 24, 2020).

- **Environment**: Environmental degradation is translating into a health emergency in Mexico (Merino, 2020).

### Sub-national

- **Local**: Lack of producer involvement leads to inappropriate choices around seedling selection, and this can impact long-term ecological goals of agroforestry systems (Montagnini, Zuñiga).

- **Environment**: Loss of more than half of native forests in Mexico (Eguiluz-Piedra, 2003).

### Local

- **Social**: Issues of gender-based violence in rural communities (Secretaría de Bienestar. (2019, November 17)).

- **Environment**: Plant resources in forests were historically dependent on human management, so agroforestry practices mirror this traditional socio-ecological system (Vallejo et al., 2015).

- **Security**: Organized crime could derail community-led conservation efforts (D Bray, Personal Communication, Mar, 24, 2020).
## Appendix 4. Interview List

<table>
<thead>
<tr>
<th>Country</th>
<th>Individual</th>
<th>Position</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>Daniele Cesano</td>
<td>Chief Executive Officer</td>
<td>Adapta Group</td>
</tr>
<tr>
<td>Brazil</td>
<td>Andrew Miccolis</td>
<td>Country Coordinator, Brazil</td>
<td>ICRAF (World Agroforestry Centre)</td>
</tr>
<tr>
<td>Brazil</td>
<td>Valmir Ortega</td>
<td>Executive Director</td>
<td>Conexus</td>
</tr>
<tr>
<td>United States (interviewed for Mexico)</td>
<td>David Bray</td>
<td>Professor</td>
<td>Florida International University, Department of Earth and Environment</td>
</tr>
<tr>
<td>Mexico</td>
<td>Hilario Caamal</td>
<td>Facilitador del programa (Program Facilitator)</td>
<td>Sembrando Vida, Quintana Roo Centro</td>
</tr>
<tr>
<td>Mexico</td>
<td>Teresita de Jesús Fausto Moya</td>
<td>Graduate Student, Rural Regional Development Studies</td>
<td>Chapingo Autonomous University</td>
</tr>
<tr>
<td>Mexico</td>
<td>Elsa Esquivel Bazán</td>
<td>Gestora y Desarrolladora de proyectos (Project Manager and Developer)</td>
<td>Cooperativa AMBIO</td>
</tr>
<tr>
<td>United States (interviewed for Mexico)</td>
<td>Florencia Montagnini</td>
<td>Senior Research Scientist and Director, Program in Tropical Forestry and Agroforestry</td>
<td>Yale University, School of Forestry and Environmental Studies</td>
</tr>
<tr>
<td>Mexico</td>
<td>Gustavo Sánchez Valle</td>
<td>Presidente del Consejo Directivo (Chairman of the Board of Directors)</td>
<td>Red Mexicana de Organizaciones Campesinas Forestales (Red MOCAF)</td>
</tr>
<tr>
<td>Mexico</td>
<td>José Iván Zúñiga</td>
<td>Gerente de Paisajes Forestales (Forests Manager)</td>
<td>WRI México</td>
</tr>
<tr>
<td>United States (interviewed for India)</td>
<td>Ruth DeFries</td>
<td>Professor</td>
<td>Columbia University, Department of Ecology, Evolution and Biology (E3B)</td>
</tr>
<tr>
<td>India</td>
<td>Vamshi Krishna</td>
<td>Senior Manager, Sustainable Agriculture</td>
<td>WWF-India, Hyderabad</td>
</tr>
<tr>
<td>India</td>
<td>Rajashree Joshi</td>
<td>Chief Thematic Program Executive</td>
<td>RAIF Development Research Foundation</td>
</tr>
<tr>
<td>India</td>
<td>Apoorva Oza</td>
<td>Chief Executive Officer</td>
<td>Aga Khan Rural Support Program (AKRSP)</td>
</tr>
<tr>
<td>India</td>
<td>Sachin Oza</td>
<td>Executive Director</td>
<td>DSC Foundation, Gujarat</td>
</tr>
<tr>
<td>India</td>
<td>Roshan Rathod</td>
<td>Subject Area Specialist - Gender and Institution Building</td>
<td>People's Science Institute, Uttarakhand</td>
</tr>
<tr>
<td>India</td>
<td>Shilpa Vasavada</td>
<td>Gender and National Resource-Based Livelihood Professional</td>
<td>Working Group for Women and Land Ownership (WGWLHO), Gujarat</td>
</tr>
<tr>
<td>India</td>
<td>Yogesh Sawant</td>
<td>Senior Thematic Program Executive</td>
<td>RAIF Development Research Foundation</td>
</tr>
</tbody>
</table>
Appendix 5. Framework Deliverable for WRI India

Left: Information on policies. Right: Information on incentives

Note that this is just a snapshot of the entire framework, and that the full Excel will be sent to WRI India.
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