

Branching Out

Incentives & Disincentives to Agroforestry

COLUMBIA UNIVERSITY | SIPA



CAPSTONE PROJECT PREPARED FOR The World Resources Institute

BY Olivia Alves, Elena Belletti, Caroline Blanck, Josefina Correa, Louise Efthimiou, Jonas Goldman, Alisha Lee, Nathalia Nagai, Beryl Sinclair, Nuvodita Singh

FACULTY ADVISOR Louise Rosen

THE EARTH INSTITUTE
COLUMBIA UNIVERSITY



Table of Contents

ACKNOWLEDGMENTS	3
ABOUT THE WORLD RESOURCES INSTITUTE AND THE PROJECT	4
EXECUTIVE SUMMARY	5
KEY MESSAGES	6
I. INTRODUCTION	9
II. METHODOLOGY	12
III. POLITICAL ECONOMY OF AGROFORESTRY	17
BRAZIL	20
INDIA	27
MEXICO	34
IV. FRAMEWORK FOR ANALYZING THE POLICIES OF INTEREST AND THEIR INCENTIVES	40
BRAZIL	42
INDIA	47
MEXICO	53
V. CROSS-COUNTRY COMPARISON	57
VI. CONCLUSION	66
VII. NEXT STEPS	67
GLOSSARY OF TERMS	68
APPENDIX	70
REFERENCES	78
PHOTO CREDITS	86



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Kathleen Buckingham, Research Manager, Global Restoration Initiative, World Resources Institute
Miguel Calmon, Forests Director, World Resources Institute Brasil
Javier Warman, Forests Director, World Resources Institute Mexico
Manuel Cervera, Forests Coordinator, World Resources Institute Mexico
Ruchika Singh, Director- Sustainable Landscapes and Restoration, World Resources Institute India
Marie Duraisami, Senior Project Associate, World Resources Institute India
Swati Chaliha, Consultant, World Resources Institute India
Jared Messinger, Manager, Global Restoration Initiative, World Resources Institute
Helen Ding, Environmental Economist, World Resources Institute
Cristina Taylor, Forest Restoration Policy Consultant Intern, World Resources Institute
Daniele Cesano, Chief Executive Officer, Adapta Group
Valmir Ortega, Executive Director, Conexsus
Andrew Miccolis, Brazil Country Coordinator, World Agroforestry Centre
José Iván Zuñiga, Forests Manager, World Resources Institute Mexico
David Bray, Professor in the Earth and Environment Department, Florida International University
Hilario Caamal, Program Facilitator, Sembrando Vida
Florencia Montagnini, Senior Research Scientist and Director- Program in Tropical Forestry and Agroforestry, Yale University
Elsa Esquivel Bazán, Project Manager and Developer, AMBIO Cooperative, Mexico
Gustavo Sánchez Valle, Chairman of the Board of Directors, Red MOCAF
Teresita de Jesús Fausto Moya, Graduate Student, Chapingo Autonomous University
Ruth DeFries, Professor of Ecology and Sustainable Development, Columbia University E3B
Shilpa Vasavada, Gender and National Resource-Based Livelihood Professional, WGWLO, India
Vamshi Krishna, Senior Manager- Sustainable Agriculture, WWF India
Rajashree Joshi, Chief Thematic Program Executive, BAIF Development Research Foundation
Apoorva Oza, Chief Executive Officer, Aga Khan Rural Support Program (AKRSP), Telangana, India
Sachin Oza, Executive Director, DSC Foundation, Gujarat, India
Roshan Rathod, Gender and Institution Building Specialist, People's Science Institute, India
Yogesh Sawant, Senior Thematic Program Executive, BAIF Development Research Foundation
Joshua Fisher, Director- Advanced Consortium on Cooperation, Conflict and Complexity, Columbia University
Lucia Ferrarese, Teaching Associate for Master of Science in Negotiation and Conflict Resolution, Columbia University

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
ICRIER: 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 Colonização e Reforma Agrária)
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 Nature
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
MIAF: Milpa Interspersed Between Fruit Trees (Milpa Inter-calada 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)
PBRs: People's Biodiversity Registers in India
PES: Payment for Environmental/Ecosystem Service
PM-KISAN: Prime Minister's Kisan Samman Nidhi, an Indian government scheme
PMKSY: Pradhan Mantri Krishi Sinchayee Yojana, Indian Policy
PNAE: National School Feeding Program (Brazil)
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.

List of Figures & Boxes

- p. 10. **Figure 1** - Evolution of the Agroforestry Landscape
- p. 11. **Figure 2** - Policies of Interest in Brazil, India and Mexico
- p. 12. **Figure 3** - Outline of Methodology
- p. 14. **Box 1** -Sustainable Land-Use Terminology
- p. 15 **Box 2** - Broad Stakeholder Categories
- p. 16. **Figure 4** - Power-interest Matrix (Adapted from the World Bank)
- p. 18. **Figure 5** - Evolution of the Percent Land Cover of Agriculture and Forest
- p. 18. **Figure 6** - Evolution of the Proportion of Rural Population Over Total Population
- p. 18. **Figure 7** - 2016 Gender Distribution of Land Ownership
- p. 18. **Figure 8** - Proportion of Farmers (in percentage) Owning Farms of Different Sizes (in hectares)
- p. 20. **Figure 9** - Combined States Goals of the Policies of Interest
- p. 21. **Box 3** - Brazil's Biomes Analyzed in this Report
- p. 21. **Figure 10** - Ecoregions of Brazil (with Biome Names)
- p. 23. **Figure 11** - Contrast of Species Used for Agroforestry and Export Commodities
- p. 24. **Figure 12** - Historical Evolution of Forestry and Agriculture-related Policies in Brazil
- p. 25. **Figure 13** - Summary of Policies of Interest in Brazil
- p. 26. **Figure 14** - Power-interest Grid of Stakeholders Surrounding the Policies of Interest and the Current Agroforestry Scene in Brazil
- p. 27. **Figure 15** - Ecoregions of India
- p. 28. **Figure 16** - Historical Evolution of Forestry and Agriculture -related Policies in India
- p. 29. **Figure 17** - States of Interest in India
- P. 31. **Figure 18** - Summary of Policies of Interest in India
- p. 33. **Figure 19** - Power-interest Grid of Stakeholders Surrounding the Policies of Interest in India
- p. 34. **Figure 20** - Ecoregions of Mexico
- p. 35. **Figure 21** - Value of Agricultural Production in Mexico
- p. 35. **Figure 22** - Annual Cultivated Area (million hectares) by Type of Crop
- p. 36. **Box 4** - Features of rural economic units (UERs)
- p. 37. **Figure 23** - Historical Evolution of Forestry and Agriculture -related Policies in Mexico
- p. 38. **Figure 24** - Summary of Mexico's Policy of Interest
- p. 38. **Figure 25** - Map of States Where Sembrando Vida was Implemented in 2019 and 2020
- p. 39. **Figure 26** - Power-interest Grid of Stakeholders Surrounding the Sembrando Vida Program Under the AMLO Administration
- p. 41. **Figure 27** - Policy and Informal Incentives for Agroforestry
- p. 42. **Box 5** -Incentives Categories
- p. 42. **Figure 28** - A Comprehensive Supporting System for Agroforestry
- p. 43. **Figure 29** - Summary of the Incentives in Brazil's Policies of Interest
- p. 47. **Figure 30** - Summary of the Incentives in India's Four Policies of Interest.
- p. 48. **Box 7** - NPF Implementation Examples
- p. 49. **Box 8** - Livelihood Activities Fund in Gujarat
- p. 50. **Box 9** - Transit Rules Status
- p. 51. **Box 10** - Need for Uniformity and Simplicity of Transit Rules
- p. 51. **Box 11** - Shortfall of Funds
- p. 51. **Box 12** - WDC-PMKSY Projects' Status
- p. 52. **Box 13** - NGO Involvement in Watershed Projects
- p. 53. **Figure 31** - Summary of Sembrando Vida's Incentives
- p. 56. **Figure 32** - Summary of Policy Challenges and Other Barriers to Achieving These Aspects of an Agroforestry Supporting System
- p. 57. **Figure 36** - Summary of the Main Actors Identified in Agroforestry Implementation
- p. 57. **Figure 37** - Summary of Agroforestry Benefits Identified in the Policies of Interest

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.

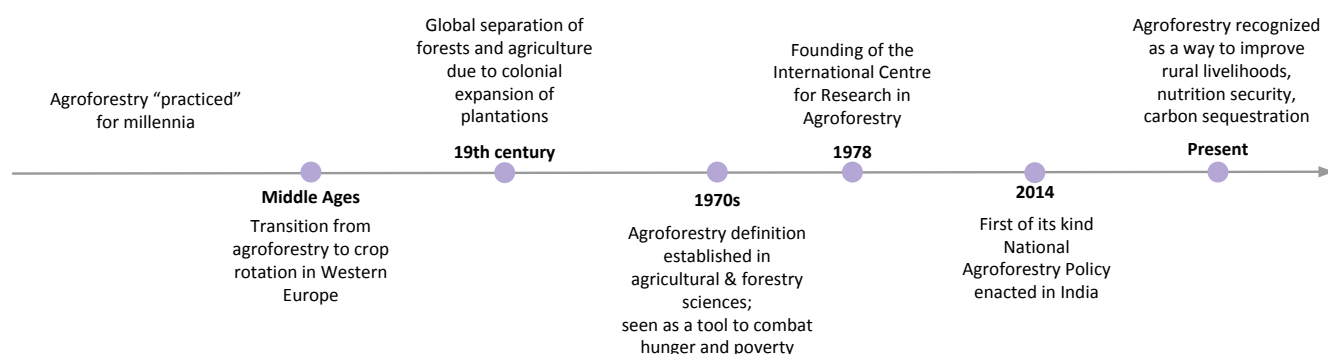
- The presence of trees and multiple crop species **improves nutrient cycling, soil quality, and water retention** (Nair, 1993). The latter is especially important for food systems in drier regions (Ribaski & Menezes, 1994; Mazumdar-Shaw, 2019).
- In some instances, trees act as **windbreaks and prevent 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-

Figure 1. Evolution of the Agroforestry Landscape



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).

BRAZIL	National Family Farming Program (PRONAF, 1995)	National School Farming Program (PNAE, 1976)	Food Acquisition Program (PAA, 2003)	Forest Code (revised 2012)
INDIA	National Policy for Farmers (2007)	Integrated Watershed Management Program (2009)	Transit Rules under Forest Conservation Act	National Biological Diversity Act (2002)
MEXICO	Sembrando Vida (2019)			

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-

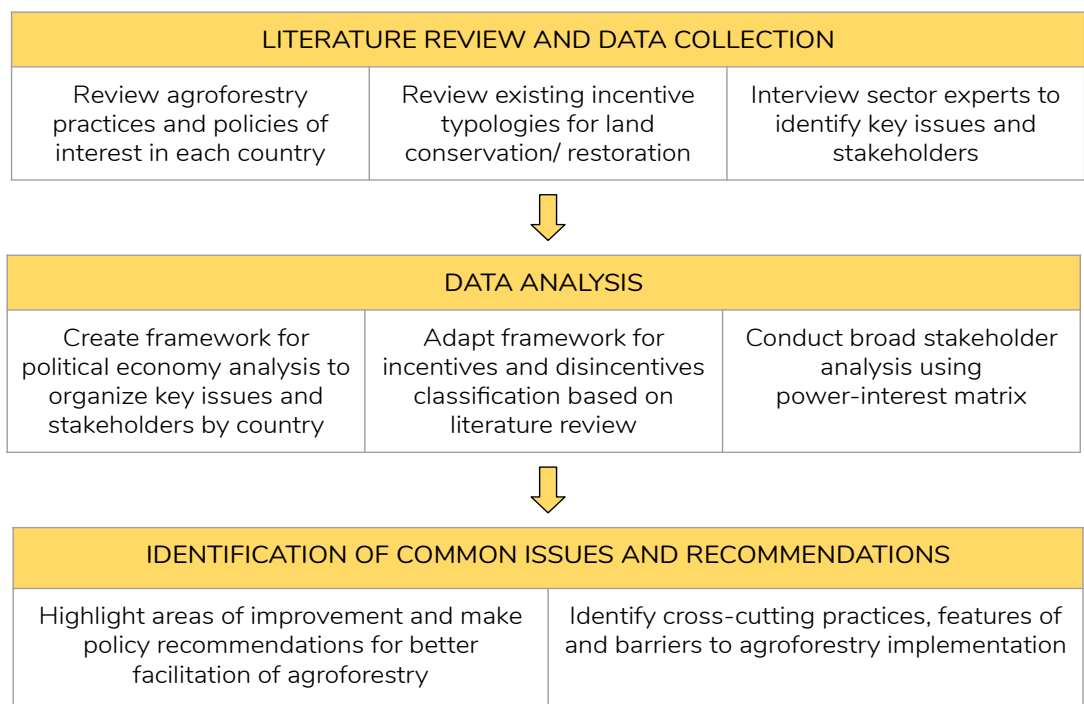


Figure 3. Outline of Methodology

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 periodical 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

Land degradation	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).
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.).
Sustainable land-use practices	Natural resource management practices that meet both current and future human needs by maintaining the landscape's key ecological functions.
Agroforestry	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.
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 5ha 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

National Government	This category concerns all government agencies (federal, state, municipal) administering agroforestry policies and projects, or whose policies can affect agroforestry outcomes.
Farmers and cooperatives	Farmers are the target stakeholder of agroforestry policies (Rahnman, 2018). In this category, we include farmer associations that represent these stakeholders' interests.
Civil society organizations (CSOs), non-governmental organizations (NGOs), and other local institutions	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.
Private sector and agribusinesses	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.
Indigenous communities	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.

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:

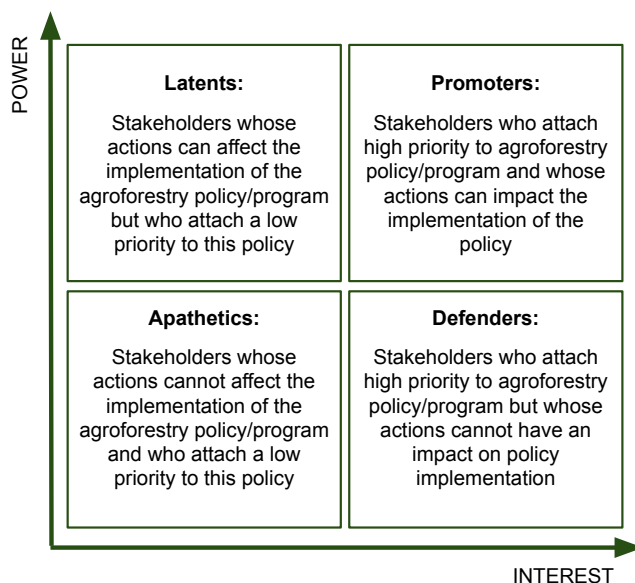


Figure 4. Power-interest Matrix
(Adapted from the World Bank)

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?



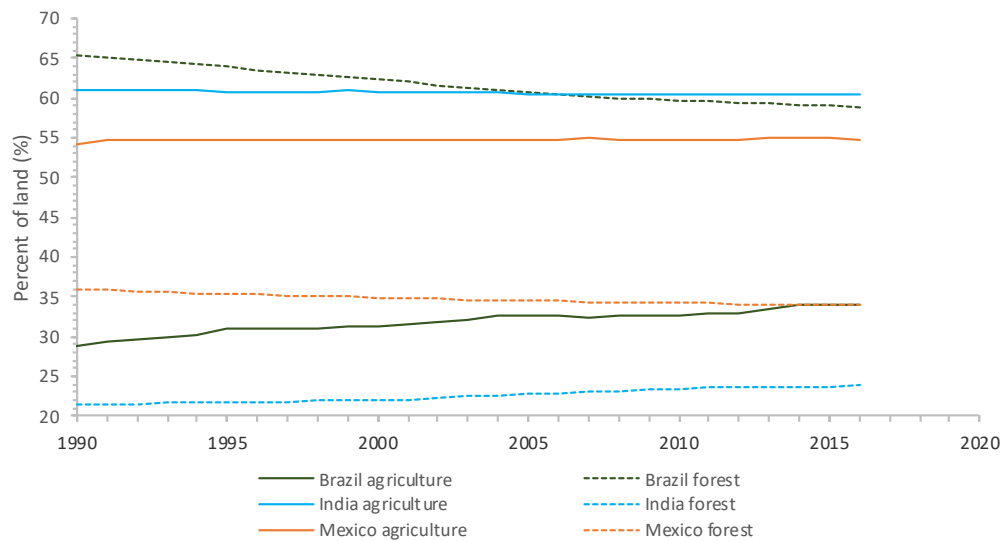


Figure 5. Evolution of the Percent Land Cover of Agriculture and Forest (data from the World Bank)

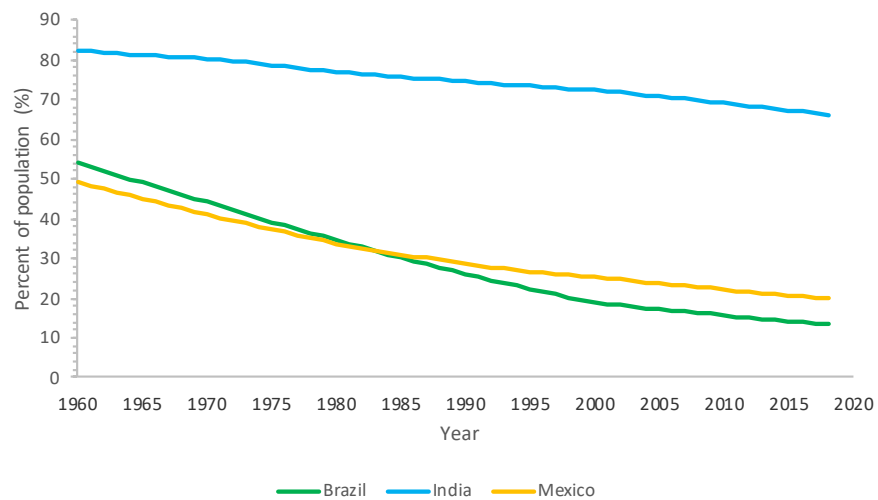


Figure 6. Evolution of the Proportion of Rural Population Over Total Population (data from the World Bank)

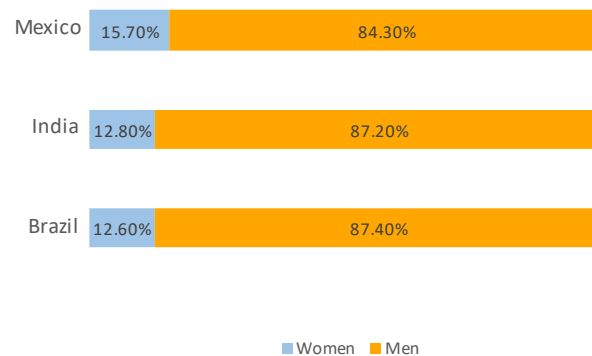


Figure 7. 2016 Gender Distribution of Land Ownership (data from the World Bank)

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.

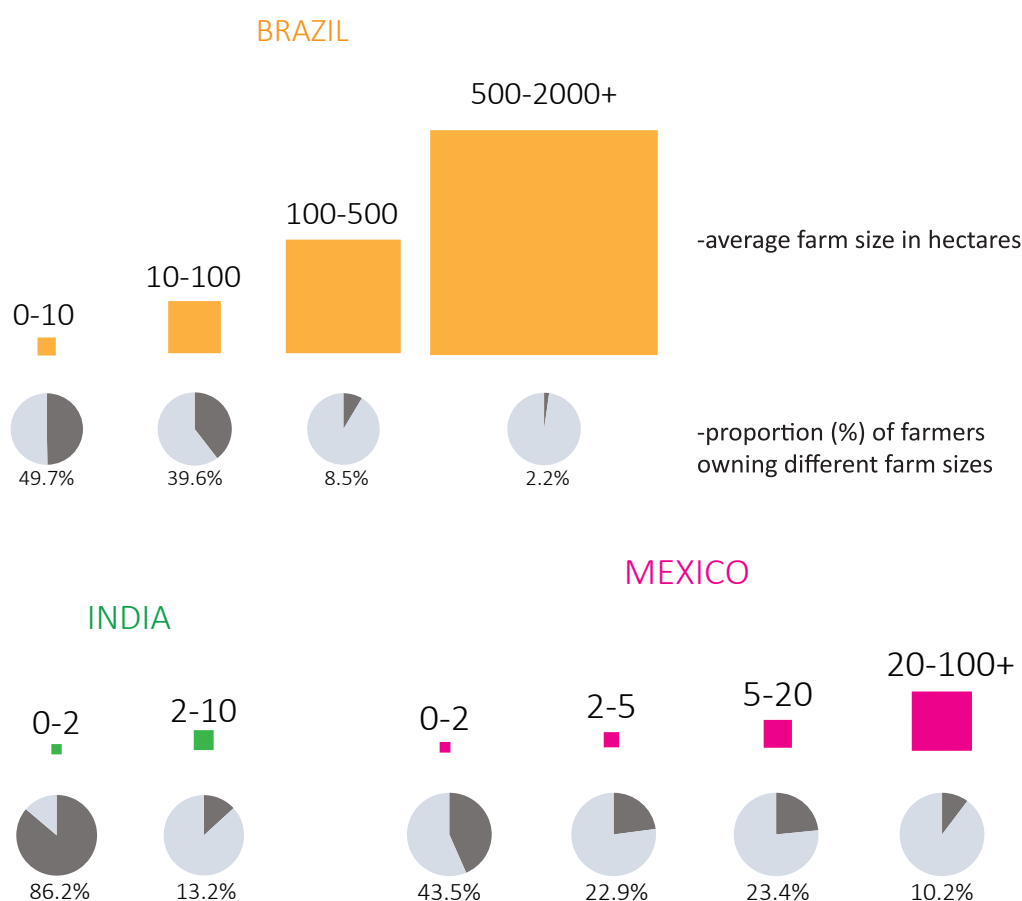


Figure 8. Proportion of Farmers (in percentage) Owning Farms of Different Sizes (in hectares)

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:



Figure 9. Combined States Goals of the Policies of Interest

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:

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, Ministério de Meio Ambiente)



CERRADO: occupies 24% of Brazil; grasslands and dense forests; variable rainfall with a wet summer season and dry winter season (ISPN, 2015); threat of deforestation from soy and eucalyptus plantation and livestock; only 55% of natural vegetation remains (Miccolis 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 Atlântica, Ministério do 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

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).

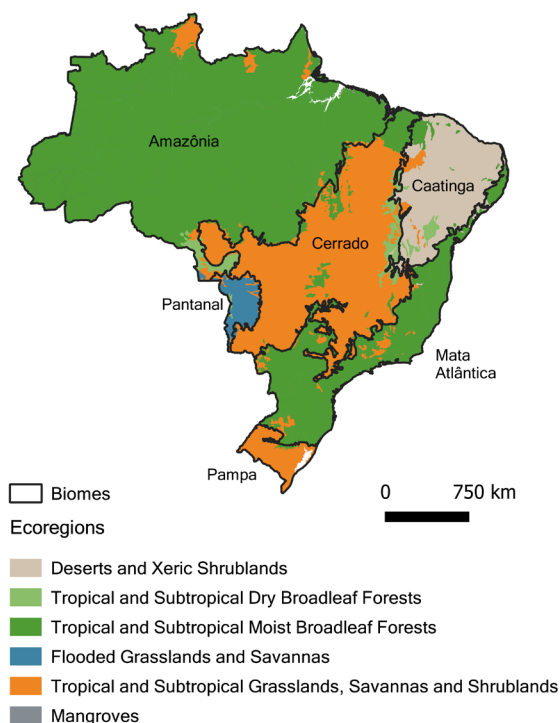
Agriculture, economy, and land tenure

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).



Source: The Nature Conservancy, Global Forest Watch. Map: Beryl Sinclair, color scheme from the Millennium Ecosystem Assessment. Made with Natural Earth.

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 Schneider, 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

(Bauch et al. 2009; Casado & Londono, 2019; Escobar, 2019). 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 envi-

ronmental conservation, increase resilience to external inputs, and promote adaptation to climate change (Miccolis et al., 2016; Hoffmann, 2013).

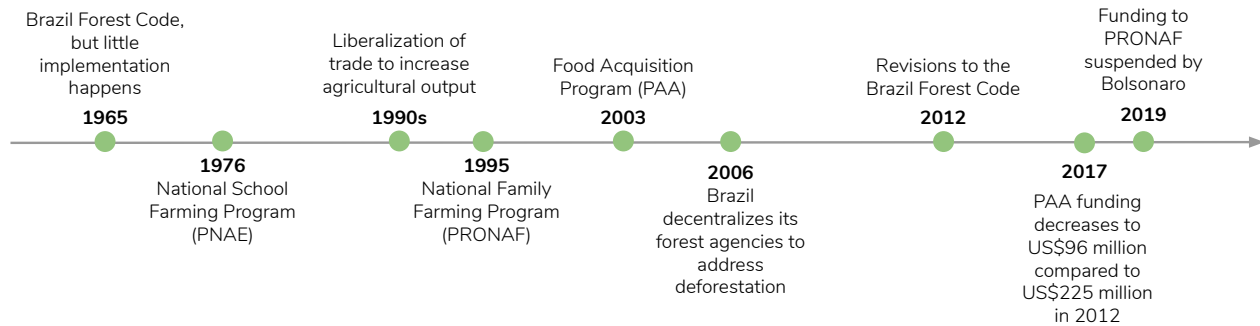
Plant Combinations used in CAMTA (Amazon)
Cocoa
Açaí Palm
Yellow Mombin
Andiroba*
Ipê*
Mahogany*
Black Pepper
Squash
Passion Fruit
Rice
Other Family Farm Species
Cassava
Beans
Pineapple
Banana
Top Export Commodities
Sugarcane
Soybeans
Coffee
Beef
Corn
Poultry
Eucalyptus
Cotton

* 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.

Figure 12. Historical Evolution of Forestry and Agriculture-related Policies in Brazil



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 descendents 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

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 promoter 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,

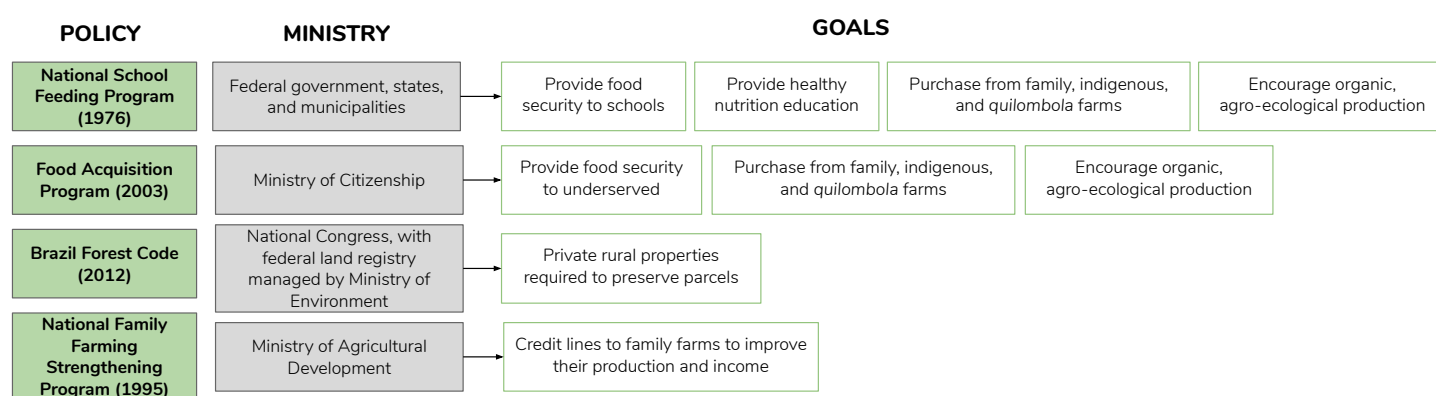


Figure 13. Summary of Policies of Interest in Brazil

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).

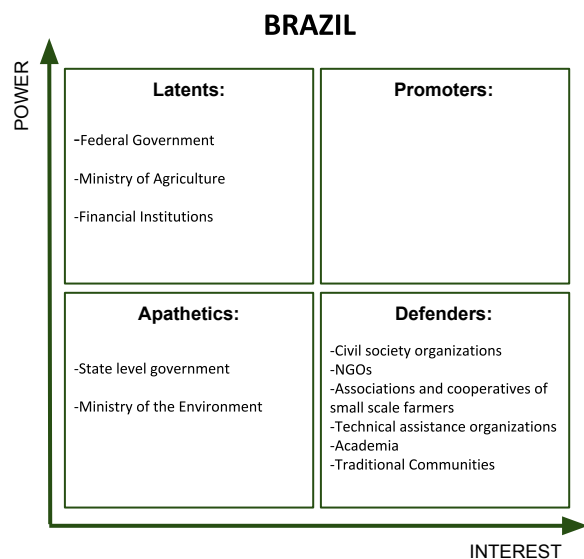


Figure 14. Power-interest Grid of Stakeholders Surrounding the Policies of Interest and the Current Agroforestry Scene in Brazil

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).

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).

INDIA

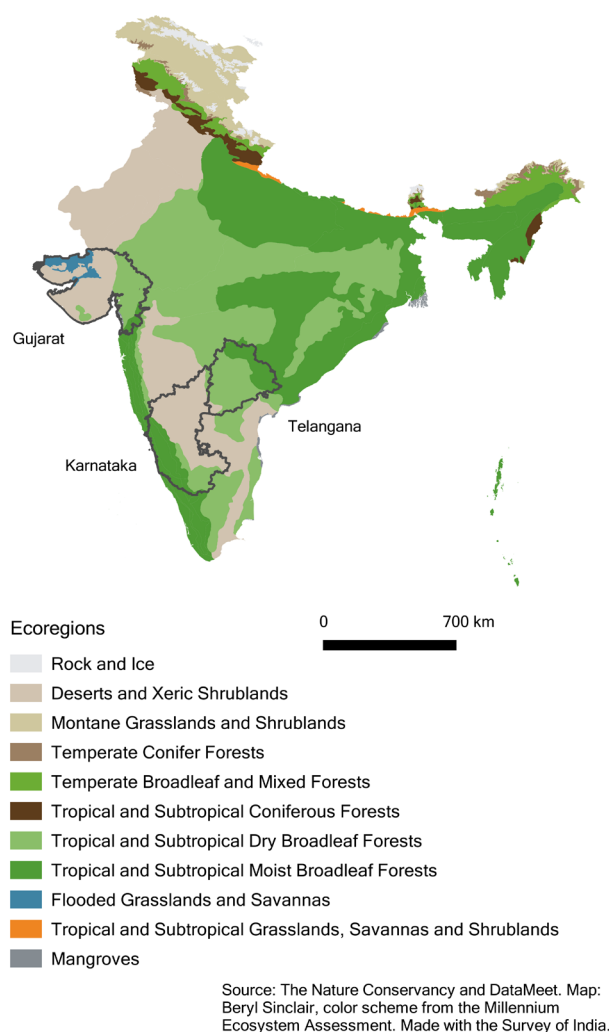


Figure 15. Ecoregions of India

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

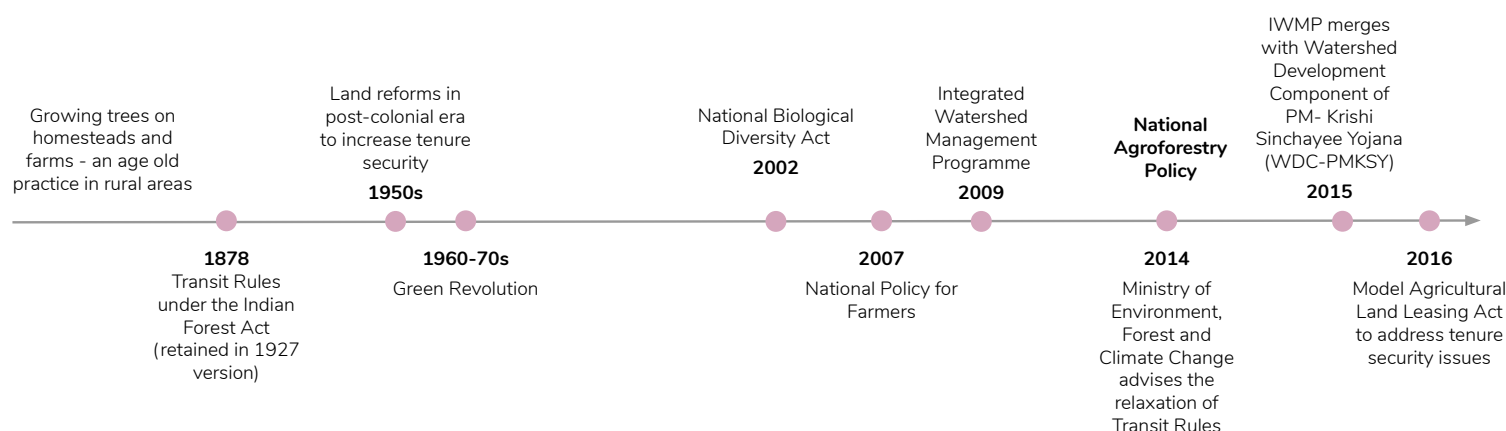
contribution to supporting community requirements of food, timber, traditional medicine, improved soil quality, etc.

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



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.

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

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 exist-

ing 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.

Watershed Development Component of Pradhan Mantri Krishi Sinchayee Yojana (WDC-PMKSY), Erstwhile Integrated Watershed Management Programme (IWMP) (2015)

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)

To arrest unprecedented loss of biological diversity globally, the Earth Summit at the United Nations Conference on Environment and Development (1992) instituted the Convention on Biological Diversity (CBD).

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

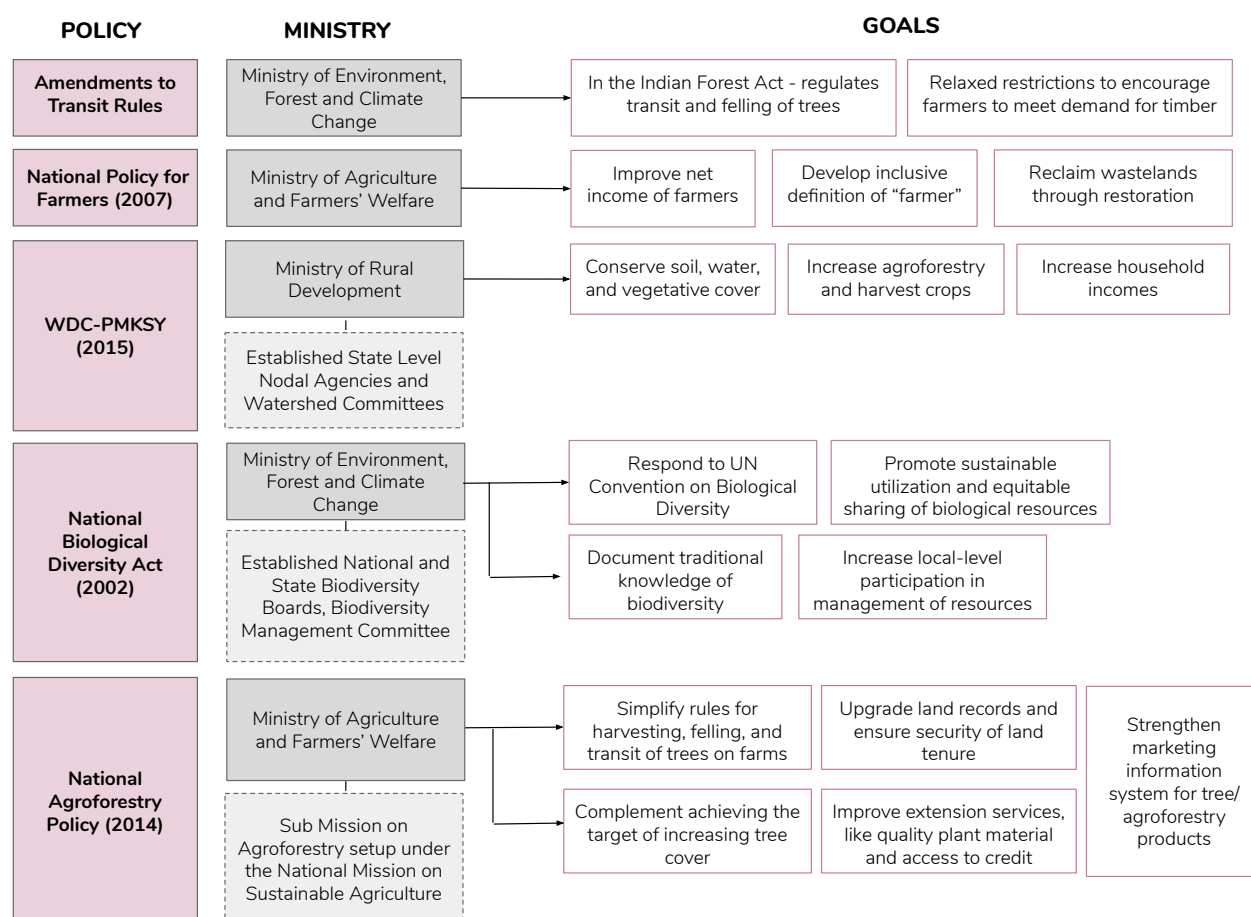


Figure 18. Summary of Policies of Interest in India

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.

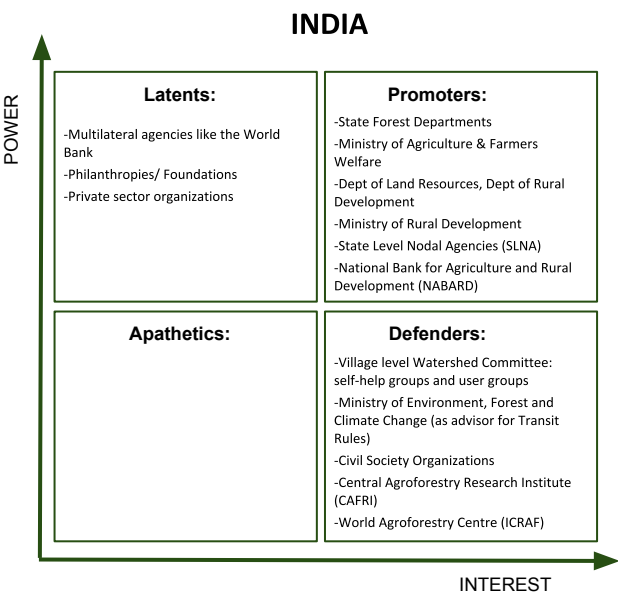
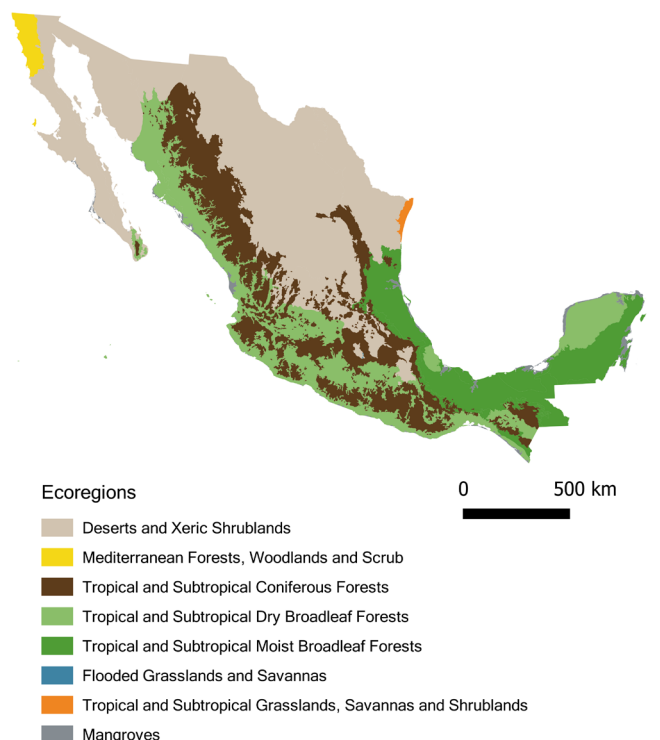


Figure 19. Power-interest Grid of Stakeholders Surrounding the Policies of Interest in India

MEXICO



Source: The Nature Conservancy. Map: Beryl Sinclair, color scheme from the Millennium Ecosystem Assessment. Made with Natural Earth.

Figure 20. Ecoregions of Mexico

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).

Figures 21 and 22 show more details about the main crops grown in Mexico and how much land their cultivation takes up.

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

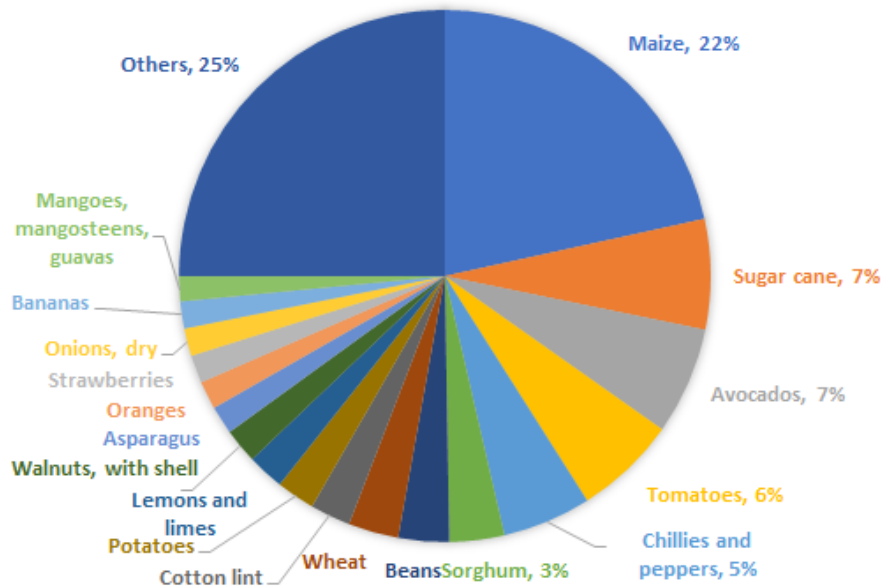


Figure 21. Value of Agricultural Production in Mexico
Source: FAO

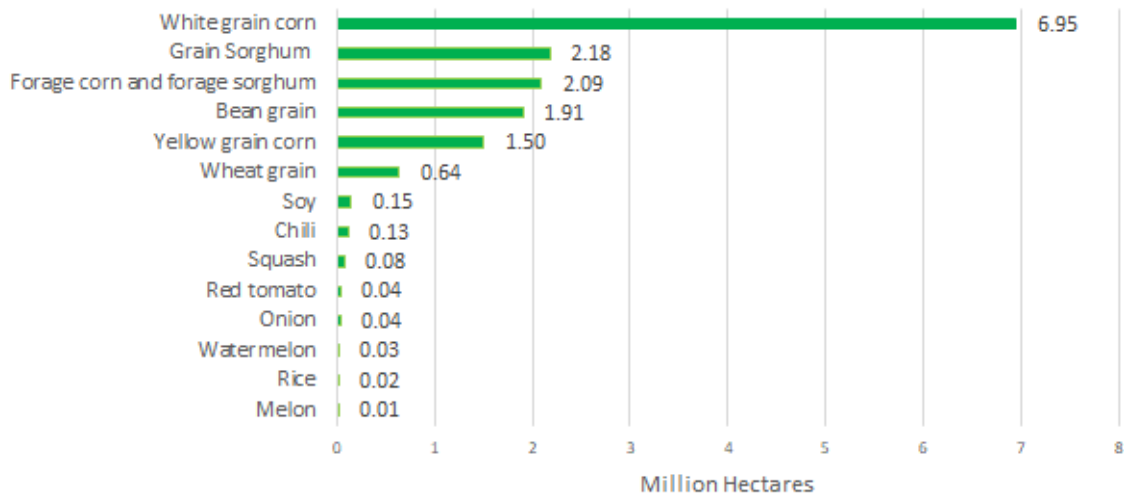


Figure 22. Annual Cultivated Area (million hectares) by Type of Crop
Source: INEGI, National agricultural survey 2017

Box 4. Features of rural economic units (UERs)

Strata classification	Main features of UERs	
E1: Subsistence family member with no link to the market	• 22.4% of UERs • Average value of productive assets: MXN\$ 4,246 • Practically no sales revenue or only makes sales of unplanned surpluses	The first three strata, which correspond to 78.52% of the UERs, have capitalization problems. Due to their low-income levels, they have difficulties accumulating capital. They display an asset level below the national average, which is MXN\$ 132,051 and considered as the critical threshold.
E2: family subsistence with links to the market	• 50.6% of UERs • Average value of productive assets: MXN\$ 42,301 • Family character. Primary products sale not exceeding MXN\$ 55,200 per year	
E3: In transition	• 8.3% of UERs • Average value of productive assets: MXN\$ 141,986 • Average sales: MXN\$ 73,931 per year	
E4: Business with fragile profitability	• 8.9% of UERs • Average sales: MXN\$ 151,958 per year	
E5: Strong Business	• 7.6% of UERs • Average sales: MXN\$ 562,433 per year	
E6: Dynamic Enterprise	• 0.3% of UERs • Average sales: MXN\$ 11,700,000 per year	

UER: 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 (SAG-ARPA, 2019).

resources (Eguiluz-Piedra, 2003). **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 (SEMARNAT, 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).

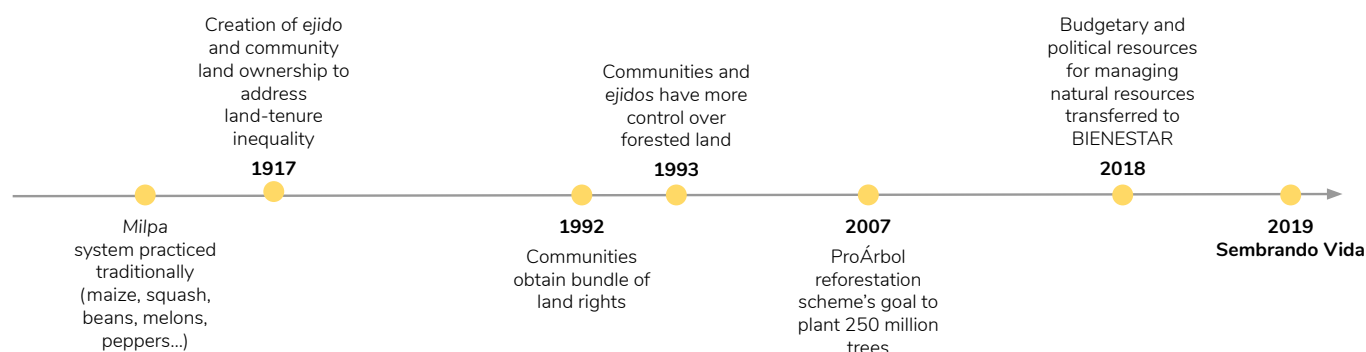
Mexico has never implemented a coordinated agroforestry program at the federal level.

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.

Figure 23. Historical Evolution of Forestry and Agriculture-related Policies in Mexico



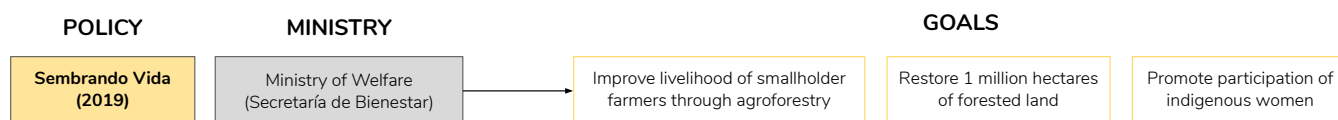


Figure 24. Summary of Mexico's Policy of Interest

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). Nayarit was subsequently added to the program for a total of twenty targeted states in 2020 (Secretaría de Bienestar, 2020).



Figure 25. Map of States Where Sembrando Vida was Implemented in 2019 and 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.

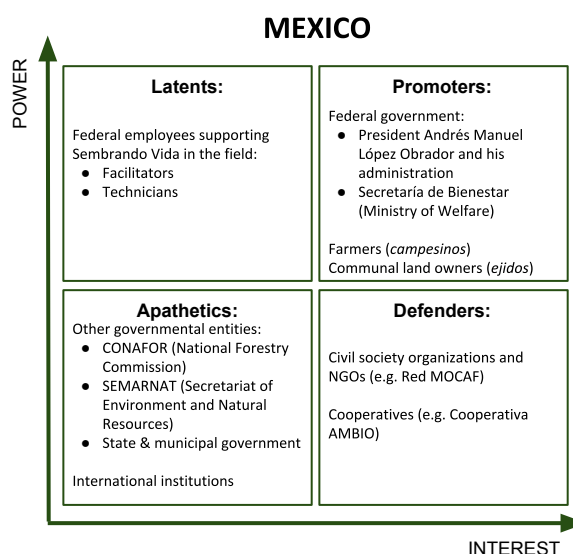


Figure 26. Power-interest Grid of Stakeholders Surrounding the Sembrando Vida Program Under President Andrés Manuel López Obrador's (AMLO) Administration



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.

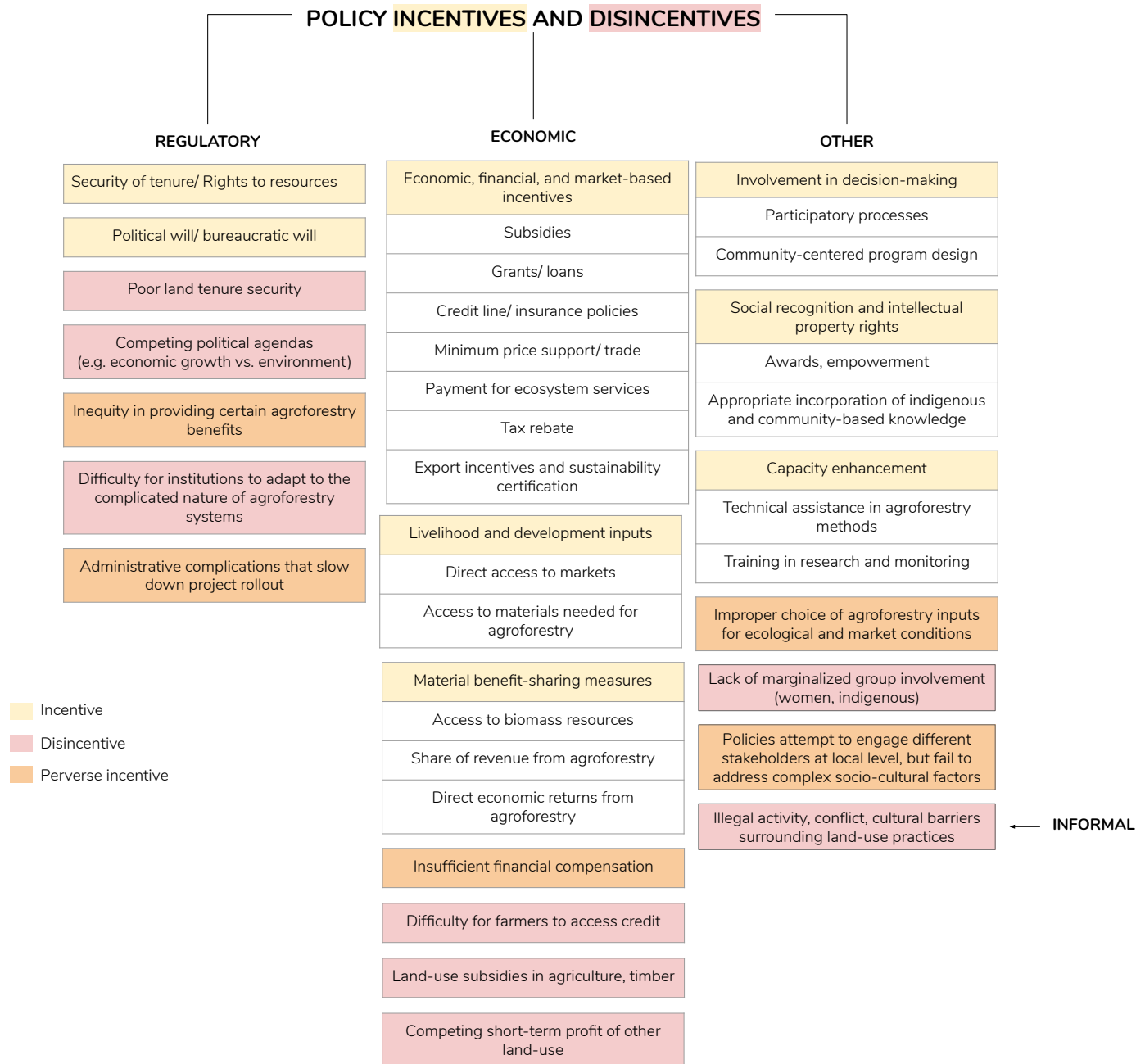


Figure 27. Policy and Informal Incentives for Agroforestry

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.

Box 5. Incentives Categories

Incentive	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.).
Perverse incentive	Incentives that attempt to achieve the stated policy goal, but instead have an unanticipated negative or reverse effect.
Disincentive	Existing incentives that are preventing the goals of the stated policy to be reached, because they are driving antithetical behaviors.

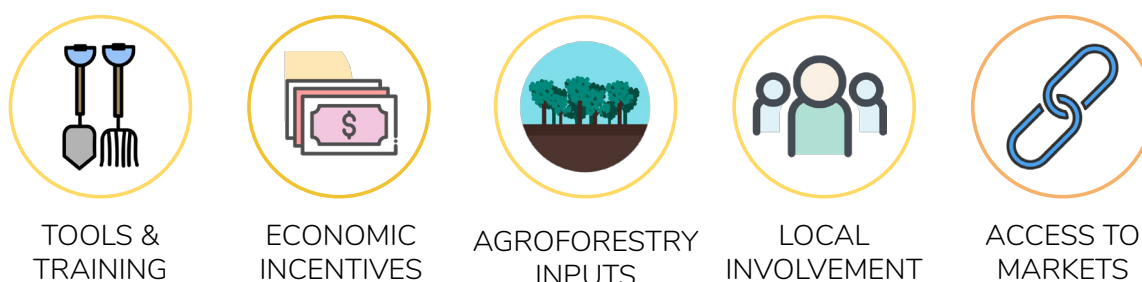


Figure 28. A Comprehensive Supporting System for Agroforestry

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**

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

Figure 29. Summary of the Incentives in Brazil's Policies of Interest

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.

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).



INDIA

In the short run, 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.

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

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 NPE, 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.

Box 8: LIVELIHOOD ACTIVITIES FUND IN GUJARAT

The WDC plan of Gujarat states that at least **10% of the Livelihood Activities fund must benefit asset-less, landless, and women**. The project in Jetpurpavi Taluka, Vadodara District in Gujarat allocates Rs. 6.75 million from IWMP funds towards Livelihood Activities. This means that Rs. 675,000 is designated to benefit women and asset-less. Prior to the project, inclusion of women and asset-less in watershed management was “minimal” (DARPG). Nonetheless, women in Vadodara are often more responsible for agricultural work than men, but do not reap the benefits of such projects as they are not recognized as farmers (Shroffs Foundation Trust, 2014).

Watershed Development Component of Pradhan Mantri Krishi Sinchayee Yojana (WDC-

PMKSY)

WDC attempts to address the concerns and expertise of local people with its **Water-shed 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.

The Act details **benefit-sharing obliga-**

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.

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.

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 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).

MEXICO

	Security of tenure/ Rights to resources	Economic/ Financial and Market-Based incentives	Material benefit-sharing measures	Involvement in decision-making	Social recognition and intellectual property rights	Capacity enhancement, Livelihood & development inputs	Political/ bureaucratic will
Sembrando Vida	Program targets small farmers, but access is restricted to having at least 2.5 hectares of unutilized land	5,000 Mex\$/month transfer to work land Mon-Sat; saving requirement from that transfer; indirect market incentive from new products		On-the-ground learning center for technicians		Seedlings provided from government, but choice of species for each region can be improved Technical assistance	Strong narrative on improving farmer welfare from central government

Figure 31. Summary of Sembrando Vida's Incentives

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

Dialogue, 2019). Therefore, the access criteria to the program may represent a **perverse 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 perverse 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.

TOOLS & TRAINING		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
ECONOMIC INCENTIVES		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
AGROFORESTRY INPUTS		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
LOCAL INVOLVEMENT		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)
ACCESS TO MARKETS		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

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

V. Cross-Country Comparison

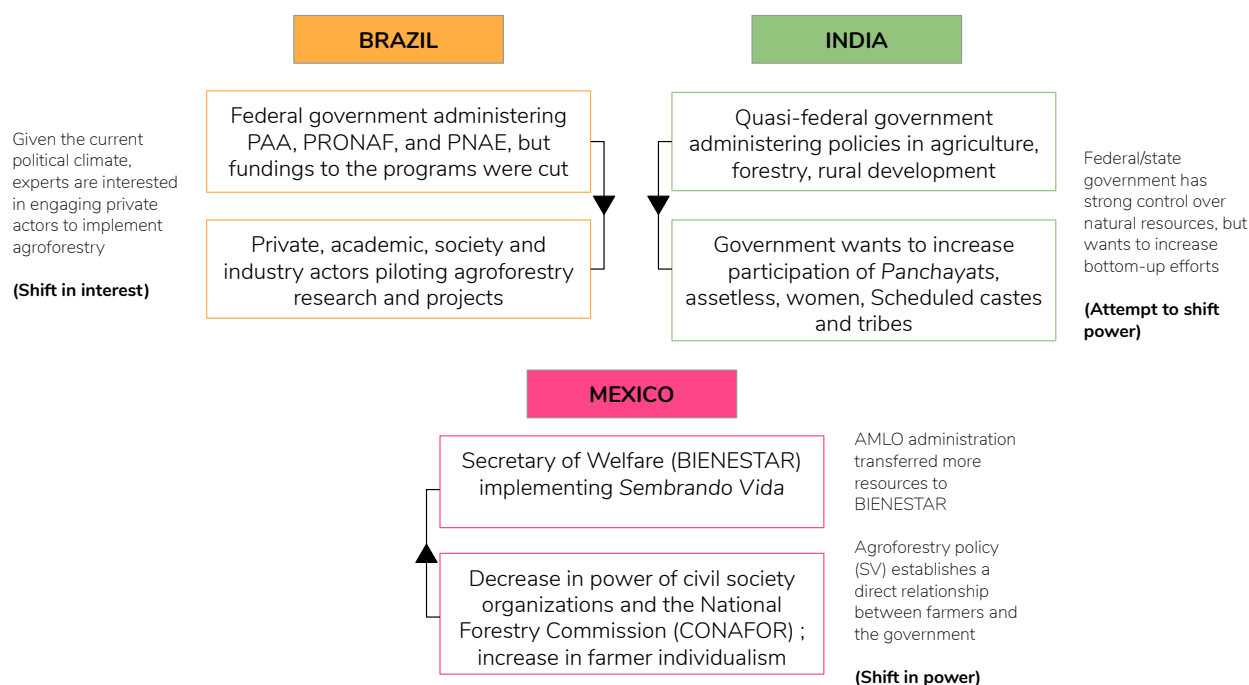


Figure 36. Summary of the Main Actors Identified in Agroforestry Implementation

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.

ECONOMIC/ FINANCIAL	ENVIRONMENTAL	SOCIO-CULTURAL/ POLITICAL
Provide food security	Restore degraded lands	Improve status of women indigenous, and marginalized groups
Provide timber, energy (biofuel, bioenergy) and other goods	Increase tree cover	Strengthen community organizations
Improve business ecological footprint	Preserve biodiversity	Preserve cultural traditions
Generate/diversify income	Conserve soil and water	Increase political acceptance
Create new markets	Sequester carbon	
Provide employment		
Improve access to credit and financial literacy		

Figure 37. Summary of Agroforestry Benefits Identified in the Policies of Interest

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

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).

Land equity, ownership, as well as rights to resources in rural settings are key in determining who benefits from agroforestry and who might lose out.

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.



Agroforestry systems can help diversify farmer incomes to alleviate poverty, but practitioners need incentives that account for the lag between the initial planting period and the reaping of benefits.

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-

diate 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 re-portionment 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 (Upriy, 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 (Priya, 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-attribution 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).

Appendix

Appendix 1.a. Incentives Table (1/2)

LOCAL INCENTIVES INVENTORY	BRAZIL	INDIA	MEXICO
Formal institutions involved in agroforestry and policies of interest	National Family Farming Program (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. Many of the liens are earmarked or come with strict structural constraints (Goncalves,).	Ministry of Agriculture and Forests, Welfare Ministry of Environment, Forests and Climate Change Ministry of Rural Development- Dept of Land Resources, Dept of Rural ext Ministry of Tribal Affairs National Bank for Agriculture and Rural Development (NABARD) National Cooperative Apex Bank National Book Trust India National Rainfed Area Authority Forest Survey of India Convergence with other schemes: MGNREGA PM KISAN (income support) PM Fasal Bima Yojana (crop insurance) Soil Health Card Scheme Renuitnary Approach for Agriculture and Allied sector Rejuvenation of Eroding Farmers' Income Green India Mission under NAPCC	The Ministry of Welfare administers Sembrando Vida (SV). The program provides a package of economic incentives to smallholder farmers to plant a mix of trees and crops in unutilized land. The program formally has the double objective of increasing tree cover and improving farmers' livelihoods. In reality, however, it is mostly a welfare program.
Definition of "agroforestry practitioner"	As defined by the 2006 Family Farming Law (Law 11 326), small farmers are land holders less than four fiscal modules, that predominantly utilizes its own family labor, where household incomes mostly originates from the family farm, and where the family manages the farm (Grauub et al, 2016). There is debate on whether larger commercial farms can play a role in agroforestry systems.	Agroforestry systems include Agri-silviculture and silv-horticulture, agri-horticulture and silv-pasture systems for different agro-ecological zones. It includes Trees outside forests (TOF) mean the trees available on agricultural land, along road side, railways, canals, ponds, orchards, parks, gardens, and homestead Farmers include small and marginal farmers, and landowners or tenant farmers, often owning 2 hectares of land or less.	Campeño is the term used for small farmer. Their land ownership may be private or communal; the latter category is further subdivided in ejido and comunidad (see section 3.C.1. for more information). Smallholders have limited access to land and capital and predominantly use family labor (Grauub et al., 2016).
Security of tenure/ Rights to resources/ Environmental regulations on land-use	Brazil does recognize the rights of farmers on both public and private lands. Public land occupation is quite flexible and includes rural settlements, indigenous land, and slashcropping. There is limited government capacity to provide tenure security because of "inaccurate land registry, overlapping titles for the same parcels, and a limited capacity to ensure protection from eviction even when boundaries are properly recorded and formal titles issued (LandLinks). The Brazilian Forest Code highly requires privately owned properties to conserve some of their land (Law 12651/2012).	Beneficiaries typically accrue to farmers who own the land, excluding tenant farmers. However, the National Policy for Farmers, 2007 includes tenants and agricultural labors in its definition of farmer. It also - recommends joint patras (ownership rights) of homestead and agricultural land for women so that they can access credit and other services. -Model Agricultural Land Leasing Act, 2016, "ensure complete security of land ownership for landowners and security of tenure for tenants for the agreed lease period" (ICED) - Necessity of security of land tenure for farmers in decision to take up agroforestry addressed in National Agroforestry Policy: - Recommends states simplify regulations regarding and usufructure - States should ensure secured land tenure systems (Telangana successfully updated its land records prior to implementing Rythu Bandhu scheme of income transfer) -Rights to tree felling and transit are different in different states, which might affect adoption of agroforestry	After 1992 reforms, communities (ejidos and comunidades) obtained a nearly full bundle of agrarian rights (but different throughout territories) (Bey et al., 2006) Under Sembrando Vida, practitioners have full rights and access to the biomass and survival resources generated from agroforestry systems, including full access to local markets. Consumer-producer links could be better developed, depending on the region.
Material benefit-sharing measures	Small scale farmers and their rural communities would be the beneficiaries of agroforestry practices.	National Biological Diversity Act 2002 details benefit sharing obligations on the trader and producer for commercial exploitation of a resource (between 1% - 15% of the purchase price) 10% of revenue goes to State Biodiversity Board, and another 10% to community. -Like the states of interest have already done, relaxing transit and felling permits would incentivize agroforestry. The government (State Forest Department) has a monopoly and fixes prices on tree species, as a result of heavier regulations due to illegal harvesting. -Gujarat: farmers charged royalties for felling of "reserved" (non-exempt) trees. Must pay 1% of sale price to state if felling for commercial use. -National Agroforestry Policy: recommendation: provide credit and insurance cover to agroforestry practitioners (Chavan et al) Latest Budget details three schemes: - PM KISAN: annual income support for procuring agricultural inputs - Interest Subsidy Scheme on crop loans - PM Fasal Bima Yojana (crop insurance scheme) covers all farmers, including tenant farmers and slashcroppers There is a Minimum Support Price for publicly procured agricultural produce (1.5x Production cost)	The federal government plans to build 3 200 new branches of the Banco del Bienestar in Mexico to better distribute loans and grants and later, facilitate transfers from migrants (Fernandez-Vega, 2020)
Financial and market-based incentives	Credit lines are considered by the industry to be the most important and promising incentive for farmers. Agroforestry practices require up front money with long term and little financial payback that farmers cannot afford. Traded cash crops are responding to the international market trend of adopting socio-environmental certifications based on sustainability principles (Nature Conservancy).	- Currently, any reliance for extension services would have to go to KVICs (Krishn Vighan Kendra) - same as agriculture -IWMP: There are resources provided for the conversion of wastelands into productive agroforestry resources to help small and marginalized farmers (Singh and Dhyani, 2014) -Lack of access to credit against agroforestry plantations (Dagar et al) -Strict and complicated transit permits dissuade farmers from taking up agroforestry, and so states have exempted many wood species because of this -The government has monopoly over popular tree species; farmers must sell at fixed prices (Ghosh and Sinha)	Access to markets is dependent on pre-existing social and economic infrastructure. The government supports farmers by providing seedlings and technicians on the ground. However, due to insufficient consultation with farmers, seedlings are not always selected appropriately for the local climate, and capacity building efforts are often insufficient. Marginalized groups, for example women and indigenous persons, are given priority to access Sembrando Vida benefits.
Appropriate livelihood and development inputs	One problem facing farmers is access to market and selling their goods. Most small farmers handle their products from seed to customer. This allows for farmers to be involved for the majority of their supply chain, however it does lead to inefficiencies (Cesario, pers coms, February 28, 2020). In order for farmers to participate in agroforestry practices they would have to make large up front purchases.		

Appendix 1.b. Incentives Table (2/2)

LOCAL INCENTIVES INVENTORY	BRAZIL	INDIA	MEXICO
Capacity enhancement, training, education	Agroforestry experts in Brazil have identified technical access and training as key to success. Agroforestry practice in Brazil focused on indigenous biodiversity and trees reap long term benefits. Farmers must be provided the tools and knowledge to learn how to ensure their actions reap the intended long-term benefits (Ortega, pers comms, March 23, 2020). Some unique case studies like the CAMTA cooperative provide knowledge and assistance to farmers, which leads to more sustainable farming practices.	There is technical assistance from the World Bank. 2015-2019 Neeranchal National Watershed Project supported IWMP (closed). 2018-2023 Atal Bhujal Yojana (ABHY) – National Groundwater Management Improvement Program. Mass publicity was undertaken by the DoA through wall paintings, printing pamphlets, distribution of required inputs under subsidy on the various initiatives taken by the government for improving production and productivity of the crops.	Technical assistance is provided by the central government in the form of on-the-ground technicians, working in pairs, who are ultimately responsible for advising 200 producers. One pair of technicians supports 8 learning centers (CAO) with 25 producers in each. Each regional facilitator supports 5 pairs of technicians (so 40 CAOs and 1000 producers). The groups are often too large, so the technicians cannot always properly provide education/support to producers (J Zúñiga, Personal Communication Apr. 19, 2020). However, when the technicians are able to provide feedback (e.g. on the quantity of seedlings necessary), as well as monitoring, the program implementation is smoother (H. Caamal, personal communication, March 23, 2020). Training should be provided to the technicians and facilitadores (who oversee the technicians) in each region of each state. Training would be enhanced if existing community resources and groups were consulted more (J Zúñiga, Personal Communication Apr. 19, 2020; G. Sánchez & T. Fausto, Personal Communication, March 23, 2020). The federal government should provide seedlings (nurseries), fertilizers and other supplies but there is sometimes a lack of capacity on the ground, which hampers distribution (J Zúñiga, Personal Communication Apr. 19, 2020).
Social recognition, awards, empowerment, and other "non-material" incentives	There is a national mindset of the agribusiness and large intensive monoculture with high output as the standard for agriculture. Non-material incentives are crucial to shift this narrative and improve the image of agroforestry systems.	- Preparation of People's Biodiversity Register under the National Biological Diversity Act relies on local knowledge. - Recognition in National Policy for Farmers that women hold most traditional knowledge.	Multiple experts indicated that the previous social infrastructure is key for the success of agroforestry policies in any location. Also, successful policy design and implementation require consultation with local producers and organizations (Morlaín and Zúñiga). In areas where there is social organization, land use plans, good technicians, and some experience from the producers, the program is successful. For example, in Quintana Roo, the program is working very well. This is due to: - Good technicians - Producers understanding the agro-ecological systems - Sufficient resources (seedlings etc.) - Presence of agricultural plots beforehand as communities have land-use plans (Caamal, J Zúñiga, Personal Communication Apr. 19, 2020)
Involvement in decision-making, implementation, monitoring	Experts note the need to involve indigenous groups in novel agroforestry projects. In reality, though, indigenous communities are represented in the agroforestry conversation in a marginalized manner.	-IWMP: Watershed Committee for village-level implementation. 5/10 to be from Scheduled Castes/Tribes, self-help groups, women, and/or landless). State Level Nodal Agencies (SLNA) implements projects. -The main reasons for the non-adoption agroforestry programs to the desired extent have been the lack of participation of people (Singh and Dhyanl, 2014).	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 techniques, etc (J Zúñiga, Personal Communication Apr. 19, 2020) Individual producer-centered program design, without input of local civil society organizations (J Zúñiga, Personal Communication Apr. 19, 2020) 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 reportedly more successful than Chiapas in achieving program goals (G. Sánchez & T. Fausto, personal communication, March 23, 2020; E. Esquivel, Personal Communication, Mar. 24, 2020; H. Caamal, personal communication, March 23, 2020). Ensuring a direct relationship between technicians and local farmers, and close contact with facilitators, allows for better communication and creates better support on the ground than if the program were administered at the central level (H. Caamal, personal communication, March 23, 2020).
Political will/ bureaucratic will	Small farmers in Brazil are not currently an organized body engaged in politics. This is due to the vast country size, variable climates and therefore farming types, frequent farmer poverty, and quantity of farmer (Cesano, pers comms, February 28, 2020).		Decision makers (i.e. federal government) is proactive in advancing the welfare aspect of the program and in garnering political goodwill, but arguably environmental outcomes come second to broad political support.
Intellectual property rights	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 of an industrial agriculture effort, not traditional agriculture.	- The National Biological Diversity promotes local communities as owners of bio-resources and traditional knowledge. -Complaints from Ministry of Tribal Affairs (MoTA) regarding lack of involvement from right-holders and indigenous groups on the Indian Forest Amendment Act	Sembrando Vida was designed to connect federal employees who implement the program directly with program participants, cutting out the involvement of community groups and civil society organizations. This leaves a knowledge gap on the ground as established local institutions are not always able to provide expertise or leverage existing relationships. (J Zúñiga, Personal Communication Apr. 19, 2020)
Removal of perverse incentives	Due to political interest of the current federal government, existing projects (i.e. PAA, PVAE) are being further underfunded (Micoils, pers comms, February 27, 2020).	Issue of government not distinguishing forests from plantations, which undermines the longevity and sustainability of agroforestry and related goals. More specifically, if increasing tree cover through land under plantations or agroforestry systems is coming at the expense of natural forest cover, there may be unintended negative consequences (Dérries, pers comms, March 28, 2020).	There have been reports of new deforestation in areas in order to qualify land for new agroforestry production. When farmers don't have necessary supplies or technical support, they plant what they know (corn, milpa, traditional agriculture) but not necessarily agro-ecological systems (J Zúñiga, Personal Communication Apr. 19, 2020) Lack of seedlings and other supplies (e.g. mesh netting for nurseries) due to speed of rollout. Participatory processes only exist between the federal government and individual producers under Sembrando Vida which cuts out the traditional role of CSOs and NGOs. Technicians are paid around 4x the monthly subsidy. Working with the government provides connections, and they can control a lot of money going to the producers. Each coordinator controls more than what the states have for their own agricultural programs. Lots of power in these roles (J Zúñiga, Personal Communication Apr. 19, 2020)

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”).

Based on: Kothari, Ashish. “Incentives for Biodiversity Conservation at the Local Community Level.” Pune, India: Kalpavriksh- Environmental Action Group, 1999; WRI’s classification of incentives for restoration and IPBES’ classification. **Further points drawn from:** FAO (1999), POVERTY ALLEVIATION AND FOOD SECURITY IN ASIA Enhancing Forestry and Agroforestry Contributions.

Appendix 2. Disincentives Table

LOCAL DISINCENTIVES INVENTORY	BRAZIL	INDIA	MEXICO
Land-use subsidies	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-degrading crops/practices, however it also does not support environmentally beneficial practices (World Bank).	Schemes like Rythu Bandhu in Telangana may adversely incentivise farmers to adopt unsuitable crops to the extent that they are covered by investment support schemes like it.	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.
Infrastructure subsidies		There could be potential competition over conversion of non-agricultural or degraded land to commercial land vis-a-vis its restoration through forestry/ agroforestry.	
Market disincentives	There is not a strong market for agroforestry positive products. Most products in Brazil are cash crops for local food production (Miccolis, pers comms, February 27, 2020). Financial institutions currently support this cash crop model.	Increased demand for pulp incentivizes plantations on tree outside forests, which if used as an argument for an increase in tree cover or agroforestry systems could overstate the true value of these changes (DeFries, pers comms, March 28, 2020).	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.
Regulatory disincentives	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).	Restrictions on tree felling and transit are the biggest hindrance in planting trees on farmlands. Tenant farmers and women farmers stand to lose from schemes that make land ownership the basis for any benefit transfers.	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 unutilized land, which is an entry barrier for many seasonal farmers who don’t own land and cannot get it loaned/leased (Zuñiga, pers comms, April 19, 2020).
Administrative disincentives	Financial institutions have no standardized financial information to properly analyze and assess the risk of the agroforestry projects in order to give credit. There are many individual farmers in Brazil and not many local associations/organizations, which makes it impossible for the government to potentially manage individual loan applications for agroforestry.	There is a concern of alienation of local people from decision processes due to hierarchical structures of policies and lack of communication.	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 (Zuñiga, pers comms, April 19, 2020), but this is very regionally dependent. 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 (Zuñiga, pers comms, April 19, 2020).
Political will/ bureaucratic will	There is a lack of subject matter knowledge within the government. Current administration has been systematically dismantling and defunding sustainable agriculture products (Miccolis, pers comms, February 27, 2020). Our research found that the majority of government websites did not have comprehensive information and lots of links were dead.		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.
Informal disincentives	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 (Ortega, pers comms, March 23, 2020).	Despite progressive laws for women’s right to land tenure, cultural norms make change difficult to implement.	Marginalized groups (women, indigenous persons) are given priority in the program; however, cultural and social norms still prevent them from fully participating.

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

ISSUE MATRIX: BRAZIL	Political	Economic	Social	Environment	Security
International	Trade liberalization since the 1990's has caused commercial agricultural export growth (World Bank, 2017).	Dichotomy in Brazilian agriculture. Half are small scale family farms, and the other half are large commercial output farms (Haupt, 2015).			
Regional/ sub-regional	Disproportionate ratio of land ownership between latifundia and small farmers (FIAN, 2000).	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).		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).	
National	Due to political interest of the current federal government, existing projects (i.e. PAA, PNAE) are being further underfunded.	Financial institutions have no standardized financial information to properly analyze and risk assess the agroforestry projects in order to give credit.	Cultural barrier - national mindframe of the agribusiness as large intensive monoculture with high output. (Gross, 2019)	Lack of technical assistance in the definition and planning of the agroforestry system.	
Sub-national					
Local		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).	Indigenous people, when included in the conversation, are so in a very marginalized way.	Majority of Brazil's population lives in urban areas. (World Bank, 2020)	Very weak law enforcement that allow for prevailing loopholes in the expansive country (Haupt, 2015).

Appendix 3.b. Issue Matrix India

ISSUE MATRIX: INDIA	Political	Economic	Social	Environment	Security
International		India's emissions reductions targets as laid out in international climate pledges (Watson et al., 2019)	Country with one of the largest populations of absolute poor (World Bank, 2020)	India's NDC (National Determined Contribution) for carbon sequestration (Ministry of Environment, Forest, and Climate Change, 2018) India is a signatory to the Convention on Biological Diversity (CBD), 1992 Indian government made a Bonn Challenge pledge to restore 13 million hectares of degraded land by 2020 and an additional eight million hectares by 2030 (Panda, 2018)	
Regional/ sub-regional		National timber demands drive forest exploitation and illegal timber imports, which could be answered by agroforestry (Mazumdar-Shaw, 2019).	Feminisation of agriculture, yet difficulty accessing land rights and credit (Dagar, 2010)	Increasingly erratic monsoon patterns as a result of land-use and human activity (energy sources) in India and other Asian countries (Amrith, 2019)	Asian Development Bank to support climate change adaptation and mitigation in South Asia (Asian Development Bank)
National	Country with first National Agroforestry Policy 2014, goal to achieve 33% tree cover and increase food/energy security Overall top-down approach to agriculture and forest management (DeFries, pers comms, March 28, 2020, and policy documents)	Declining share of agriculture as % of GDP, but still largest employer (World Bank, 2020) (OECD, 2020). Small and marginal farmers with less than 2 hectares of land make up >85% of farmers in India, so they own less than 50% of crop area. (Bera, 2018). 8.2% of country land area is under agroforestry (includes both irrigated and rainfed systems) (Dagar, 2014).	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)	Agroforestry seen as a way to protect critical watersheds that can meet demands of a rising population for food and energy (Dhyani et al.) Goal to increase "Trees Outside Forest" land cover under agroforestry (NRCAF), but could have questionable impact if it decreases natural forest tree cover (DeFries, pers comms, March 28, 2020) Forest department does plantation drives to increase forest cover, but not forest longevity (DeFries, pers comms, March 28, 2020) Tradeoff between water for crops and for trees (DeFries, pers comms, March 28, 2020)	Water stress due to unpredictable precipitation trends induced by climate change (rainfall dependence), widening gap between supply and demand, poor water resource management (OECD) Climate change and subsequent agricultural failure linked to increased rate of farmer suicides (Carleton 2017)
Sub-national	-Transit rules as a legacy of British colonialism complicating the rights of farmers to manage and transport certain tree species (Bhushan, 2018)	-Small landholdings are providing the bulk of the country's domestic wood products (NRCAF) -Potential of corporate sector to get involved in agroforestry and provide employment (with bioenergy) (NRCAF)	-Aging rural population, young people migrating to urban areas (DeFries, pers comms, March 28, 2020)	Significant spatial and temporal variation in rainfall and water availability (OECD)	The three states accessed struggle with lack of rainfall and droughts Conflict over scarce agricultural land (BBC, 2015).
Local	Disjointed communication between different levels of government on agroforestry policy implementation (interviews, Singh and Dhyani, 2014). Lack of participation at local level for agroforestry implementation (interviews, Singh and Dhyani, 2014) Poor land records in rural land markets	67.3% of rural households rely on timber for domestic energy needs in 2011 (pillariseti A et al, 2017) Agroforestry products consumed locally in a highly unorganized market, but commercial agroforestry in tandem with wood-based industry has immense potential (Dagar, 2010) -Lack of success for banks in reaching the rural poor to access credit (OECD)	Major role of rural poor in agroforestry and more specifically watershed protection (Dagar, 2010) Lack of knowledge/training to assist with agroforestry practices	Decreasing size of lands demands for more efficient and multi-use practices like agroforestry (Jitendra, 2015)	Marginalized populations and tribespeople more subject to land acquisition (BBC, 2015).

Appendix 3.c. Issue Matrix Mexico

ISSUE MATRIX: MEXICO	Political	Economic	Social	Environment	Security
International		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			Strong network of community-based organizations in region advocating for rights of indigenous persons and of small-scale producers (G Sanchez, Personal Communication, Mar, 23, 2020).		
National	Community forestry funding in place since the 1970s has been cut both before and under AMLO administration. (D Bray, Personal Communication, Mar, 24,2020) Because of political reasons, government do not always rely on the existing local network of cooperatives and associations, and prefer working with farmers directly (J Zúñiga, Personal Communication Apr, 19,2020). The SV program has a national committee composed of academics and civil society organizations. They advise the government (E Esquivel, Personal Communication, Mar, 24, 2020). The SV program has trouble recognizing and using the experience and work that already exist in the different regions. Since the government somehow wants to start from scratch, this has limited the participation of local cooperatives and farmers organizations (E Esquivel, Personal Communication, Mar, 24, 2020). In general there is a lack of monitoring of public policies related to land use (E Esquivel, Personal Communication, Mar, 24, 2020).	Agricultural subsidies of maize, cattle, and other monocultures from the free trade policies of the past ~30 years disincentivize small-scale agroforestry practices.	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). Producers can be divided into: those who want to participate in SV and cannot (less than 2.5ha), those who can and do not want to, and a small band that can and wants to participate (E Esquivel, Personal Communication, Mar, 24, 2020). Environmental degradation is translating into a health emergency in Mexico (Merino, 2020).	Loss of more than half of native forests in Mexico (Eguiluz-Piedra, 2003). Failure to discuss with local farmers what crops would be more suitable for reforestation/agroforestry (F Montagnini, Personal Communication, Mar, 2, 2020). SV program is implementing a model that seeks crop diversity based on issues of food self-sufficiency & subsistence income, but not biodiversity concerns (E Esquivel, Personal Communication, Mar, 24, 2020).	
Sub-national	There are also instances of regional participation (committees) where there are people responsible for promoting and developing the SV program (E Esquivel, Personal Communication, Mar, 24, 2020).	Tropical areas are often more marginalized areas (E Esquivel, Personal Communication, Mar, 24, 2020).	Some regions have existing culture and knowledge linked to agroforestry, while others lack the necessary traditional knowledge or expertise (E Esquivel, Personal Communication, Mar, 24, 2020).	Differences between temperate and tropical zones in terms of crop types (E Esquivel, Personal Communication, Mar, 24, 2020). Some areas depend more than others on the supply of military nurseries for seedlings. This is closely linked to the level of local knowledge (E Esquivel, Personal Communication, Mar, 24, 2020).	
Local	Some of the poorest program participants do not have access to land to farm. Sembrando Vida allows for transfers between participants, but this is not always possible in reality (J Zúñiga, Personal Communication Apr, 19,2020).		Issues of gender-based violence in rural communities (Secretaría de Bienestar. (2019, November 17). Socio-cultural values of indigenous communities and local ecological knowledge can promote natural resource maintenance (F Montagnini, Personal Communication, Mar, 2, 2020; Vallejo et al., 2015).	Lack of producer involvement leads to inappropriate choices around seedling selection, and this can impact long-term ecological goals of agroforestry systems (Montagnini, Zúñiga). Plant resources in forests were historically dependent on human management, so agroforestry practices mirror this traditional socio-ecological system (Vallejo et al., 2015).	Organized crime could derail community-led conservation efforts (D Bray, Personal Communication, Mar, 24,2020) .

Appendix 4. Interview List

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

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

[illegible]

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