Local Regulatory and Economic Instruments to Encourage Tropical Forestry Conservation: An Analysis of the Policy Process in Costa Rica and Mexico

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ABSTRACT

Forests are the most biologically diverse land ecosystems, providing shelter, jobs, and security to people who depend on them. However, global deforestation continues alarmingly; for decades, people destroyed approximately 13 million hectares (32 million acres) annually, largely in tropical countries. Today, the world loses about 3 million hectares per year — an equivalent of 11,500 soccer fields — daily, that is still a tremendous amount.

This study reviews theories and evidence concerning the process of formulating and adopting forest policies. It examines the theory on dynamics of policy processes, analyzing the process that Mexico and Costa Rica follow to slow and even reverse deforestation. In addition to reviewing the publications in this field, this study provides empirical evidence by presenting the results of interviews conducted with policymakers who participated in the forest policy process in both nations, reporting on their motivations, obstacles, and other criteria relevant in a policy process. Among the public policies and policy instruments analyzed in the case studies, it reviews new forest laws, regulations, and the use of economic instruments, particularly the Payment for Ecosystem Services (PES) scheme, as part of each country's effort to more effectively maintain forest cover.

The literature review reveals that, in the history of conservation and environmental policy, there are successes and failures in implementing different policies using incentives or regulations. Not all approaches fit the individual conservation/use objectives in every country or region. Hence, countries cannot use a single recipe to define their forestry policies; they are more likely to succeed if they use a combination of approaches, instruments, and tools.

As this thesis shows, leadership from high-ranking people is a key element in a successful policy process. Direct participation from those involved is also a positive step in the process. The introduction of certain economic instruments has enabled regional planners and policymakers to halt deforestation and, in the case of Costa Rica, even to increase forest cover. However, it is necessary to highlight that those instruments came to exist as part of a new law that includes incentives and sanctions, eliminates perverse incentives, and dictates measures regarding land tenure and land-use change.

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Dedication

To my mother, Cyma Pinchanski; my husband, René Castro Salazar; my kids, Raquel Castro Cordero and René Castro Cordero; and especially to

Mariana, who brought truthful love, happiness, and hope into my life.

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"No one climbs a high mountain alone. Experience and expertise, support and encouragement are all needed." (Roberts, 2010, p. 11)

I would like to use this opportunity to express my gratitude to a great number of people who contributed to the long journey of my dissertation in various ways.

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Without all your help, it would have been impossible for me to keep working and to finish my dissertation.

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List of Acronyms

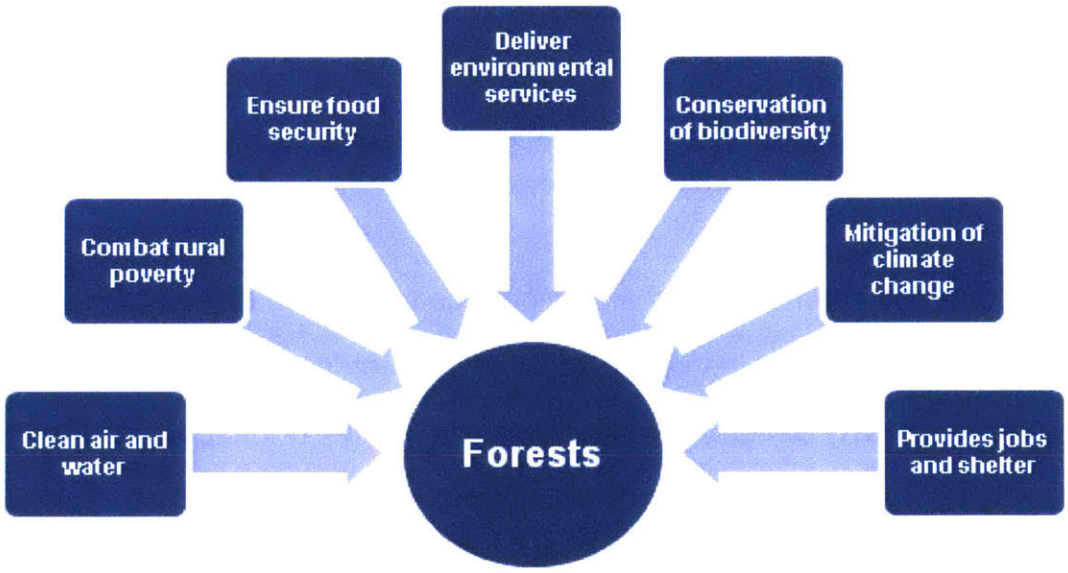
AIJ	Activities Implemented Jointly
CAC	Command-and-control
CAF	Reforestation Payment Certificate, Spanish acronym (Costa Rica)
CAFA	Advanced Payment Reforestation Certificate, Spanish acronym (Costa Rica)
CAFMA	Forest Management Payment Certificate, Spanish acronym (Costa Rica)
CCB	Forest Conservation Certificate, Spanish acronym (Costa Rica)
CCT	Tropical Science Center, Spanish acronym (Costa Rica)
CDM	Clean Development Mechanism
CIFOR	Center for International Forestry
CITES	Convention on International Trade of Endangered Species of Wild Fauna and Flora
CO_2	Carbon dioxide
COB	Certificate for Forest Conservation, Spanish acronym (Costa Rica)
CONAFOR	Forestry National Commission, Spanish acronym (Mexico)
CONAGUA	National Commission for Water, Spanish acronym (Mexico)
CONANP	National Commission for Protected Areas, Spanish acronym (Mexico)
COP	Conference of the Parties
CPB	Forest protection Certificate, Spanish acronym (Costa Rica)
CSA	Ecosystem Service Certificates, Spanish acronym (Costa Rica)
DGF	Forest General Directorate, Spanish acronym (Costa Rica)
ECODES	Conservation Strategy for Sustainable Development, Spanish acronym (Costa Rica)
ECOSOC	Economic and Social Council of the United Nations
EPA	Environmental Protection Agency (US)
ESPH	Heredia Public Services Utility, Spanish acronym (Costa Rica)
FAO	Food and Agriculture Organization of the United Nations
FIP	Forest Investment Program (Mexico)
FONAFIFO	National Fund for Forestry Financing, Spanish acronym (Costa Rica)
FRA	Forest Resources Assessment

FUNDECOR	Foundation for the Protection of the Central Volcanic Mountain Chain Spanish acronym (Costa Rican NGO)
GCF	Green Climate Fund
GEF	Global Environment Facility
GHGs	Greenhouse Gases
ICE	Costa Rican Institute of Electricity, Spanish acronym (Utility)
IFF	International Forum on Forestry
IIED	International Institute for Environment and Development (UK)
IPCC	Intergovernmental Panel on Climate Change
IPF	Intergovernmental Panel on Forestry
IUCN	International Union for the Conservation of Nature
MAG	Ministry of Agriculture and Livestock, Spanish acronym (Costa Rica)
MBIs	Market-based instruments
MINAE	Ministry of Environment and Energy, Spanish acronym (Costa Rica)
MIRENEM	Ministry of Natural Resources, Energy and Mines, Spanish acronym (Costa Rica)
$MtCO_2e$	Million tons of CO_2 equivalent
NGOs	Non-Governmental Organizations
OCIC	Costa Rican office of Joint Implementation
PAF-CR	Forestry Action Plan, Spanish acronym (Costa Rica)
PES	Payment for Environmental/Ecosystem Services
PPP	Pollution pays principle
PROCAMPO	National Program for Rural Areas Support, Spanish acronym (Mexico)
PROCYMAF	Community Forest Development Program, Spanish acronym (Mexico)
PRODEFOR	Forest Development Program, Spanish acronym (Mexico)
PRODEPLAN	Forest Plantation Program, Spanish acronym (Mexico)
PROFOR	Innovation and Action for Forest
PRONARE	National Reforestation Program, Spanish acronym (Mexico)
PSA- CABSA	Program for Markets Development of Environmental Services for Carbon Capture and derived Biodiversity, Spanish acronym (Mexico)
PSAH	Payment for Hydrological Services, Spanish acronym (Mexico)
REDD	Emissions Reduction from Deforestation and Forest Degradation

REDD+	Emissions Reduction from Deforestation, Forest Degradation, and Avoided Deforestation
RFF	Resources for the Future
SDGs	Sustainable Development Goals
SDGs	Sustainable Development Goals
SEMARNAT	Secretariat for Environment and Natural Resources, Spanish acronym (Mexico)
SINAC	National System of Conservation Areas, Spanish acronym (Costa Rica)
SINAP	National System of Protected Areas, Spanish acronym (Mexico)
TNC	The Nature Conservancy
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNED	National University at a Distance, Spanish acronym (Costa Rica)
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
UNOFC	United Nations Office on Drugs and Crime
WB	World Bank
WCMC	World Conservation Monitoring Center
WRI	World Resources Institute
WWF	World Wildlife Fund

1. INTRODUCTION

According to the United Nations Environmental Programme (UNEP), forests cover one third of the world's landmass, and about 1.6 billion people depend on forests for their livelihoods.[1] As clearly summarized by the Food and Agriculture Organization of the United Nations (FAO), "Forests play a fundamental role in combating rural poverty, ensuring food security, and providing decent livelihoods; they offer promising mid-term green-growth opportunities; and they deliver vital long-term environmental services, such as clean air and water, conservation of biodiversity, and mitigation of climate change" (FAO, 2016a, p. v). Figure 1 presents most of the benefits provided by the forests.



Source: Prepared by the author with information from (FAO, 2016a).

Figure 1. Benefits Provided by Forests

Given the importance of the benefits provided by forests, it is essential to study the way in which countries dictate their policies, regulations, legislation, and economic

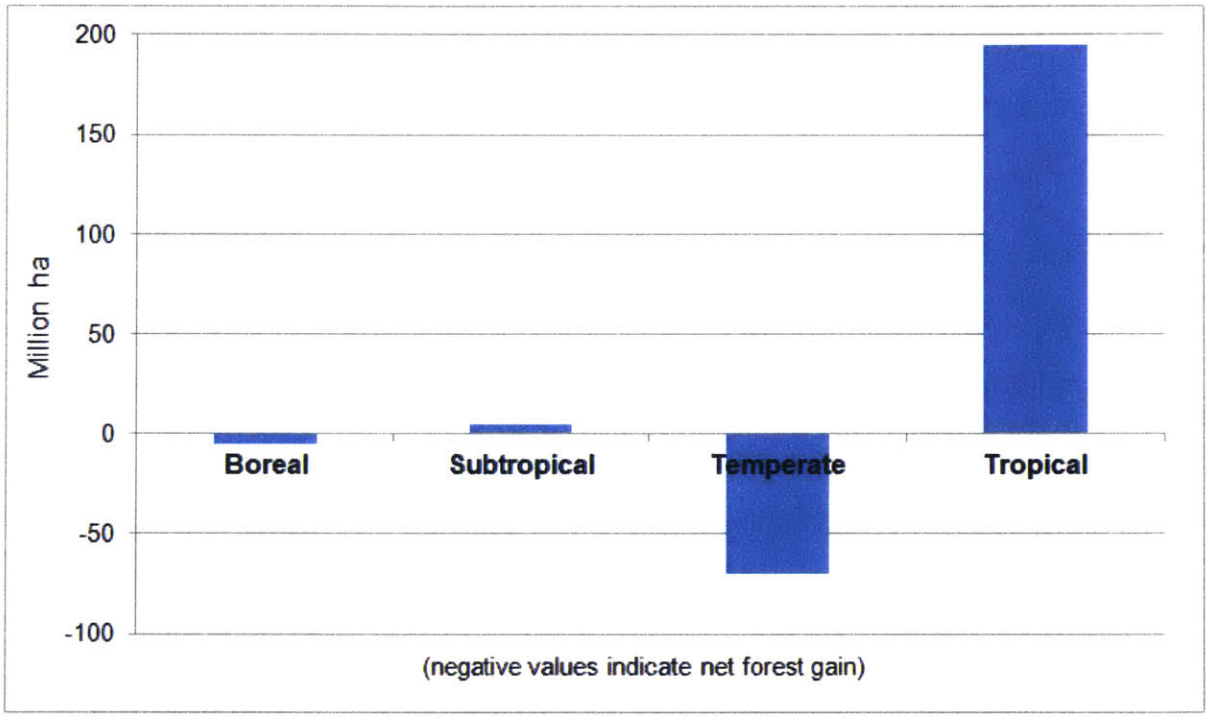
[1] http://www.unep.org/forests/AboutForests/tabid/29845/Default.aspx

instruments; regarding not only forests per se but also other such interrelated areas as agriculture, land use, land tenure, and water. Is it possible to have a regulation that works transversally? Is it possible to link a national forest policy to other policies?

Although the extent of the world's forest coverage continues to decline globally, by 2015, the world has reduced the rate of net forest loss by over 50% even as the human population continues to grow and the demand for food and land increases. This is the result of various measures; for example, countries are designating larger areas for biodiversity conservation (around 15% of all forest), which helps to cut the rate of net forest loss (FAO, 2016b). Forest gains and losses occur continuously at the global level and are very difficult to monitor, even with ever-improving high-resolution satellite imagery. Therefore, measuring deforestation, or forest conversion, is very complicated. There is also a difference between change-dynamics patterns of natural forest areas and of planted forest areas —and these vary dramatically across national conditions and forest types (FAO, 2016a).

General agreement exists on the need to stop global deforestation, and particularly that occurring in tropical developing countries. In September 2015, the United Nations (UN) General Assembly established the 17 Sustainable Development Goals (SDGs): Goal 15 proposes halting deforestation by 2020. However, the main discussion has been on finding the causes to tackle forest loss and not so much on specific policy prescriptions that have proved to be effective in reducing or reverting deforestation rates in specific countries. In fact, there are many complicated and interrelated drivers of deforestation—though agricultural expansion is the most significant—accounting for an estimated 55–80% of total global deforestation (FAO, 2016a). Unexpectedly, in 2016, the FAO documented more than 20 countries where both forest cover and populations' food and nutrition increased.

The ways in which forest-covered areas have changed over the past 25 years are important, particularly given the continued growth in human populations and the demand for forest products. We can observe, in Figure 2, that from 2000 to 2010 the boreal [2] and subtropical climatic domains have seen relatively little change. Net forest area has increased in temperate countries in every measurement period, and tropical forests have a net forest loss, accounting for approximately 200 million hectares lost.



Source: FAO (2016a). *Global Forest Resources Assessment 2015: How are the world's forests changing?* (2nd ed). Rome: Food and Agriculture Organization of the United Nations.

Figure 2. Net Forest Loss 2000—2010, from Country Reports

Moreover, the largest area of forest converted to other land uses between 1990 and 2015 was in the tropics, which presented losses in every period measured since 1990. Observing the vast net forest loss in the tropics (almost 200 million ha. in a decade) creates an urge to concentrate on that region. In terms of the distribution of

[2] In a visit to the Saint Petersburg Forest Technical University (March 21, 2018), scholars mentioned that in Russia the problem to target is forest quality and that quantity is almost irrelevant.

forest, based on a country's income, the FAO concludes that the largest proportion of the world's forest is in high-income countries, followed by upper-middle, lower-middle, and low-income countries. This is true for total forest area, primary forest, and other naturally regenerated and planted forest (FAO, 2016a).

The FAO estimated that in North and Central America, as a whole, forest areas were almost the same in 2000 as in 2010. However, while these areas are increasing in North America, they continue to decrease in all countries in Central America except Costa Rica. Also, the net gain in the United States outweighs the net loss in Mexico (FAO, 2016a).

Table 1 shows that from 1990 to 2015 total world forest measured in hectares diminished; however, from 1990 to 2005, the annual change was larger than from 2005 to 2015, with the biggest change happening between 1990 and 2000. The annual change is mainly due to countries' specific actions to reduce deforestation, in an international environment increasingly aware of the role of forest in the global carbon cycle.

Table 1. Global Forest Area Change (1990–2015)

Year	Forest (Thousand ha)	Annual change (Thousand ha)	Annual growth rate
1990	4,128,269		
2000	4,055,602	-7,267	-0.18
2005	4,032,743	-4,572	-0.11
2010	4,015,673	-3,414	-0.08
2015	3,999,134	-3,308	-0.08

Source: (FAO, 2016b, p. 14).

Despite the fact that FAO statistics show that the rate of deforestation has slowed globally, it continues at a high rate in several countries, mainly in South America and Africa. As shown in Table 1, the annual rate of global deforestation is diminishing:

from -0.18 in 2000 to -0.08 in 2015. Moreover, from 1990 to 2015, there was a net loss of some 129 million hectares of forest, which represents an average annual rate of –0.13% and a total area of approximately the size of South Africa. According to the FAO, policymakers' concern is growing because most of the land is going to agriculture (FAO, 2016a).

The FAO estimated the average net loss of forest area in tropical countries as 8.3 million hectares per year for the decade 1990-2000; while, for the following decade, 2000–2010, the FAO calculated it at 7 million hectares per year, which represents a reduction.[3] At the same time, 2000-2010, there was a net gain in agricultural land of 6 million hectares per year (FAO, 2016b, p. x). The FAO also found that, for the same period, the greatest net loss of forests and net gain in agricultural land was in the low-income group of countries, where rural populations are growing.

In this research, I argue that national forestry policies are required to reduce and/or reverse deforestation, and that the process of a policy influences its success.[4] Moreover, Its is necessary to have a policy mix, in which complementary regulation and economic instruments are present as well as alignment with other interconnected policies. I ground this argument in the literature review, presented in Chapter 2, which includes the following topics: forest governance and international efforts, sustainability related to forests, land tenure, land use change, and policy instruments used internationally in forestry issues. In addition, in this chapter I review the debate over payment for environmental services (PES) as a way to increase forest coverage and promote sustainable development strategies. Chapter 2 also presents the theoretical

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[3] For the same period the average global net loss of forest area was 5.2 million hectares per year, showing a smaller net loss than in tropical countries.

[4] In this dissertation, I look only at the quantity, meaning changes in deforestation rates and not at the quality, meaning type of species, effect on soil, difference between domestic and introduced species and so on. This is because most of the PES schemes were based on quantity and not quality; hence, information on quality is rarely available and what exists is either incomplete or not comparable.

framework that explains theories of policy process. I reviewed critical evaluations of policy process theories, because I am convinced that the process is very important for the design of future policies that could systematically respond to the big array of challenges faced.

Chapter 3 introduces the reader to the research strategy, the research question, and the methodology I used in this dissertation. It also includes limitations I faced during the research.

Chapters 4 and 5 present the findings of case studies conducted in Costa Rica and Mexico, analyzing the points discussed in chapter 2 plus an analysis of the policy process during the enactment of each country's most recent forestry law.

Chapter 6 presents a comparative analysis of the two cases studied and the main conclusions I obtained from this research. Finally, Chapter 7 presents a conclusion, that includes recommendations arising from, and broader implications of, this study.

I present a number of definitions in Appendix A. It is important to take these definitions into account because different sources might provide different results based on the definitions that they use, and to make valid comparisons they have to be based on the same criteria. For example, a study conducted in 2008 about the various definitions of "forests" found that more than 800 different definitions were in use around the world (Lund, 2008; mentioned by (UNEP, FAO, & UNFF, 2009).

2. LITERATURE REVIEW

Since the first UN Conference on Human Environment in Stockholm (1972), forests in general, and tropical forests in particular, have been receiving increasing attention from the global community.

During the 1980s, tropical forest area cleared yearly in Latin America reached 7.4 million hectares (FAO, 1988), almost as much as the annual deforested area of Asia and Africa combined. Although within Latin America, most of the deforestation — over 85%— took place in the Amazon Basin of South America, the FAO reported that the highest rates of deforestation were in Mexico and Central America, where relatively few standing primary forests remained at the time.

Deforestation has been accelerating appallingly in Central America and Mexico since the 1960's. Table 2 presents a comparisson of the deforestation trends around the world. It clearly shows how much faster forests were disappearing in percentage terms in Mexico and Central America followed by South America than in the rest of the regions for the period 1990 -2015 (with the exception of Africa).[5] This fact might be explained because first, in Mexico and Central America, a highly significant part of the population still inhabits in rural areas were agriculture is a fundamental activity that has been expanding. Second, the patterns of settlement and subsistence in those countries present a large portion of land and its resources controlled by the ruling upper classes and third, the character of the political power.

[5] I am concentrating in Mexico and Central America, and some examples from South America (instead of Africa) due to the data quality, availability, and capacity to access different sources these areas present.

Table 2. Forest Area Change by geographical sub-region (1990–2015)

	Forest Cover (in thousand of ha)		**Annual change 1990 – 2015 ***	
Sub-region	1990	2015	Thousands ha	% per year
Central America & Mexico	97,286	86,290	-439.8	-0.45%
Caribbean	5,017	7,195	87.1	1.74%
Asia	568,122	593,362	1,009.6	0.18%
Africa	705,740	624,103	-3,265.5	-0.46%
Europe	994,271	1,015,482	848.4	0.09%
North America	650,196	657,167	278.8	0.04%
South America	930,814	842,011	-3,552.1	-0.38%
Oceania	176,825	173,524	-132.0	-0.07%

Source: Calculated by the author using data from (FAO, 2016a)

(*) Positive numbers indicate increase in forest coverage

Consequently, if countries do no slow the deforestation trend, there will be little forest left and if countries do not protect soon important forest areas, particularly those that serve the major rivers and watersheds of the region, "no amount of social and economic reform will be able to provide for the many elementary needs of the region's increasing population." (FAO, 2016b; Myers & Tucker, 1987).

As of 2015, the FAO's Global Forest Resource Assessment (FRA) confirms that forest gain is happening in rich countries and at high latitudes, whereas in poor countries and in the tropics forest loss continues (Sloan & Sayer, 2015).

2.1. Environmental economics and ecological economics

Since I am reviewing economic instruments used in forestry policy, it is important to examine the economic theory behind them. There are two basic schools of economic thought on global economic integration and the environment: environmental and ecological economics. On one hand, environmental economists see economic growth as a potential positive force for the environment. They view markets as effective tools to

amend environmental problems; in particular, when they put in place the correct incentives. For this school of thought, the goal is to maintain equilibrium between the economic activity and the environmental impacts by taking into account all the costs and benefits. For example, environmental taxation has become relatively common in Europe; tradable permits have become common in the control of air pollution in the US and fisheries around the world; and many countries use deposit/refund systems to reduce the external costs of littering.[6]

On the other hand, ecological economists (who draw on theories of ecology and physics as well as economics) see economic growth as having on balance a negative impact on the environment. In a simplified way, ecological economics approaches economics from a standpoint that places the economy as a subset of the environment. In addition, ecological economics accounts for ecosystem services, and explore issues of social resilience. It also incorporates issues of sociology and has additional dedication to issues of justice and social sustainability (Xepapadeas, 2009). Some ecological economists accept the power of markets but they argue that markets alone cannot correct environmental problems created by economic growth (Clapp, 2011).

Followers of ecological economics criticize the neoclassical models used in environmental economics as inadequate, because they (a) ignore the natural limits to growth; (b) disregard the interdependency between economy and environment; and (c) diminish the role that time plays. Therefore, they advise the use of a variety of methods in order to expand the neoclassical models and accommodate the larger ecological issues (Venkatachalam, 2007). Among the main issues, ecological economics requires

[6] Thomas Tietenberg, course description, WBIEN Environmental Economics and Development Policy.

to allocate resources in a way that they do not threaten the stability either of the system (planetary boundaries) as a whole or of key components of the system.

On one hand, those against environmental economics argue that it tends to rely basically on the market. In other words, environmental economics operates within a neo-classical economic paradigm in which the economy can continue to grow and operate independently of the limits of our physical world. Environmental economics is keen to the notion that innovation and the market can continue to provide for the needs of demand. Environmental economists frequently discount aspects such as externalities, health, or education showing a preference towards today's consumption instead of future consumption. In addition, in environmental economics the assessment of the role of values and ethics is fairly new.

On the other hand, critics of ecological economics consider that it favors an almost impossible goal of strong sustainability (assuming that natural capital cannot substitute physical capital), and is not concerned about being objective. In addition, they believe that the level of analysis in ecological economics is inherently systemic, while microanalysis may need improvement. Environmental economics, however, principally encompasses both, macro and microanalysis (Venkatachalam, 2007).

According to Unruh, there is a discrepancy because "ecological economics assumes that natural capital is exogenous and fixed, while environmental economics assumes human preferences are exogenous and fixed." (Unruh, 2010). He argues that in ecological economics, there is an implicit assumption that unlimited economic growth is impossible, even if it might be sustainable, whereas in environmental economics there is no inherent reason to assume either way. Finally, I believe that both are anthropocentric because resource conservation is an anthropocentric view of natural

systems as opossed to biocentric. "Anthropocentrism promotes the preservation of the environment as a means to an end rather than an end in itself. However, biocentrism treats environmentalism as a moral imperative independently of its impact on human flourishing."[7][8]

Currently, environmental economics is having a larger impact on environmental policy (Beder, 2011). "Though a narrow path was followed, the environmental economics has proved to be 'analytically rigorous' and more effective in influencing policymaking. The 'pluralistic' approach adopted in the ecological economics is considered to be highly 'challenging' but it seems that its scope has become 'too vast' focusing on too many areas." (Venkatachalam, 2007, p. 556).

Nevertheless, ecological economics is a growing transdisciplinary field that aims to improve and expand economic theory to integrate the earth's natural systems, human values and human health and well-being.[9] Moreover, I have found that, although for some scholars their differing paradigms create a profound debate between the two schools of thought; for other scholars there is a strong overlap between the two fields (Ma & Stern, 2006). In the case of PES, I believe that there is a combination; ecological economics was more concerned about the recognition of ecosystem services, while environmental economics concern was to value those services, which at the end do not affect my approach.

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7 Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4138930/

8 In fact, economist calculate the total value of the environment as the in-use value (direct and indirect use), and the non-use value (option and existence value), which is an anthropocentric view of the value.

9 For example, Costa Rica used principles of Ecological Economics to value the damage caused by Nicaraguan Military Forces in a border area in the Northeast. In 2017, the International Court of Justice located in The Hague, partially accepted the economic valuation presented by Costa Rica and order Nicaragua to pay for the damages they caused.

2.2. Sustainability

"Our Common Future" also known as the Brundtland Report was the publication that not only popularized the concept of sustainable development to the UN, but also described how countries could achieved it. The World Commission on Environment and Development released it in 1987 and it states "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (United Nations, 1987, p. 41). However, it was not until the Earth Summit in 1992, Rio de Janeiro that UN member countries adopted the concept, and only in 2015 the UN adopted measurable goals.

Sustainable development is a concept that came out in the context of an increased awareness of an ecological crisis. Many fear that economic growth might endanger the survival of the human race and the planet. The feelings of anxiety are expressed in a growing body of academic literature. For example, Nathan Glick wrote that "if we continue our present practices we will face a steady deterioration of the conditions under which we live." (Dubos et al., 1970, p. 2). In addition, LaMont C. Cole stated, "humankind may destroy the ability of the earth to support life" (Dubos et al., 1970, p. 3). This alarmist mood, in anticipation of a forthcoming ecological tragedy, inspired a new mode of thinking about development; furthermore, prepared the way for sustainable development as an alternative to unlimited economic growth.

In the early 1990s, economists leaned toward a concept of sustainability that relied more on the environment-economic relationship than do the concepts they look at today (such as triple bottom line).[10] Nowadays, we also include broader concepts—ones that includes equity, employment, and social aspects of life. In that framework,

[10] It has been widely accepted that sustainability consists of three 'pillars' or 'bottom lines' – environmental, economy, and society.

sustainably using and conserving forest is integral to sustainable development and future resource use. Furthermore, many scholars argue "major technological, organizational, institutional, and social changes, not just incremental advances, are necessary to achieve sustainability." (Ashford & Hall, 2011, p. 271).

In September 2015, the Heads of State and Government convened at the UN headquarters and agreed to new, global, SDGs. In "Transforming the World: the 2030 agenda for sustainable development" the UN presented the new 17 SDGs.

Among the goals, Goal 15 directly addresses forests: "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss" (United Nations, 2015, p. 18).

More specifically related to forest, participants at the International Conference "Working across Sectors to Halt Deforestation and Increase Forest Area: From Aspiration to Action"[11] concluded that "achieving SDG 15, especially halting deforestation and restoring degraded forests by 2020 requires urgent action now. Best practices and tools are available but their application must be up scaled and progress accelerated." Participants believe that having goal 15 as one of UN SDGs for 2030 has provided an international framework for cooperation and now the challenge is to act swiftly. In fact, the foundation of the 2030 Agenda for Sustainable Development and SDGs is in fact sustainability as part of a global framework for international cooperation.

The meaning of sustainability is still the subject of intense debate among different schools of thought. The traditional economic view of the natural world differs from the views of many natural scientists and also from the view of ecological economics. The

[11] Held at FAO headquarters, Rome, February 20 – 22, 2018.

debate between environmental and natural resources economics focused on the substitutability between the economy and the environment or in other words among "natural capital" and "human made capital" a debate captured in terms of "weak" vs. "strong" sustainability, (Atkinson & Mourato, 2015; Ayres, van den Bergh, & Gowdy, 1998; Pelenc, 2015; Solow, 1974; Wilson & Wu, 2017).

Weak sustainability might result in the risk of losing critical natural capital (irreversibility - uncertainty); therefore , the need to keep the ecological functioning of natural systems above specific thresholds of degradation, became more imperative in order to safeguard its capacity to provide the services that are critical (Wilson & Wu, 2017). In this framework, and given the uncertainties in decision-making, emerges what is known as the Hartwick rule stating that "consumption may be held constant in the face of exhaustible resources only if the rents deriving from the intertemporally [*sic*] efficient use of those resources are reinvested in reproducible capital." (Common & Perrings, 1992, p. 10).

Furthermore, environmental economists defined certain rules for maintaining the natural capital stock. The rules are known as "Natural Resources Rules of Environmental Management", and are presented below, (Pearce & Turner, 1990; Tietenberg & Lewis, 2016; Turner, 1993; Turner, Pearce, & Bateman, 1993).

- Rule 1. Always use renewable resources in such a way that the harvest rate (the rate of use) is not greater than the natural regeneration rate (Renewable resources).
- Rule 2. Always keep waste flows to the environment at or below the assimilative capacity of the environment (Non-renewable resources).

- Rule 3. Increase the efficiency of resource use, to obtain a given standard of living from a reducing stock of resources (Human-made resources).

If we observe rules 1 and 2, we know that the stock of renewable resources and the stock of assimilative capacity will remain, allowing the world to preserve the critical natural capital (Tietenberg & Lewis, 2016; Turner, 1993)

In dealing with sustainability, ecological economics describes the relationship between dynamic human-economic systems, and larger also dynamic, but normally slower-changing ecological systems. This relationship visualize a socio-ecological context in which (a) human life can continue for ever, (b) individuals can prosper, and (c) cultures can develop; however, the consequence of human activities should remain within boundaries, to avoid destroying the diversity, complexity, and function of the ecological life support system (Costanza, Daly, & Bartholomew, 1991; cited by (Sneddon, 2000). The argument in ecological economics is that to put forth sustainability requires redirecting economic and environmental policies to guarantee that the stock of natural capital would not be depleted—do not violate planetary boundaries, (Costanza, 1991a; Sneddon, 2000), which coincide with the rules of environmental economics.

2.3. Forest Governance

Governance is "... about how we establish goals, how we define rules for reaching the defined goals, and finally how we control outcomes following from the use of these rules." (Vatn, 2010, p. 1246).

According to the FAO, the quality of governance is what determines if countries are using forest resources equitably, efficiently, and more importantly in a sustainable way (PROFOR & FAO, 2011). Moreover, many scholars claim that policy makers

cannot dictate forest policies in isolation, that there is a complex web of intersectoral and cross cutting relationships (Laarman, 1995; Repetto & Gillis, 1988).

I fully agree with this idea, since there is a relationship between forest - agriculture, forest - land tenure, and forest - climate change, and the formulation and adoption of those policies should be coordinated, or better still, integrated. For example, given that relationship, it is important to know what type of agriculture prevails in a country. Depending on the circumstances in each country, it can be large-scale commercial agriculture, small-scale agriculture, subsistence agriculture, or a mix of various types depending on the region. Having this knowledge helps create agricultural policies that at the same time assist in protecting forests.

Another factor to take into consideration is that the demand for a product in one country can result in environmental degradation of another country. For example, an increase in the demand for timber or agricultural products in the United States might cause extensive deforestation in tropical regions eager to sell their products. In addition, agriculture policies that may perhaps increase profitability – for example soft loans – and changes in market conditions, can increase demand for agricultural land, and lead to deforestation. Europe is promoting programs to combat illegal logging trade especially from Africa.

The FAO claims that poor governance and lack of clear land tenure can be among the drivers of deforestation; for example, where the connections between the different sectors are weak. In addition, policies designed for high-priority sectors – such as agriculture, industrial development and energy – may have a greater impact on forests than the forest policy itself, especially when a country considers forests as a low priority (FAO, 2016b).

In general, many factors are associated with effective forest governance, but they vary across the different places studied. Among the key factors are land tenure, land use change, and trade.

2.3.1. International Actions

In the early 1990s, a large part of the international community, governments and public in general, felt unease over the clearing and degradation of forests all over the world and especially in tropical countries (FAO, 1995). The international community achieved a high point during June 1992 at the UN Conference on Environment and Development held in Rio de Janeiro (informally named the Earth Summit). The main results obtained from the Earth Summit were: Agenda 21, the Rio Declaration on Environment and Development, the Statement of Forest Principles, the UN Framework Convention on Climate Change (UNFCCC), and the UN Convention on Biological Diversity. A significant part of the debate and decisions taken was devoted to issues of forest conservation and development. The Statement of Forest Principles reflects this remarkable concern for the fate of the world's forests.[12]

The Rio negotiations in 1992, led to the development of an international forest body known as the Intergovernmental Panel on Forestry (IPF), which operated from 1995 to 1997. Subsequently, it was renamed the International Forum on Forestry (IFF) and operated from 1997 to 2000. Both institutions were in charge of the provision of an international platform for forest negotiations.

The Economic and Social Council of the UN (ECOSOC) created the UN Forum on Forests (UNFF) in October 2000 being the only international forum that focuses solely on forest issues. Its main objective is to promote "... the management,

[12] http://www.un.org/geninfo/bp/envirp2.html

conservation and sustainable development of all types of forests and to strengthen long-term political commitment to this end…".[13]

In January 2017 a special session of the UNFF shaped the first-ever UN Strategic Plan for Forests, and provided an ambitious vision for global forests in 2030. The UN ECOSOC adopted the plan on 20 April 2017, and the UN General Assembly then adopted it on April 27, 2017. The UN strategic plan for forests 2017–2030 provides a "global framework for sustainably managing all types of forests and trees outside forests, halting and reversing deforestation and forest degradation and increasing forest area" (UNFF, 2018, p. 2). It includes 6 voluntary global forest goals and 26 targets to be achieved by 2030, as well as provisions for voluntary national contributions towards their accomplishment.[14] It is too soon to assess its success; however the plan has lead to high expectations.

Up until 2017, the UNFF and its predecessor (IPF and IFF) were unable to create any legally binding instruments concerning the use and management of the world's forests, a common challenge in global agreements on most issues surrounding sustainable development. This is one relevant aspect to take into consideration in the formulation, implementation, evaluation and control of any national or local policies.

The recognition that environmental issues are frequently of a transboundary nature requires international collaboration. As a result, numerous countries have entered into international agreements in the hopes of fostering a concerted effort to address some of the most pressing problems. Some of the most widely known international environmental agreements include conventions and protocols.

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[13] http://www.un.org/esa/forests/forum/index.html

[14] In accordance with paragraph 30 of the Strategic Plan, Member States may, on a voluntary basis, determine their contributions towards achieving the global forest goals and targets, taking into account their national circumstances, policies, priorities, capacities, levels of development and forest conditions. (http://www.un.org/esa/forests/documents/un-strategic-plan-for-forests-2030/index.html).

Conventions such as the UNFCCC, the Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES), and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. Additionally, there are other global instrument such as Conferences of the Parties (COP) 21 and 22; and protocols, such as the Kyoto Protocol, and the Montreal Protocol on Substances that Deplete the Ozone Layer. The global dimension of the problems, as well as the need for cooperation in trying to solve them, is the basis of this growing body of international treaties and agreements. The environment is a global good—and there is certainly a growing level of public awareness of its importance.[15]

In particular, the UNFCCC Bali Action Plan (December 2007) is quite clear in recognizing the need to avoid deforestation and very strong on encouraging Parties to address the drivers of deforestation by exploring a range of actions, identifying options, and undertaking efforts to achieve that goal (FAO, 2011). Among the drivers identified, the UNFCCC mentioned the conversion of forest to agricultural land, overexploitation of forest resources, and non-sustainable management practices.

However, in executing prior agreements of the climate regime, in particular the Kyoto Protocol, the international community has failed to confer the necessary incentives to care for the forests.[16] To mention one example, as of April 2012, the Clean Development Mechanism (CDM) of the Protocol has registered fewer than 40 projects—and only one project has received carbon credits—out of 2,300 projects.[17] This is due to the low demand for carbon credits in general and forestry credits in particular, as well as

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[15] https://www.sciencedaily.com/news/earth_climate/environmental_awareness/, http://www.huffingtonpost.com/steven-cohen/the-growing-level-of-envi_b_6390054.html

[16] The unique category for forestry projects is afforestation and reforestation.

[17] http://carbonmarketwatch.org/category/sustainable-development/forestry-land-use-projects/ and https://cdm.unfccc.int/Registry/index.html both accessed May 26, 2015.

the methodological difficulties of forestry projects, resulting in comparatively higher prices than the average for the projects included in the CDM.

More recently, during the COP 21 held in Paris in December 2015, 195 countries adopted the first-ever universal, global climate deal.[18] The Article 5 of the Paris Agreement is mainly dedicated to forests. It has two paragraphs. Paragraph 1 is a mandate for action that includes forests.

> *(1) Parties should take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases as referred to in Article 4, paragraph 1(d), of the Convention, including forests. (Climate Focus, 2015, p. 1).*
>
> *The second paragraph of Article 5 focuses on reducing forest-related emissions in developing country Parties. It recognizes the existing REDD+[19] framework and calls on Parties to take action and move to implementation of REDD+ in accordance with existing UNFCCC decisions, which by reference are integrated into the Paris Agreement. (Climate Focus, 2015, p. 2).*

Many scholars consider this article as a significant advance in international forestry agreements because it requires reporting (it was approved in 2016, by 55% of the Parties that represent a minimum of 55% of the world emissions); which happened surprisingly fast as more than 192 countries formally ratified the Paris Agreement in November 2016.[20] Nevertheless, issues with the monitoring and enforcement of the Paris Agreement have not yet been clarified and could be considered a mayor risk for success.

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[18] Each Party shall prepare, communicate and maintain successive nationally determined contributions that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions (Paris Agreement).

[19] Emissions Reduction from Deforestation, Forest Degradation, and Avoided Deforestation

[20] All Parties should strive to formulate and communicate long-term low greenhouse gas emission development strategies, mindful of Article 2 taking into account their common but differentiated responsibilities and respective capabilities, in the light of different national circumstances (Paris Agreement).

Another institution, the Global Environment Facility (GEF), assists developing countries with finance to protect the global environment. The GEF does not have an individual forest program but funds forest projects through biodiversity, climate change, and land degradation programs. The land degradation program created a sustainable land-management project theme that is broad enough to encompass projects related to sustainable forest management.

As for the Non-Governmental Organizations (NGOs), The World Wildlife Fund (WWF) for example, has worked on protected areas management and sustainable forestry. It created the Global Forest and Trade Network to combat illegal logging and promote responsible forestry (WWF, 2015). WWF uses different approaches to stop deforestation, such as Emissions Reduction from Deforestation, Forest Degradation, and Avoided Deforestation (REDD+) programs, engaging with governments. The other is via market-based certification schemes, engaging with agriculture producers.[21] Other NGOs such as The Nature Conservancy (TNC) and Conservation International, promote gifts and bequests of land for conservation purposes. In 2005, the Alliance for Forest Conservation & Sustainable Use agreed to devote resources to reducing deforestation by 10 per cent by 2010 (WWF & WB, 2005). Contrastingly, some NGOs have strongly criticized the World Bank for funding forest projects that apparently contributed to deforestation (Rainforest Foundation UK, 2005; The Ecologist, 2007).

2.3.1.1. REDD Programs

The loss of forests threatens biodiversity preservation, and results in the loss of soil and the natural sink forests provide for absorbing carbon dioxide. This leaves more

[21] https://www.worldwildlife.org/initiatives/forests. Retrieved May 7, 2018.

carbon in the atmosphere and exacerbates global warming. The estimation of degraded land globally is about 2 billion hectares.

As a result, at the UNFCCC COP 13 in December 2007, Parties decided to increase efforts to reduce emissions from deforestation and forest degradation (REDD) in developing countries.[22] As we feel the effects of climate change globally, it becomes more crucial than ever to concentrate on keeping global forest carbon stocks intact, improving forest management, and reforesting degraded land.

In sum, REDD is an effort — with limited measurable success and results— to provide a financial value for the carbon stored and fixed by forests, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. "REDD+" added the + sign because it goes beyond deforestation and forest degradation, and includes avoided deforestation, the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks. Since changes in land-use patterns, deforestation, land clearing, agriculture, and other activities have all led to a rise in the emission of carbon dioxide—and knowing that deforestation alone accounts for over 17% of global greenhouse gas emissions—the need to act now to reduce deforestation is even more pressing.

However, not all commentators are in favor of REDD. Some are concerned over whether the REDD regime can be successfully implemented in countries where there is inadequate governance. In addition, there is apprehension because efforts to conserve forests might ignore other important issues such as community rights, that in some cases might result in displacement of forest inhabitants (FERN, 2008)

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[22] http://www.unep.org/ecosystemmanagement/Default.aspx?tabid=3166

In 2008, UNEP, the United Nations Development Programme (UNDP), and the FAO jointly developed the UN-REDD Programme, a shared initiative that tried to reinforce the discussion among countries on REDD, and increase confidence among negotiators and Parties to include REDD in a new climate change agreement when the Kyoto protocol expired in 2012.[23] UN-REDD supports nationally-led REDD+ processes promoting the involvement of all stakeholders, including Indigenous People and other forest-dependent communities. "UN-REDD is also helping nine pilot countries to manage their forests in a manner that maximizes their carbon stocks and maintains their ecosystem services, while delivering community and livelihood benefits."[24] However, UN-REDD has advanced very slowly, and the vast majority of its activities are considered in the "readiness phase." In October 2016, the UN organizations presented to the Green Climate Fund (GCF) a funding proposal for UN-REDD implementation phase.

Though these international organizations agree on the objective of reducing deforestation, they are not so specific on the solutions. There is no prescription specifically recommended to obtain that goal. Nevertheless, the discussion states a few general observations:

a) To use a cross-sectoral "landscape approach" encompassing all land uses
b) To be aware of the need to create policies, laws, and action plans
c) To recognize the full value of the multiple goods and services provided by the forest
d) To use incentives provided by a REDD+ instrument

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[23] FAO established a Forest Department mostly for policy advice, data gathering and analysis, It publishes every 5 years the Forest Resource Assessment (FRA), a global forest report that collects data from the countries. The first FRA was published in 1946 and the last in 2015.

[24] http://www.unep.org/ecosystemmanagement/UNEPsWork/TerrestrialEcosystems/Forests/tabid/3166/Default.aspx accessed April 9, 2016.

e) To avoid perverse incentives for conversion of forest land to agriculture

2.3.2. Forest Revenues and Expenditures

Currently, policy-makers recognize forests as an integral part of national economies. There are many revenues that come from forest, such as the selling of timber either in the local market or for exports, selling of other non-forest products, entrance fees to forest reserves (if they apply), foreign assistance to the forestry sector (loans, grants, technical assistance, and other forms of support). In general, expenditures include salaries, operating expenses, and capital costs.

On one hand, forests contribute to development, for instance, in the form of natural capital. On the other hand, forests might constrain and limit development, for example, some countries commonly regarded forests as obstacles that producers need to remove before productive activities are possible. Finally, in other circumstances, countries treat forests as scarce natural resources that governments must protect from all types of exploitation.

Table 3. Gross Value-Added in the Forestry Sub-Sector. Selected Tropical Countries

	1990	2000	2010
	In million USD at 2011 prices		
Colombia	817	450	559
Costa Rica	76	75	135
Ecuador	637	760	856
Guatemala	303	462	342
Honduras	146	82	88
Mexico	1,949	1,993	1,209

Source: Prepared by the author with data from (FAO, 2014a).

Gross value-added is a measure of the contribution to GDP made by a sector, in this case forestry. The above table presents this data for selected tropical countries[25] for three years 1990, 2000, and 2010. Mexico is the country with the highest gross value-added for all three years (also the one with the largest territory), which shows the importance of forest for that country, although year 2010 presents a considerable reduction. Costa Rica presents the lowest gross value-added and the trend is upwards (the one with the smallest territory). Colombia and Honduras present a downward trend, which shows in part the effect of loss in forest cover in those countries given that Colombia went from a forest area of 62,519 thousand hectares in 1990 to 60,499 thousand hectares in 2010, and Honduras went from 8,136 thousand hectares in 1990 to 5,192 thousand hectares in 2010. In addition, Colombia's civil war encouraged the exploitation of natural resources.

2.3.3. Policies and Policy Instruments

Public policy consists on formulating and implementing responses to issues of public concern. Frequently public policy is the result of public officials' initiatives to mitigate problems on behalf of the citizens they represent (Kraft & Furlong, 2017).

Governments often develop and implement policy-making responses, with input from stakeholders and the civil society, and frequently include strategic actions, such as laws, regulations, funding, and taxes (Kraft & Furlong, 2017). In general, forest policy is primarily concerned with how to govern the relationship between humans and the natural forests in a mutually beneficial manner.

Policy analysis has developed into a discipline concerned with an even deeper analysis of the policy process, with "the analysis of the determinates, characteristics and

[25] Part of Mexico's forest is temperate.

implications of public policies and programmes." (Poister, 1978, p. 5). In other words, it is the study of how and why governments choose to act or not on some issues; what triggers the decision of designing a new policy, what role leadership plays; and what are the expected results of the effects of policies, both intended and unintended.

The adoption of public policies is essentially a political process. This is often not scientific, but at the same time it does not exclude science. By understanding the politics of the policy process, researchers can learn to work with it towards a more comprehensive and interrelated type of policies.

2.3.3.1. Legislation and Regulation

Deforestation has become an international political issue because, forests contribute to the maintenance of global public goods; however, in international law, forests are an autonomous resource of the state (Humphreys, 2010). For example, many Brazilian governments claim that no other country has the right to say how to use the Brazilian Amazon. This situation repeats itself with other natural resources like gold and oil, provoking sovereignty discussions.

Although regulations are not legislation per se, they have the force of law, since countries adopt them under authority granted by statutes, and they often include penalties for violations.[26] Hence, to simplify I will assume regulation to mean the employment of legal instruments for the implementation of social-economic and environmental policy objectives.

Many countries have laws that might regulate production and trade of timber products at different stages, however, usually the problem is not the law but compliance. These laws can be violated in any number of ways, such as exploiting

[26] Source: http://dictionary.law.com/Default.aspx?selected=1771#ixzz45Kt7h0oD

wood from protected areas, harvesting more than what is allowed by permits, and harvesting protected species. Moreover, illegal logging is a common practice in certain areas of the world, threatening valuable forests, like the rainforest in the Amazon and the tropical forest in Indonesia. Nevertheless, legislation related to forest does work in some areas. For example, Paraguay reduced its rate of deforestation by 85% in the years just following the enactment of its 2004 Zero Deforestation Law (WWF, 2015).

There is also a discrepancy among commentators in terms of their preference between voluntary, market-based actions and legislation and regulation. Some environmental economists believe that regulation creates market distortions and is thus inefficient (Schuck, 2014), whereas others believe that regulation induces innovation that provides first-mover advantages to the leading firms, (Ashford, 1999; Ashford, Ayers, & Stone, 1985; Ashford & Hall, 2011; Porter & van der Linde, 1995).

Table 4. Legislation and Regulation

ADVOCATES	OPPONENTS
Environmental law facilitates exchanges of best practices (UNEP, 2012).	Failure in non-point sources of pollution (nitrogen, acid rain) (Adler, n.d.; Andersen, 1995; Fiorino, 2014).
Environmental laws promote public participation in decision-making (UNEP, 2012).	Hard to implement and enforce (Harrison, Hyman, Martin, & Nataraj, 2015; John, 2011; Schuck, 2014).
Environmental laws allow for clear and coordinated mandates and roles (Rorie, Rinfret, & Pautz, 2015; UNEP, 2012)	Command and control often allow emissions/resource extraction below the regulatory threshold to occur for free (Fiorino, 2014; UNEP, 2004).
Environmental laws ensure accountability (UNEP, 2012). encouragement of transparency and accountability (Asquer, Becchis, & Russolillo, 2017).	It has imited regulatory capacity and limited accountability in developing countries (Harrison, Hyman, Martin, & Nataraj, 2015).
Environmental laws provide for review and renewal of standards, to update requirements based on new knowledge (UNEP, 2012).	Politicians follow self-interest in defining the law (John, 2011).
Environmental law provides accessible, fair, impartial, timely and responsive dispute resolution mechanisms (UNEP, 2012).	Passive resistance –responsibility for action/inaction moves away from the individual to the state (John, 2011).
Regulation induces innovation (Ashford, 1999; Ashford et al., 1985; Ashford & Hall, 2011; Porter & van der Linde, 1995).	Waste of social resources, more costly than alternatives (Kurukulasuriya, Schutte, Haywood, & Rhodes, 2013; Schuck, 2014).
Promotes beyond compliance behavior (Rorie, Rinfret, & Pautz, 2015).	Compliance heavily relies on sanctions (John, 2011).
Increase social well-being (Schuck, 2014).	Reduces competitiveness (EPA, 2001, 2014).

Source: Summary prepared by the author.

As we can observe from this summary, there is no agreement on the effectiveness and efficiency of regulation. I believe that the main difference arises from the conditions on which countries created regulation. For example, if we assume that regulators have sufficient (almost perfect) information, and intend to pursue the public interest, the results of the regulatory framework created are different than when we assume that regulators do not have sufficient information with respect to cost, demand, quality and other dimensions of firm/polluter behavior.

There are other factors affecting the effectiveness and efficiency of regulation, for example the structure of the regulatory process, the legal and political environment in which regulation takes place, the motivation for regulation, the nature of regulatory

instruments, and the industry's economic characteristics. Moreover, regulation might have different results in developing vs. developed countries due to the conditions in which it operates. Those other factors might help explain the difference of opinions presented in Table 4. Nevertheless, in most countries, expert-based regulation for environmental policy is currently incorporating economic incentives, information-based approaches, public-private partnerships, as well as other tools.

2.3.3.1.1. Command-and-control

Command and Control (CAC) legislation involves tools such as environmental standards[27] to protect or improve environmental quality that stipulate which polluting activities can be undertaken and/or how those being regulated should conduct these activities. CAC instruments ensure compliance with an environmental standard and are beneficial where there is certainty about the risks or outcomes of an environmentally damaging practice, "as it can be directly limited or prevented" (Hackett, 2015).

The term CAC includes a wide and diverse set of regulatory approaches. For example, if the regulator specifies the exact treatment procedures that polluters should follow in a project, this action obviously falls within CAC instruments. In fact, the dividing line between so-called CAC and incentive-based policies is not always so clear. CAC instruments have traditionally provided the main policy tool to achieve environmental objectives. Numerous analysts have praised and criticized this regulatory form for many decades.

[27] A standard is a mandated level of performance enforced through a piece of legislation. A few examples are the limits set on the volume of timber that could be harvested, bans on the cutting of trees, and maximum levels legally allowed for pollution emissions.

On one hand, proponents of CAC instruments argue that they have been effective to achieve specific environmental objectives and that compliance and oversight are much easier. Furthermore, Cole and Grossman affirmed "they can even be (and have been) more efficient than alternative economic approaches to regulation" (Cole & Grossman, 2005). In a study of illegal artisanal mining in Indonesia, the authors found that "command and control approach has essential value, as a solution in preventing negative impact of illegal community mining" (Puluhulawa, 2015).

On the other hand, opponents of traditional CAC instruments based on legislation enacted to protect the environment have argued that they have not been as effective as expected. The US Environmental Protection Agency (EPA) stated that CAC standards give organizations no incentive to exceed what is necessary for compliance. Moreover, some scholars argue that CAC use prescriptive and rigid environmental instruments (with little flexibility to achieve goals). In addition, they can be costly to administer, because they rely on monitoring and evaluation, complex administrative systems, and a high capacity for enforcement, which can be time-consuming and often requires many personnel (Cropper & Oates, 1992; EPA, 2014; Kurukulasuriya et al., 2013).

In a study conducted in India, to compare the effects of a CAC approach with price incentives to achieve pollution abatement, and reduce coal use in highly polluting industries; researchers found that "price-based policies could be a more powerful tool for broadening the scope of regulation to include smaller establishments in industries that have not been traditionally targeted, without imposing an additional burden on regulators" (Harrison, Hyman, Martin & Nataraj, 2015, p. 27).

Other scholars believe that today's world is very different from that of the environmental awakening in the late 1960s, and need much more flexible instruments (Hatch, 2005b; Pelkmans & Renda, 2014).

Over the last decade there is increasing recognition of the need to complement CAC instruments with other policy instruments, mainly economic instruments. Furthermore, now a days, CAC regulation is increasingly complemented with economic instruments, as well as educational and other measures.

2.3.3.1.2. Criminal Law

One important change in forestry laws is the introduction of criminal charges. For example, in 1997 the People's Republic of China joined a growing number of countries adopting criminal sanctions for violators of environmental laws. On March 14, 1997 former president Jiang Zemin signed new legislation requiring courts to sentence persons convicted of logging without a license to a minimum three-year prison term. The law's innovative aspect is its mandatory prison terms for violators (Clark, 1997).

Nevertheless, there are other cases such as Indonesia, where the forest law includes a penalty of up to 15 years in jail for buying, selling, or receiving illegal timber. Traditionally, despite the inclusion of criminal charges in the law, vulnerability to forest crimes increased due to inadequate law enforcement and corruption. There have been some arrests of illegal logging perpetrators; however, Indonesia effectively prosecuted just a few cases and frequently offenders more likely received light jail sentences or small fines.[28] Recently the situation has improved by listing illegal logging as a crime under anti-money laundering legislation (Luttrell et al., 2011).

[28] https://www.unodc.org/southeastasiaandpacific/en/indonesia/forest-crime.html. Accessed on January 26, 2017.

Finally, in Costa Rica and Mexico, it is a fact that illegal logging and poaching have damaging outcomes for forests, the people and species that depend on forests, and the national economy. They usually occur in remote forest areas, distinguished by some combination of local poverty, unclear property rights, and inadequate official oversight. The government might undertake some measures such as promoting alternative means of livelihoods, improving supply of fuel wood, increasing patrolling and monitoring, introduce well-defined property rights, adjusting legislation to increase the severity of fines and prosecutions for criminals apprehended. The increase in fines might unintentionally increase the possibilities of bribery; hence countries are increasingly experimenting with criminal prosecution.

2.3.3.2. Economic Instruments

Since the late 1980s, national governments, environmental agencies, and intergovernmental organizations supported a "new generation" of environmental policy instruments, usually labeled under the umbrella of economic instruments also called market-based instruments "MBIs". (Gómez-Baggethun & Muradian, 2015). Those are the same participants that introduced the first generation of environmental policy regulations, mostly through CAC mechanisms. Hence there was a paradigm shift regarding how countries design their environmental policy, a shift away from centralized CAC regulations and towards market-based schemes (Whitten, van Bueren, & Collins, 2003). In Australia, policy makers introduced market reforms to the banking, transport and electricity sectors. For example, Australia has a tradable property rights framework for controlling the extraction and use of irrigation.

In general, policy makers use MBIs to provide market and financial incentives for polluters and natural resource users expecting they change their behavior. Among the

incentives are taxes, emission or access charges, marketable permits, and changes to property rights. UNEP argued that economic instruments provide a way to internalize environmental and social costs, and to correct market and policy failures. Moreover, UNEP argues that if policy makers design and implement MBIs correctly and within the right policy framework, they can contribute to achieve sustainable development (UNEP, 2004, 2012).

Supporters of the use of MBIs argue that policy makers can use them to achieve specific and sustainable national and global development goals (Stavins, 2003). Some environmental economists argue that the overriding benefit of economic instruments is their promise of more flexible, cost-effective, and efficient approaches to environmental management, (Bryner, 2005; Dente, 2010; K. H. Engel, 2006; European Commission, 2007; Hatch, 2005b; MacEachern, 2013; Pirard & Lapeyre, 2014; Stavins, 2003).

Many scholars argue that in the search for instruments to achieve sustainable development and solve global environmental problems, MBIs applied at the local level are effective and flexible, where they define "effective" in terms of the results obtained and "flexible" in terms of being adaptable to local conditions and differences amongst firms. Although policymakers apply MBIs primarily at the national and local levels, they can also adopt such instruments in an equally effective manner at regional and global levels.

In a study conducted in the European Union (including eight cases) to review how MBIs can support and drive the shift towards resource efficiency, researchers found that for those cases, policy makers successfully used MBIs to provide environmental and resource efficiency improvements (Rademaekers, van der Laan, Smith, van Breugel, & Pollitt, 2011). In addition, to support the use of taxes on non-clean fuels, researchers found evidence from Santiago, Chile, where consumers responded to changes in relative prices by switching to lower-priced natural gas (Coria, 2009) cited by (World Bank, 2012).

Europe has strongly supported these instruments as is reflected in key documents, for instance the EU Biodiversity Strategy to 2020 states, "The Commission and Member States will promote the development and use of innovative financing mechanisms, including market based instruments (European Commission, 2007, p. 9).

Though, many scholars argue that most incentive-based mechanisms started through public policies, not all of them originated as a market solution. Nonetheless, these supporters suggest that policy makers design and set these goals based upon environmental science, economics, and social considerations. Moreover, they argue that, by using specific economic instruments, policymakers can reduce the cost of achieving such goals.

Reviews of incentive-based experiences related to PES, volunteer carbon markets, and CDM claim that incentives can be successful in supporting forest conservation. However, some scholars argue that past programs tended to harm the poor, and thus increased their marginalization. Considering that policy makers designed these programs with the objective of forestry conservation, countries conducted these programs in particular geographic regions that needed forest intervention, and

sometimes it was among populations that were many times better off than other groups. Contrastingly, supporters of the PES program in Mexico claim that its main objective was poverty alleviation at the expense of conservation goals.

High transaction costs made it difficult for the poor to participate because often they could not afford those costs; and, where carbon markets led to more formalized rights than existed previously, the poorest could not prove their land rights, similar to the exclusion suffered by women and indigenous populations.

Vatn provides an interesting argument stating, "what protects the environment in any economic instrument including a market mechanism is not the trade element but the element of command that defines the liability or politically-set environmental target" (Vatn, 2015) cited by (Gómez-Baggethun & Muradian, 2015, p. 220). For him, trade alone is not enough to obtain results; it needs the definition of targets through regulation.

Regarding market-based solutions, the ALBA countries[29] have openly opposed the use of them since COP 16 (Sterk, Arens, Eichhorst, Mersmann, & Wang-Helmreich, 2011). Nonetheless, in spite of being a controversial issue, I could not find any specific recommendation from ALBA on the use of alternatives to market-based solutions in the UNFCCC reports.

More recently, the "Laudato Si" from the Vatican, supported the same "anti-trade" position, suggesting instead cooperation and other altruistic paths (Holy Father Francis, 2015).

[29] Antigua and Barbuda, Bolivia, Cuba, Dominica, Ecuador, Nicaragua, Saint Vincent and the Grenadines, and Venezuela.

Table 5. Economic Instruments (MBIs)

ADVOCATES	OPPONENTS
Flexible. They do not prescribe specific technologies or solutions. Allow for new and cleaner technologies, (Andersen, 1995, 2007; Whitten, van Bueren, & Collins, 2003).	Industries can continue to pollute if they pay the price- anti ethical (Andersen, 1995). Incentives may be very low (Vatn, 2010).
Polluting firms control more than required in order to sell their excess to others at a profit (UNEP, 2004) beyond compliance	Green taxes for fiscal not environmental purposes (Andersen, 1995).
Encourages the use of goods and services that do less environmental damage, (UNEP, 2004).	May become perverse incentives. (Seroa da Motta, 2001).
Generates revenue (Andersen, 1995, 2007).	Costly to use markets, excludes small players (Vatn, 2010).
MBIs tend to reduce societal cost to achieve any given level of environmental quality. Reduce compliance costs (Fiorino, 2014; UNEP, 2004).	Strong opposing political factions (UNEP, 2004). Regulatory institutions can be weak or understaffed (Greenspan Bell, 2002).
Dynamic instrument to reduce emissions, (Andersen, 1995, 2007; European Commission, 2007).	Monetary reward reduces willingness to supply (Vatn, 2010).
More efficient to shift the costs and responsibilities of pollution back on to the polluter (UNEP, 2004) PPP	Dependency on design and settings of goals (Chairman's Report, 1995). Lack of consistency and clear details (MacEachern, 2013).
Establish, clarify or improve property rights (Gómez-Baggethun, de Groot, Lomas, & Montes, 2010; UNEP, 2004). Private sector manages more efficiently natural resources (Humphreys, 2010), private ownership	Concern on impact on international competitiveness (Chairman's Report, 1995; World Bank, 2012).

Source: Prepared by the author

Analyzing the literature on MBIs one may conclude that there have been successful and not so successful experiences because success mainly depends on the initial conditions in which policy makers apply and evaluate them. Moreover, the claim that a country needs strong regulatory and enforcement mechanisms, as well as strong institutions for MBIs to function effectively (World Bank, 2012) arises because MBIs in a small country, without strong institutions and a regulatory framework, might be unsuitable to obtain the environmental goals set by a country. In addition, there are other conditions for success, for example MBIs require a strong and transparent financial management of the funds for it to be sustainable. Another point to consider in the appraisal of MBIs is the evaluation criteria used, because scholars cannot make

conclusions on a specific approach without knowing the relative weight given to different evaluation criteria, such as economic efficiency, environmental performance, and distributive justice. Consequently, evaluators often reach diverging conclusions about the merits and shortcomings of MBIs. Nevertheless, "market-based instruments have not replaced, or have come anywhere close to replacing, the conventional, command-and-control approach to environmental protection." (Stavins, 2003).

Lastly, after reviewing many cases I came to the conclusion that economic instruments on their own are not sufficient as a policy instrument because they lack (a) the regulatory framework to support them and (b) clearly stated sanctions in case of violation. The majority of evidence suggests that there is no "one best" instrument for forest recovery and conservation. Instead, they suggest a mix of ambitious policy instruments; in particular those that promote long-term forest protection. These coincide with my findings in terms of the Costa Rican and Mexican forest policies. Consequently, policy makers should combine economic instruments with other key policy tools such as regulation and sanctions, and at the same time secure financing for the instruments used to incentivize specific behaviors.

2.3.3.2.1. The Systems of Payment for Environmental/ Ecosystem Services

Traditionally we valued the trees for its wood or fruits and not the functions of the ecosystem as a whole; more specifically we provided a higher value to the trees when we cut them down as compared to when they are standing, however this is changing. In recent times, we observed how markets also value the carbon storage and other ecosystem services provided by forests (Goldstein & Gonzalez, 2014). When ecosystems function as they should, they provide a wide range of essential services. For example, forests and wetlands contribute to increase resilience to climate change,

carbon storage capabilities, help to purify and transfer reliable flows of water, improve agro-forestry efficiencies, and livelihood diversification. They also supply support for plants and animals, upon which humans still rely for food and fuel and they help mitigate droughts and floods; in sum they provide full ecosystem services. Some scientists also believe that we may find in the forest the cure for many illnesses. We refer to these benefits as "ecosystem, or environmental services." These ecosystems services help sustain human (Daily et al., 1997; Hausknost, Grima, & Jit Singh, 2017; Vonada, Herbert, & Waage, 2011).

Today, the world's ecosystems provide these services for free, they are not captured by the market; otherwise, we would have to pay for them, thus, we do not need to spend billions of dollars developing the infrastructure to provide them—even assuming that humans might actually be able to replace those services. Consequently, monetary evaluations of forests and wetlands must incorporate the complete life cycle including not just the value of timber but also the real value that includes the relevant environmental and socio-economic services they provide, to improve decision making regarding forest policies.

The Center for International Forestry (CIFOR) presents the following detailed definition of PES:[30]

A payment for environmental services scheme is[31]

a) A voluntary transaction in which
b) A well defined environmental service, or a form of land use likely to secure that service

[30] For a comprehensive discussion of PES definitions see (Corbera, 2015; Pirard & Lapeyre, 2014; Sandbrook, Fisher, & Vira, 2013).

[31] Source: http://www.cifor.org/pes/_ref/about/index.htm, retrieved September 14, 2015.

c) Is bought by at least one environmental service buyer

d) From a minimum of one environmental service provider

e) If and only if the provider continues to supply that service (conditionality).

The importance here is the definition of actors (buyer-provider) and of the environmental services, the voluntary nature of the transaction, and the condition of continuous supply for an established period. In a few examples, the lack of definition of the environmental services became a problem at the moment of valuation.

More specifically, PES transactions involve contractual agreements between individuals (or groups of people) who agree to conduct natural-resource management practices that restore or maintain the flows of ecosystem services. The main characteristic of PES transactions is the payment of money for an agreed period to private or communal landowners (providers) in exchange for them maintaining the provision of a specific ecological service, such as clean water or carbon sequestration. To ensure that providers are maintaining the ecological services under contract, the transactions usually require regular, independent verification of (a) providers' actions and (b) the effects that PES have on the resources. In sum, providers promise to maintain specific ecological structures and functions, and are accountable for delivering the services paid by the buyer. According to a study conducted by Vatn, existing PES are not really a move from public policies to market allocations, it is more a "reconfiguration of state-market-community relationships" (Vatn, 2010, p. 1251).

The creation of environmental markets—such as regulatory and voluntary carbon markets and PES —is giving an economic value to such ecosystem services. The result is that formal environmental markets now exist and self-organized PES are increasingly emerging.

In the last two decades, hundreds of new PES initiatives have materialized. "Costa Rica, Mexico, and China all have initiated large-scale programs that give direct payments to landowners for undertaking specific land use practices that could increase the provision of hydrological services, biodiversity conservation, erosion prevention, carbon sequestration, or scenic beauty" (Kelsey, Kousky, & Sims, 2008, p. 9465). In addition, since 2007, a law proposal for a national PES program has been under discussion in Brazil. In 2010, the Peruvian government launched the National Forest Conservation Program for Climate Change Mitigation as one of the flagship programs of the Ministry of Environment (Börner, Wunder, & Giudice, 2016).

The promise of PES as an effective policy instrument gained popularity and several international environmental entities have adopted it. Among them are IUCN, WWF, multilateral organizations such as the World Bank, GEF, and initiatives as the Convention on Biological Diversity and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, (Hausknost et al., 2017).

There are many arguments in favor and against PES. In Table 6, I present a summary of them.

Table 6. Payment for Ecosystem Services

ADVOCATES	OPPONENTS
Provide new value for ecosystems (Costanza et al., 1997), (Gómez-Baggethun et al., 2010).	Displacement of food production (Ibisch, 2015).
Voluntary participation and conditional transactions (Gómez-Baggethun et al., 2010), (Kelsey, Kousky, & Sims, 2008).	Benefits limited to old or new elites. Marginal groups excluded from access to land (Vatn, 2010; Wunder & Albán, 2008), reinforce inequalities
Flexible and can adapt to lessons learned (Pagiola, 2010).	High transaction costs (Vatn, 2010; Wunder & Albán, 2008).
Worked in commonly own land. Rights need not be individual, (Alix-Garcia, Shapiro, & Sims, 2010; Corbera et al., 2009)	Utilitarian framing of ecological concerns, monetization, privatization of nature, (Gómez-Baggethun et al., 2010; Kelsey et al., 2008)
Payments cover opportunity costs to the providers (Wunder & Albán, 2008).	Lack of coordination between individually owned properties (Vatn, 2010).
Payments induce landowners to change their behavior and protect resources. Modify behavioral patterns. (Gómez-Baggethun et al., 2010)	Difficult to define: Property rights of the land and right to do whatever they want (Vatn, 2010), (Engel, Pagiola, & Wunder, 2008).
Voluntary transactions resolved externalities more efficiently (Hausknost et al., 2017b).	Not market but public payments. Payments are generally very low (Vatn, 2010).

Source: Prepared by the author

My review of a number of PES examples departs from an implicit assumption: in order to ensure the conservation of ecosystems it is necessary to recognize the ecosystem services provided by nature, in other words, acknowledge, measure, and incorporate those services into private and public decision-making. PES alone is fundamentally different from conventional environmental policy instruments because PES uses monetary incentives rather than disincentives such as legal regulations, sanction mechanisms, or taxes, for PES the buyer pays the provider. However, to ensure its environmental success, PES have to be well designed, which means that payments should be a least-cost Pareto efficient solution to correct market failures. Hence, PES opponents are correct in arguing that when policy makers fail in the design, it could lead to wasted financial resources and potentially adverse environmental or social outcomes. Additionally, transaction costs tend to be high for small providers.

Many cases argue that PES had positive impacts on environmental outcomes (primarily at local or sub national scale). That is very important to highlight because

when an instrument is designed for a specific purpose (i.e. environmental protection) and then researchers evaluate it on the social equity or distributive effects, the results are not going to be very positive because the design does not include the equity issues. Again, measurements of the success of an instrument are based on the evaluation criteria used. In many aspects, PES is a policy tool that can synergistically complement environmental policy mixes if and only if policy makers carefully design and implement them in correct contexts.

Nevertheless, as expressed by Engel, Pagiola, and Wunder:

> *PES is not a magic formula to address any environmental problem, but a tool tailored to address a specific set of problems: those in which ecosystems are ill-treated because many of their benefits are externalities from the perspective of ecosystem managers. PES are based on the beneficiary-pays rather than the polluter-pays principle, and as such is attractive in settings where environmental services providers are poor, marginalized landholders or powerful groups of actors. An important distinction within PES is between user-financed PES in which the buyers are the users of the environmental services, and government-financed PES in which the buyers are others (typically the government) acting on behalf of environmental services users. In practice, PES programs differ in the type and scale of environmental services demand, the payment source, the type of activity paid for, the performance measure used, as well as the payment mode and amount. The effectiveness and efficiency of PES depends crucially on program design. (S. Engel, Pagiola, & Wunder, 2008)*

2.3.3.3. Indirect effect of other economic instruments

Perverse incentives (or market failures) have also played an important role in activities that affect forest coverage. To take just one example, in Brazil, the financing of land clearing for agricultural purposes in exchange for timber extraction contributed to deforestation, clearing the forestland, selling the timber, and starting an agricultural or cattle ranching activity allowed inhabitants to get a title for the land. Additionally,

reduction in the cost of access to frontier timberlands in Brazil may have encouraged migration of rural poor households, which contributed to the land conversion for agriculture and wood production (Seroa da Motta, 2001). Furthermore, the lack of perception of scarcity of forest resources promoted an open-access behavior.

Large-scale land conversion for agricultural ranching and cash cropping has become substantially more destructive of global forests. In many countries, one may observe that export incentives and soft financial conditions improve the profitability of such activities. Other economic instruments are also present. For example, Brazil had ranching subsidies and zero tax rates on income. In 1989, that country abolished policies that benefitted land conversion. However, ranchers continued to clear forestland for mono cropping (growing single species) that allow them to service debt rather than to grow food for local consumption (Elliot, 2004). In addition, conservation income tax credits and other tax incentives are also becoming increasingly popular in the United States and Europe (Shine, 2005).

2.3.4. Protected Areas

Since the late 1960s most environmental planning processes included the creation of formal protected areas. Many policy makers alleged that to protect its forest a country needed to protect all the area where the forest stands because setting protected areas would reduce potential timber harvests. "According to some conservationists, large, pristine, uninhabited parks are the defining criterion of success in conserving tropical forests." (Schwartzman, Moreira, & Nepstad, 2000, p. 1351). Furthermore, the designation of protected areas were regulation is stricter and better enforced have helped many countries to reduce their deforestation rates.

An opposing view is that the creation and management of protected areas and other forms of conservation territories have been problematic. For instance, "they are often inadequately funded and staffed (Bruner, et al., 2001) and are increasingly called on to meet multiple social objectives" (Wendlan, Baumann, Lewis, Sieber, & Radeloff, 2015, p. 149). Moreover, protected areas face many threats in conserving biodiversity and provisioning ecosystem services, such as: hunting, illegal logging, and forest fires.

I believe that the main problem during the initial stages was that policy makers framed the decision as conservation vs. development. This position has been changing along the way, to find options in which conservation and development can work together. I prepared Figure 3, to show how the market and policy failures can actually lead us to projects that do not imply destruction. I argue that the result of market and policy failures on environmental issues, lead to habitat destruction and environmental degradation. Hence, a stronger need arises to protect the environment; and this presents us with three options, (a) absolute conservation, that is the case of most national parks and protected areas, (b) relative conservation, which includes the creation of buffer zones that allow for certain activities, and (c) conservation and development, which provides the option to conduct non-destructive projects. In general, pure conservation approaches were important for primary forest conservation, whereas other options like sustainable forest management came to provide jobs and income to rural communities, and were likely to be successful in countries with clear property rights.

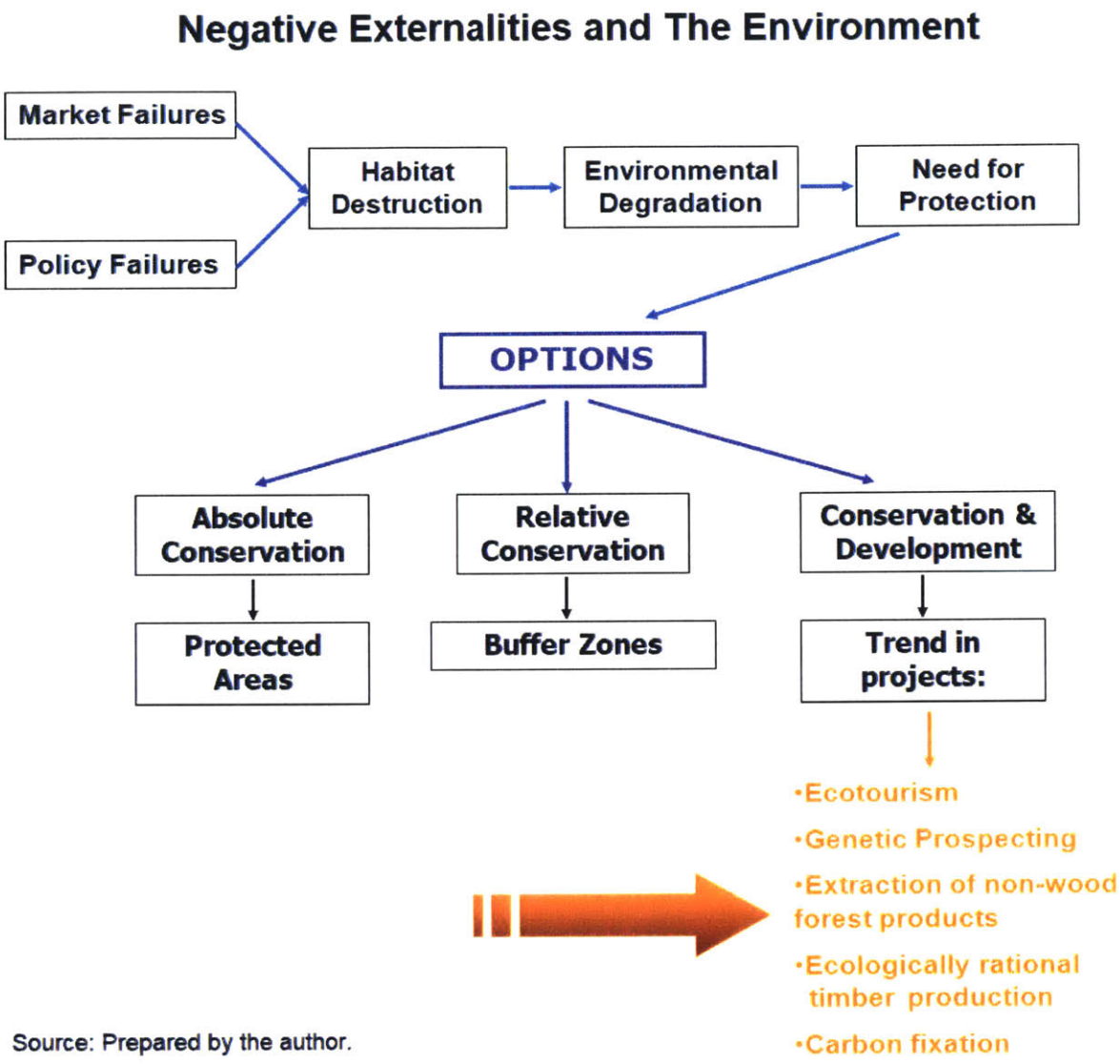
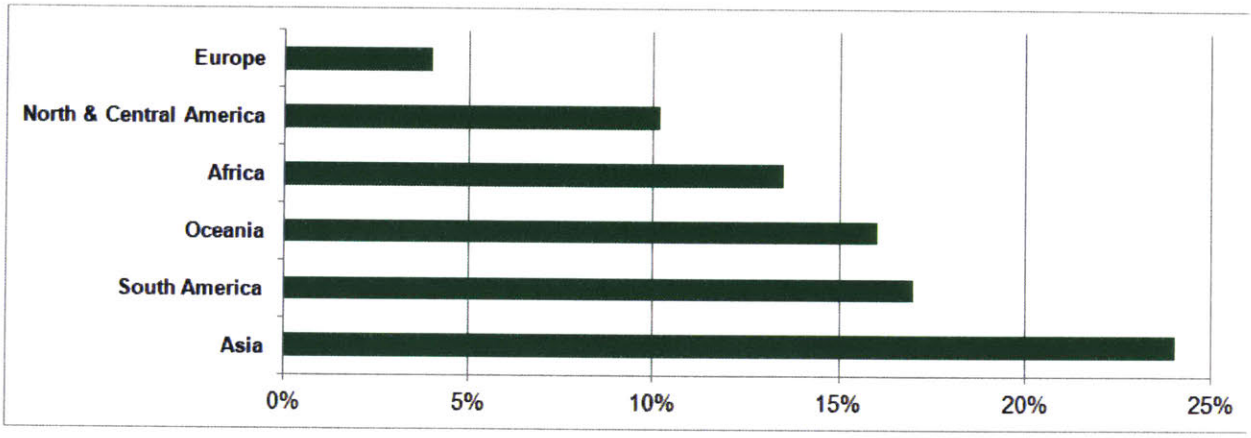


Figure 3. Conservation and Protected Areas in the Presence of Negative Externalities

In 2010, the FAO estimated that 13 percent of the world's forests were legally established protected areas, increasing to 15 percent by 2016. The protection might be in the form of national parks, wilderness areas and other forest reserves, legally established. The primary function of these forests is the conservation of biological diversity, the protection of soil and water resources, or the conservation of cultural

heritage. The area of forest within a protected area system has increased by 94 million hectares since 1990. Two-thirds of this increase has been since 2000.



Source: FAO. (2010a). *Global Forest Resources Assessment 2010. FAO Forestry Paper 163.* Rome: Food and Agriculture Organization of the United Nations.

Figure 4. Percentage of Forest in Protected Areas by Region, 2010

Figure 4 illustrates that Asia is the region with the highest percentage of forest in protected areas, followed by South America. Europe presents the smallest percentage probably because for centuries Europe used its forest for ships, energy, and mining before understanding concepts like "sustainable management" for renewable natural resources. Formerly, most protected areas in developing countries were financed by donations and grants mainly from conservationist NGOs, afterwards, countries had to find new, innovative financing mechanisms.

2.4. Other Related Policies

There are other policies linked to forestry policies directly or indirectly. In the next sections I will examine the relationship among them because it is important to understand how they relate and intersect each other when designing a forest policy, avoiding setting policies in isolation.

2.4.1. Agrarian

Many scholars claim that changes in agrarian policy usually alter deforestation rates. For example, when a government cuts down agricultural credits, eliminate subsidies or impose taxes there is a decline in agricultural production and proportionally in the land areas dedicated to agriculture. Without credit, agriculture is less profitable; hence, in many cases farmers abandon the activity. If they are not farming any more, then there is less forest cutting to clear the land for agricultural purposes (Alvarez & Naughton-Treves, 2003; Bray, Antinori, & Torres-Rojo, 2006).

One study conducted in Peru argues, "During 1986–1989, the amount of agricultural credit flowing into the Peruvian Amazon tripled from mean levels for the previous 10 years. This expansion in lending allowed local residents and colonists to clear 10 000s ha of primary forest for croplands and pasture." (Alvarez & Naughton-Treves, 2003, p. 273). Moreover, they found that in two other locations, Iquitos and Tambopata, when the government eliminated agricultural credit, the rate of deforestation diminished, from an average of 6,634.5 ha deforested before 1991, to 1,339.0 ha in 1997, despite population growth.

There are many examples, Brazil, implemented in the 1980s state-sponsored incentives for cattle ranching that resulted in the conversion of forest to pasture in the Brazilian Amazon. Subsidies in British Colombia resulted in overcutting old-growth forests in remote areas. In Chile, subsidies in the pulp and paper industry resulted in an expansion in plantation forestry. Furthermore, subsidies for paper and pulp industries in Brazil, Chile, Guyana, Indonesia, and Thailand created conflicts with indigenous groups (World Bank, 2009).

2.4.2. Climate Change

Since the first COP, policy makers around the world have been discussing the linkages between forests and climate change. Among the functions of forest ecosystem services, carbon storage is highly praised; there is consensus regarding the substantial contribution of forests to climate change mitigation and adaptation. Policy makers should definitely design forest and climate change policies taking into account these linkages. The section on REDD+ expands more on this topic.

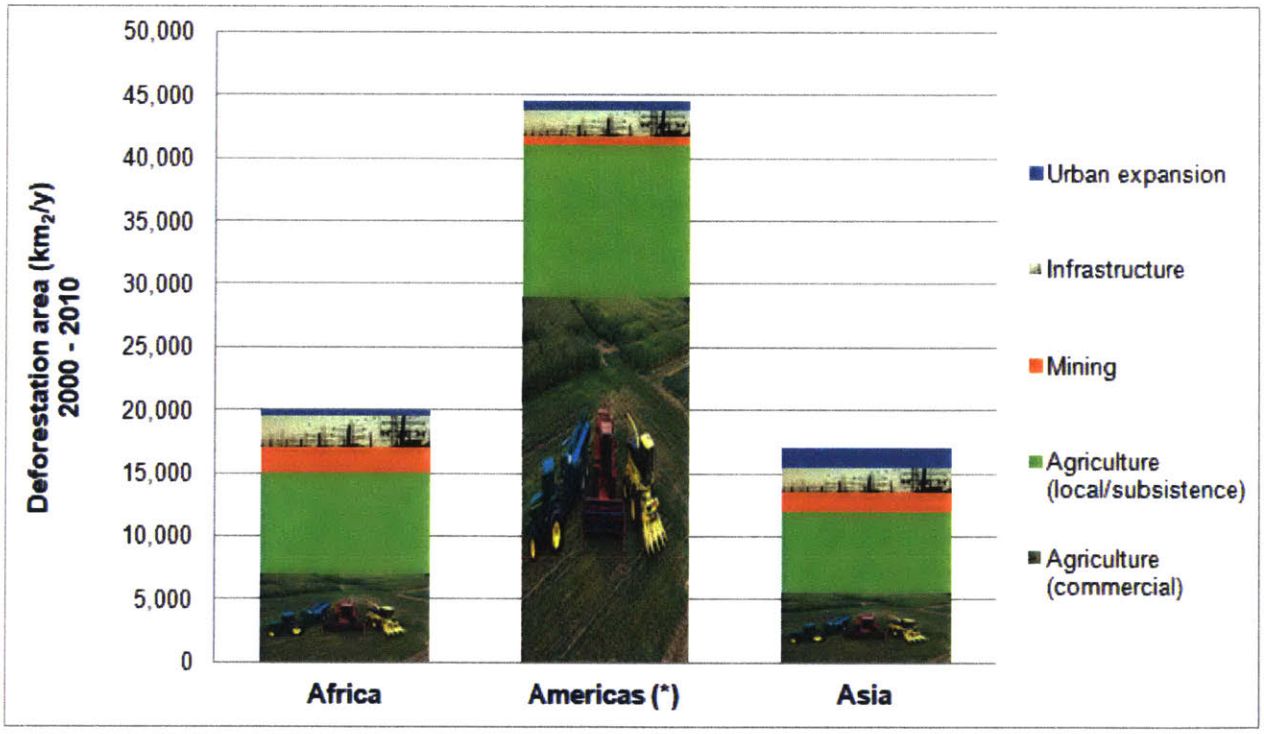
In addition, some experts argue is that burning forests for energy increase CO_2 emissions. After EPA declared that forest biomass is carbon neutral, 13 research scientists disputed these allegation and responded to the EPA's decision claiming that "Burning wood from forests to generate electricity is not carbon neutral when the direct emissions from combustion, plus emissions from soil and logging and processing the wood, are considered" (Moomaw, Schlesinger, Law, & Sterman, 2018). Nevertheless, others consider that burning biomass is neutral, because if not used, eventually biomass will naturally decompose releasing CO_2.

2.4.3. Land Use Change

As mentioned before, the main driver of deforestation is conversion of forestland to agricultural use. From 2000 to 2010 the loss of forest in the tropical domain was similar to the increase in the agricultural area – even without proving causality, correlation is clear (see page 21). Most of this forest loss and increase in agricultural area occurred in South America, sub-Saharan Africa, and South and Southeast Asia. The FAO estimated that, in the tropics and subtropics, large-scale commercial agriculture accounts for 40 percent of deforestation; local subsistence agriculture

accounts for 33 percent; and urban expansion, infrastructure and mining account for 27 percent.

Between 2015 and 2016, the FAO conducted an analysis of the national policies of 35 countries. FAO studied the ways in which countries deal with land use change from forest to agriculture and vice versa. From the countries examined, nearly 50 percent explicitly addressed the topic in their main policy documents. The study concludes that integrated land use planning is important for the future of the forests (FAO, 2016b).



Source: FAO. (2016b). State of the World's Forest 2016. Forest and Agriculture: Land-Use Challenges and Opportunities. Rome: United Nations Food and Agriculture Organization. (p.21)

(*) Includes North and South America. There is no separate data available.

Figure 5. Estimate of the absolute net forest area associated with main drivers of deforestation by region, 2000 - 2010

Nevertheless, experts concluded that worldwide, more than 90 percent of the forest conversion is due to agricultural expansion. For example, between years 2000 and 2010, commercial agriculture accounted for almost 70 percent of the deforestation in Latin America (Hosonuma et al., 2012).

On the contrary, the conversion of agricultural land to forest might result from natural forest expansion and planted forest (that became relevant during the last decade in Brazil, China, and Vietnam) mainly when agricultural land is abandoned.

Although most countries have formal policies for their forest and agriculture sectors, there is an increasing need for policies on land-use change between forest and agriculture in light of recent international agreements. Among them the 2030 Agenda for Sustainable Development, the Paris Agreement on climate change, regional initiatives like 20X20 or the New York declaration on Forest and the Bonn Challenge. [32]

Often, problems arise in countries where the legal framework governing land-use change is fragmented and inconsistent. This can occur where national policies on land use are weak or non-existent, or if there is not enough coordination when drafting legal instruments.

2.4.4. Land Tenure

Historically, national legislation in many countries left aside local forest tenure rights. Generally, forest laws have provided few opportunities for local people to play a

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[32] Initiative 20x20 is a country-led effort to restore 20 million ha. of land in Latin America and the Caribbean by 2020. The initiative will support the *Bonn Challenge*, a global commitment to restore 150 million hectares of land around the world by 2020 and the NY Declaration on Forests that seeks to restore 350 million hectares by 2030. WRI supported it, in association with *CATIE*, *CIAT*, and *IUCN*. Retrieved from http://www.wri.org/our-work/project/initiative-20x20 on October 13, 2006.

significant part in the "planning, management and allocation of forest resources" on which many generations probably depended (FAO, 2005).

Government institutions usually lack preparation or have limited financial resources to exercise their given legal power, which results in an open-access[33] situation that might lead to resource over-exploitation or degradation. A FAO study asserts that by recognizing legitimate local claims to rights over land and resources, a country may increase local people's involvement in the management of local forests resources and consequently encourage local people's law compliance (FAO, 2005).

Regarding the management of the forests, there is a divergence between developing and developed countries. Most developing countries prefer state ownership of land or forest whereas developed countries advocate an enhanced role for the private sector. Mostly developing countries prefer to have their forests as state sovereign natural resources, in order to protect them from powerful business corporations from the developed world, while developed countries support private ownership claiming that it allows a more effective management (Humphreys, 2010).

Many scholars consider that land-tenure security is a necessary condition for preventing deforestation (FAO, 2005; Robinson, Holland, & Naughton-Treves, 2014). In fact, clear, formal rights are vital to the implementation of incentive programs; hence, where rights are unclear, one can expect conflicts over benefits, for example, carbon sequestration benefits (Springate-Baginski & Wollenberg, 2010).

In addition, many researchers argue that for any market-based incentive system to do well, what is important is that property rights are well defined (Alix-Garcia et al., 2010; Corbera et al., 2009). Who inhabits the property is not as important as to who has

[33] Open Access is a particular type of regime without any recognized or enforced property rights, where each user acts to maximize their individual benefit while at the same time, shares the costs with others (Harding, 1968).

the legal rights on the property. Moreover, some claim that the fact that in some cases the owner is a private person whereas in others it is a community is not as important as to have well-defined property rights. For example, Corbera *et al.*, assert that land rights do not have to be individual, that the land rights might be held in common (Corbera, Brown, & Adger, 2007). This is a growing practice within Latin America especially among indigenous groups.

Among the countries that have carried out new land tenure reforms or community forestry activities are Equatorial Guinea, Mexico and Peru. Some of the countries that maintain state ownership of all forests (mostly in Africa) focus their attention mainly on the reform of the forest management regime.

Local communities, organized in *ejidos* or *agrarian communities*, collectively own a majority of Mexico's forests (Bray, Merino-Pérez, & Barry, 2005). Individual private farmers own most of the rest. Tenure rights are relatively secure, although agrarian conflicts persist in some areas.

The government owns most of the forests in Guatemala, about half of which is in the Maya Biosphere Reserve in the Petén. The government has given community groups in the Reserve 25-year renewable concessions to manage some 500,000 hectares of that.

The bulk of Nicaragua's forests are in indigenous territories located in the Atlantic Coast regions. Nicaragua's constitution and regional autonomy, and indigenous lands laws recognize indigenous rights to own and manage those forests. Nonetheless, most indigenous territories still lack formal titles and forest tenure conflicts are widespread. Most forest outside the Atlantic Coast regions belongs to the government or non-indigenous farmers.

The majority of Panama's forest is in indigenous territories known as *comarcas*. Costa Rica's forests belong to a mixture of private landowners, government, and indigenous communities, all of whom have secure tenure. Forest tenure in Honduras is complex, with many conflicting claims between indigenous communities, individual farmers, and national and municipal governments.

In Costa Rica the State owns approximately half of the forestlands, and the other half is in private hands. Private forest ownership is categorized in small (up to 50 hectares), medium (from 50 to 100 hectares), and large holdings (over 100 hectares). The land ownership is recorded in the cadastre, which is an official register of the ownership, extent, and value of real property in a given area, used as a basis of taxation.

2.5. Theoretical Framework

This thesis examines the dynamics of forestry policies, the conditions prior to the adoption of new laws and the introduction of new instruments, together with the factors that might lead to a successful forest policy support. The context in which policy makers implement or present any initiative is significant for effective policy design and the achievement of stated goals (Auer, 2017).

It was in the 1950s that researchers were interested in the policy process as a field of study. This action was part of an effort "to develop a science that integrates research on politics and government around a policy orientation." (Weible & Sabatier, 2017, p. 109).

The phenomenon of policy processes identifies the connections that occur over time, between public policies and surrounding actors, events, contexts, and outcomes. Moreover, scholars in this field seek to analyze the policy-making processes and strive

to explain why certain policies come into being rather than others (Kern & Rogge, 2018). To deal with the complexity of policy processes Lasswell, a well-known publisher in public policy matters, urged scholars to "focus their research on policy formulation and execution toward the realization of human dignity," when they are analyzing public policies (Lasswell, 1951). Examples of public policies are statutes, laws, regulations, executive decisions, and government programs (Birkland, 2016, p. 8; as cited by Weible & Sabatier, 2017).

Smith and Larimer, cited in (Weible, Heikkila, deLeon, & Sabatier, 2012) describe the policy process field as failing to produce a single unifying theory. According to Weible *et al.*, "a policy process research[34] is so complex and intricate that assuming that a single framework or theory can explain all its facets and effects is absurd." (2012).

Academicians define the policy process as the study of change and development of policy as well as the related actors, events, and contexts. Scholars— in order to analyze a policy process— represent the process of policy creation in a model that delineates the sequence of activities that affect the development of a specific policy (Kraft & Furlong, 2017). In sum, the "policy sequential approach" describes the sequence of activities affecting policy development.

Some scholars of the policy sequential approach describe a process conducted through a sequence of stages (also called cycles): agenda setting, policy formulation, policy adoption, implementation, evaluation, and termination, (Brewer, 1974; Brewer & deLeon, 1983; deLeon, 2007; Lasswell, 1951, 1956). Others also see the policy process as a sequence, but the stages vary, for example they might include agenda setting; policy formulation; policy legitimization; policy implementation; policy and program

[34] Public policy process research is defined as the study of the development of public policy over time and the context, events, and individuals surrounding this development.

evaluation; and policy change (Wolf & Robinson Wolf, 2013). In this research, I will focus on agenda setting, policy formulation, and policy adoption, because those stages provide the information that better determines what triggers and generates a change in a policy process (Bray et al., 2006; Kern & Rogge, 2018)

Hence, along this research, I addressed the process and the role of triggers, leadership, academia and other, within the overall conceptual framework of governance, both from a theoretical point of view as well as from empirical findings in forest related policy fields.

Likewise, theories on forest policy, land use change, land tenure and management, private forests conservation, property rights, and land use change are focal points to my research. Another body of literature that frames my research is environmental law, in particular, domestic forest legislation, and a small number of existing international forestry agreements. Above all, I am interested in finding how policy makers formulate and adopt forestry laws. What triggers them? Who and what can influence the process?

3. METHODOLOGY AND RESEARCH QUESTION

This chapter includes the research methodology of the dissertation. In more details, it outlines the research method, research questions, data collection methods, selection of the sample, research process, type of data analysis, ethical considerations, and the research limitations of the study.

3.1. Research Strategy

To reach the objectives of this dissertation, I conducted a qualitative research because qualitative research is mostly appropriate for small samples, especially when the results cannot be measure or quantified. Its basic advantage is that it offers a "complete description and analysis of a research subject, without limiting the scope of the research and the nature of participant's responses" (Collis & Hussey, 2013). Studies in the social sciences tend to use qualitative research more than quantitative research.

3.1.1. Case Studies

Case studies theory says that I can compare two countries (such as in this instance) when "the objects of investigation are similar enough and separate enough to permit treating them as comparable instances of the same general phenomenon." (Ragin & Becker, 1992, p. 1). The study subjects are Costa Rica and Mexico. I believe that the case study approach is valid in this study because Costa Rica and Mexico are different in terms of their systems of governance, size of their territory, land tenure patterns, while at the same time both introduced a new forestry law, regulations, and used economic instruments. Hence, in this study I used the case study approach to examine two countries, their forest coverage evolution linked to their forest policies processes, the connection with other pertinent policies, and the use of regulation and economic instruments in both countries to increase forest coverage and/or stop

deforestation. From these cases I can gather information from the process followed in the passing of the last forestry law and the critical variables that made the enactment possible.

I selected Costa Rica and Mexico for several reasons. First, they are tropical countries and at the global scale the greatest deforestation problems still occur in the tropics. Second, both countries have used several policy instruments to govern the forests. Moreover, they have been pioneers in the creation of financial mechanisms such as PES and have decades of experience implementing these programs with some degree of success in halting deforestation. Finally, I selected those countries because of information availability; my selections were not the result of a randomized sampling process.

Costa Rica illustrates how a "small developing country can grab the bull of global environmental degradation by the horns and reverse one of the highest deforestation rates in Latin America" becoming a model of environment success (IIED, 2012, p. 1). Mexico is an example of how a federal government was able to design and manage a program (Payment for Hydrological Environmental Services) to pay participating forest owners for the benefits of watershed protection and aquifer recharge particularly in those areas where commercial forestry is not currently competitive.

My hypothesis is that in both countries one key economic instrument to increase forestry conservation has been the PES program. Currently, many countries are looking to learn from these two countries' experiences, especially as the world increasingly recognize water economic value, water markets are more visible, and the introduction of schemes to reward forest conservation and reduced deforestation rates succeed. There are also differences between the two countries beyond the territorial extension and population size —for

instance, Costa Rica was the first country in the world to introduce a national PES scheme, while Mexico has the largest PES program in Latin America. Throughout this study, I identified other meaningful similarities and differences along the policy process.

Besides, Latin America and the Caribbean although are rich in biodiversity are the regions with the highest greenhouse gases (GHGs) emissions from agriculture and forestry activities both in absolute and relative terms (deforestation accounts for almost half of emissions in the region). Most of these GHGs emissions are the result of the conversion of forests to agricultural land use, a process difficult to stop in the presence of poverty and population growth. At the global level, according to the Intergovernmental Panel on Climate Change (IPCC), deforestation and changes in land use account for about 20% of emissions of GHGs.

3.2. Research Design

In this dissertation, I studied the theory on the dynamics of policy processes and analyzed the policy process followed by authorities in Costa Rica and Mexico with the purpose of slowing and/or reversing deforestation. This section describes the way in which I conducted the qualitative research for this dissertation.

I divided the process into various stages: First, I conducted in-depth literature review (secondary data), second, I collected primary data through interviews and then I carried out a comparative data analysis.

3.2.1. Research Question

In general, I am exploring the process of developing forestry policies in tropical countries to protect their forests and what results they have obtained. Greater

understanding of those problems and processes might get us closer to achieve a global sustainable goal: halting deforestation, in these and other tropical forests in the world.

I worked on answering the following research question:

- *What are the critical variables during a public policy process that increase the probability of policy approval? How do the results obtained in two countries compare to what the theory says in terms of the dynamics of a forest policy process?*

In addition, I studied the next questions:

- To what extent have forest policy instruments helped or delayed net forest coverage increase in the countries studied?
- What policy tools are more likely to encourage landowners to engage in forest protection and recovery?
- How do policy tools operate across different ownership types to increase the net forest coverage?
- What does the experience with policy instruments suggest about the future of PES? Are there any verified results?

3.2.2. Data Collection

I collected and analyzed two sets of data: existing theories, statistics, and relevant studies (secondary sources) and empirical data (primary sources), both sets offering crucial implications for this study.

3.2.2.1. Data from Literature Review

I worked on finding theories developed by key scholars and commentators, recognized experts and organizations in the field, qualified studies, and other comparative analysis that helped in framing my research. I divided my literature review into two sets. One set is drawn from policy process studies about the interaction among the critical variables to have a policy implemented successfully; the other set is drawn from forest policies and other related policies designed to increase or impact tropical forest coverage. The analysis of research literature also helped me in assessing the nature and extent of the deforestation problem.

As part of the literature review, I studied benchmarks in terms of a standard or reference by which I will measure or judge the countries under study. In this part, I reviewed and analyzed significant findings on instruments for forest recovery—including position papers and several pieces of empirical evidence from development institutions such as FAO, UNEP and the Wupperthal Institute, NGOs such the WWF and IUCN, and from key recognized experts—in order to determine the best set of theoretical opinions. I also consulted official documents, news through different channels and country plans.

In addition, I reviewed the last forest policies, laws, and economic instruments in both countries and the process followed towards its approval and implementation to better understand the process of introducing new local economic and policy instruments to halt deforestation and even to increase net forest coverage. I comprehensively explored each country, reviewing the conditions that are instrumental to learning about the policy process. Data on forest coverage, changes, and tendencies are also crucial to analyze results. I also examined the introduction of the PES scheme, as part of a country's regulation and other instruments that accompany this type of scheme

designed to be more effective on halting deforestation, and increasing the net forest cover

3.2.2.2. Instruments for Primary data collection

Between 2016 and 2018, I interviewed several policy makers and other stakeholders that participated in the forest policy process in both countries. I used unstructured interviews[35], based on an interview guide (see appendix C), to allow for a free imparting of information. I conducted the interviews personally and generated notes of each conversation. Each conversation lasted from 30 to 50 minutes depending on the dedication and time constraints of the interviewee. My focus was obtaining narratives or accounts in the person's own terms. I began each interview with an open question so that issues emerged more freely. I explored their motivations, obstacles, and other relevant criteria to help in the analysis of a policy process. These issues informed subsequent data collection.

I collected relevant data in both countries and obtained information to better understand stakeholders' experiences and beliefs and to assess the particular features of the policies that have work effectively in apparently similar situations in other countries.

I selected the persons interviewed because they participated in the forest policy process of each country as member of the Executive or Legislative Branches of government or as member of the academia or think tanks. Among others, I obtained primary data from the following sources: former President of Costa Rica, current and former Ministers of Environment of Costa Rica and Mexico, former and current General

[35] Interviews are divided into three categories based on the degree of structuring: structured interviews, semi-structured interviews, and unstructured interviews. The unstructured interview relies on social interaction between the researcher and the informant. Consequently, each unstructured interview might generate data with different structures and patterns.

Directors of CONAFOR in Mexico, current and former personnel at FONAFIFO in Costa Rica, former Congress members in Mexico and Costa Rica. (Please see Appendix D for specific names and a summary of the main point for each interview).

I kept a transcript of all interviews I conducted; since they were handwritten, I started by digitalizing and translating the information obtained in order to organize, analyze, and find insights from the interviews. This data provided me with the empirical input to discover connections in the data collected, find new insights, and rigorously compare the findings with evidence gathered.

I utilize techniques from grounded theory to explore forest policy processes. Grounded theory is a qualitative research methodology that aims to explain social phenomena, for example, why specific motivations or behavioral patterns occur, at a conceptual level (Woods, Gapp, & King, 2016). In the 1960s Glaser and Strauss developed the methodology that in more recent times Strauss and Corbin reinterpreted, resulting in different schools of thought (Woods et al., 2016). To simplify, grounded theory is the discovery of emerging patterns in data. The literature on grounded theory provides researchers with guidelines to ensure the rigor of the research contribution (Gioia, Corley, & Hamilton, 2013).

To be more objective and to introduce a more rigorous way for the analysis of the data I used ATLAS.ti 8 for Windows[36] that is very helpful particularly in the process of selecting, indexing/coding, and annotating data for its subsequent analysis. Once the data is prepared, the advantages of this software is that it helps in managing, extracting, comparing, exploring, and reassembling important sections from large amounts of data in a systematic way that is at the same time creative and flexible (Friese, 2018). I

[36] ATLAS.ti is a software program for qualitative analysis, created at the University of Berlin between 1989 - 1992, and its first commercial version was launched in 1993.

started by reading the manual as well as watching all the tutorial videos, to become familiar with the software. I uploaded the interviews into a project I created in ATLAS.ti and classified the documents by creating two groups, Costa Rica and Mexico. Then I proceeded to write comments on each interview, write memos, create codes, and make reports to help in the analysis of my data.

3.2.3. Comparative Analysis

I carried out this analysis to draw together conclusions from the empirical information, rigorously comparing actions and results. For example, I paid particular attention to how different actors contribute to the political process, i.e. the form and level of their involvement over time.

I obtained data on current experience with the use of regulation and economic instruments. For example, advantages and limitations on the implementation of each instrument, level of satisfaction with results obtained. Changes observed with the introduction of new instruments, how important the amount of the incentives to obtain specific behavioral changes is. How strong law enforcement is, what the level of community participation is, and what, if any, the impact of community participation in forestry programs is. I identified the common features of the responses across the interviews to help articulate the analysis and defined several points of comparison between the two countries.

Through this research, I worked on identifying patterns and relationships associated with effective forest governance processes that recur in time and space. I analyzed the way in which the policy process was conducted in Costa Rica and Mexico, what triggered the decision to design a new forestry policy, what obstacles were found along the way, and which instruments or combination of instruments (regulatory and

economic) were used for each specific country. Additionally, I reviewed all the information available on trends in forested areas by country and analyzed the possible relationship between the introduction of the last law and forest cover changes. I also attempted to identify elements that are most likely to support effective forest governance within specific contexts, particularly significant views and experiences concerning instruments for forest cover recovery. I argue that if we can understand these patterns, we will be better prepared to develop appropriate policies and encourage effective forest governance to reverse or reduce the negative trend in other tropical countries, one of the SDGs for 2020 (halting deforestation) and for 2030 (preserving biodiversity).

In my study, I concentrated on forestry conservation as a public policy because it has an important economic and environmental impact. In addition, I focused on other policies that are linked to forestry, such as land-use change, land-use tenure, the effect of price distortions through government interventions, such as changes in agriculture and cattle ranching due to subsidies, and the emergence of new economic alternatives (non extractive/non destructive), such as ecotourism. I also analyze the effectiveness of protected areas as an extreme policy alternative to protect natural forests and/or recover forest coverage.

Finally, I compared data of forest cover changes in the two countries with my findings from the studies I conducted in Costa Rica and Mexico— through interviews and literature review— and with the steps in a policy process and highlight the most important issues in each country as well as the main differences among them.

3.2.4. Limitations

As expected I found problems along the way. The most difficult problem was to locate those who used to work for the government between 10 and 20 years ago and

are currently out of the political arena. Moreover, I found that some of the main participants have moved to different countries or were difficult to contact.

Limited time and resources is always a constraint, more when you need to gather data from people in different countries. Qualitative data through unstructured interviews often generate data with different patterns and structures from one session to another, which makes the data analysis very intensive and time-consuming, and less able to be generalized and replicate in other countries.

In the forest discipline, some definitions and ways to measure vary not just between countries but also among different periods, making comparisons more difficult. For example, FAO definition of forest includes natural and planted forest, while NGOs treat planted forest differently. As for the statistics, one big problem is that deforestation estimates based on surveys or samplings have large errors, take a very long time, and sometimes the sample size is not enough to extrapolate to the whole territory. Moreover, FAO has suggested guidelines for the countries to measure forest cover and present their reports; nevertheless, each country conducts its measurement but not necessarily follows the guidelines. Other external factors (i.e. politics) can affect the results presented to FAO. A specific government may have an incentive to alter the numbers, and pretend it achieved improvements in the forest sector. FAO tries to control for this variations based on statistical analysis; however, at the end, the countries' reports are the main basis for the statistics.

Some scientists believe that the alternative is to use high-resolution satellite images that are more precise and homogeneous. As a result, Google Earth and FAO started a collaborative project to use this technology and cover a larger territory, faster, cheaper and more accurately, presenting detailed mapping of global tropical forests.

Other scholars expressed that this technology is necessary to assess the impacts of fragmentation (Steininger et al., 2001).

Finally, data reported in 1990 for different countries may possibly be different from data for the same year but reported in 2015, because the old information is adjusted to new definitions and methodologies, Hence, I decided to use the most recent statistics reported in the latest assessment (i.e. 2015) and not the original information reported (i.e. 1990). As for the use of other sources of forest statistics, most of them use FAO databases.

3.2.5. Contribution

The analysis conducted along this dissertation will allow me to identify policy recommendations to improve forest governance, and advance the academic literature on the necessary steps to conduct a forestry policy process that raise the probability that the advocated policy will be adopted improving a country's environmental status. This is true specifically in terms of land covered by forests, forestry conservation and more broadly as part of biodiversity conservation and the low carbon development path that all countries agreed when adopting the SDGs in 2015.

Moreover, in the course of this research I will examine the extent to which Costa Rica and/or Mexico provide good examples by means of the combination of policy instruments that reduce deforestation rates and, in due course, increase the net forest coverage in each country. The Costa Rican results suggest that the use of local regulatory and economic instruments, adapted to the country's conditions, have halted and even reversed their loss in net forest cover trend over the last 20 years. The results in Mexico are also positive, because they almost reach the goal of zero net deforestation, keeping in the design the preservation of hydrological services. What they

could not achieve with regulation alone, was improved with the combined use of the PES and the regulatory measures as part of the forest policy. I believe that a factor that benefited this combination was the voluntary nature of the PES with the compulsory feature of regulation.

3.3. Thesis outline

Abstract

I. Introduction

II. Literature Review and Theoretical Framework

III. Research Question and Methodology

IV. Costa Rica

V. Mexico

VI. Original Implications and Conclusions

VII. References

3.4. Thesis timeline

Activities			
Dissertation Draft proposal	Sept. 2015	to	Dec. 2015
Proposal presented to committee	Dec. 2015		
Proposal approved by committee	Dec. 2015		
Colloquium to MIT community	Jan. 2016		
Literature review	Sept. 2015	to	Feb. 2016
Design research instruments	Oct. 2015	to	Feb. 2016
Conduct Interviews	Feb. 2016		Mar. 2017
Data analysis	Mar. 2016		Mar. 2018
Progress reports:			
Send first draft of final report	May 2017		
Review of first draft	May 2017		
Send second draft of final report	May 13, 2018		
Review of second draft	May 17, 2018		
Send third draft of final report	June 15, 2018		
Review of third draft	End of June		
Last draft of final report	July 12, 2018		
Review of last draft of final report	July 25, 2018		
Dissertation defense	Aug. 7, 2018		
Final editing	Aug. 8-12, 2018		
Printing and presentation of dissertation	Aug. 13, 2018		
Planned graduation	Sep. 19, 2018		

4. COSTA RICA

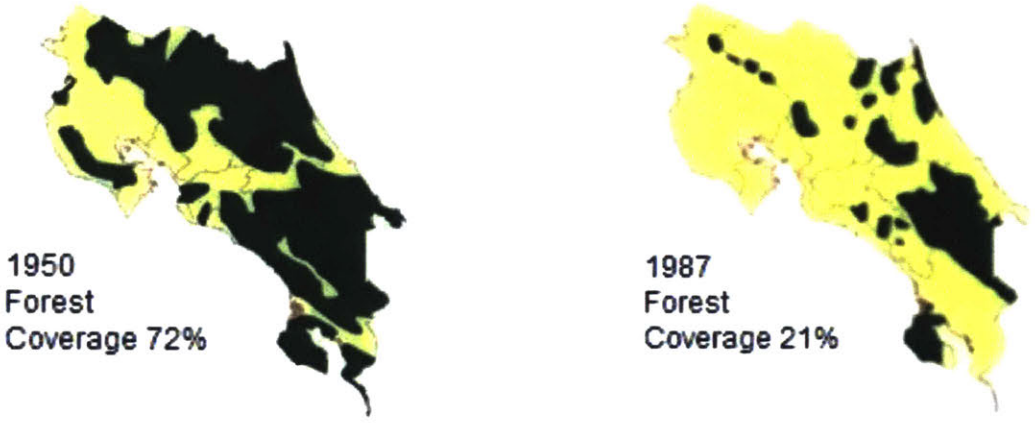
Costa Rica is a small country with an area of about 51,000 km^2 on land, and a very diverse topography and vegetation, and was once almost 100% forested (Keogh, 1984). However, between 1950 and 1980, Costa Rica became part of the countries with the highest deforestation rate worldwide: Leonard reported a deforestation rate of 3.9% per year for 1950–1984 and researchers claimed that the principal cause was the demand for agricultural land rather than for wood (Hartshorn et al., 1982; Leonard, 1986; Lutz et al., 1993).

Furthermore, during the 1980's the country carried out policies that provided positive incentives to agriculture and perverse incentives for forest conservation. For example, previous Costa Rican forestry laws considered clear-cutting forested land as an improvement, allowing those who illegally inhabited this cleared area to claim property rights over the land after a year.

In the early period of deforestation, forest rapidly converted into agricultural and cattle ranching areas, which benefited from cheap bank loans that were part of the Government's efforts to colonize new land. According to the World Bank, Costa Rica converted approximately eighty percent of the deforested areas to pasture and agriculture, nearly all of it on privately owned lands, quoted by (Ortiz Malavasi & Kellenberg, 2002). These conflicting policies together with high international prices for beef that required more pasture land, and other expansive crops such as coffee and bananas exacerbated the effects on deforestation. In sum, international markets, political pressure, as well as an incorrect combination of policies affected land use, and caused considerable alterations in the landscape.

When the country introduced reforestation incentives, the situation was in fact unclear and policies were confusing; on one hand, landowners considered reforestation incentives a risky business; and on the other hand, people commonly deforested areas in order to make lands eligible for reforestation incentives afterward.

Figure 6 shows how forest coverage dropped from 72% to 21% in a period of 37 years.



Source: (Castro Salazar, Tattenbach, & Arias, 1998).

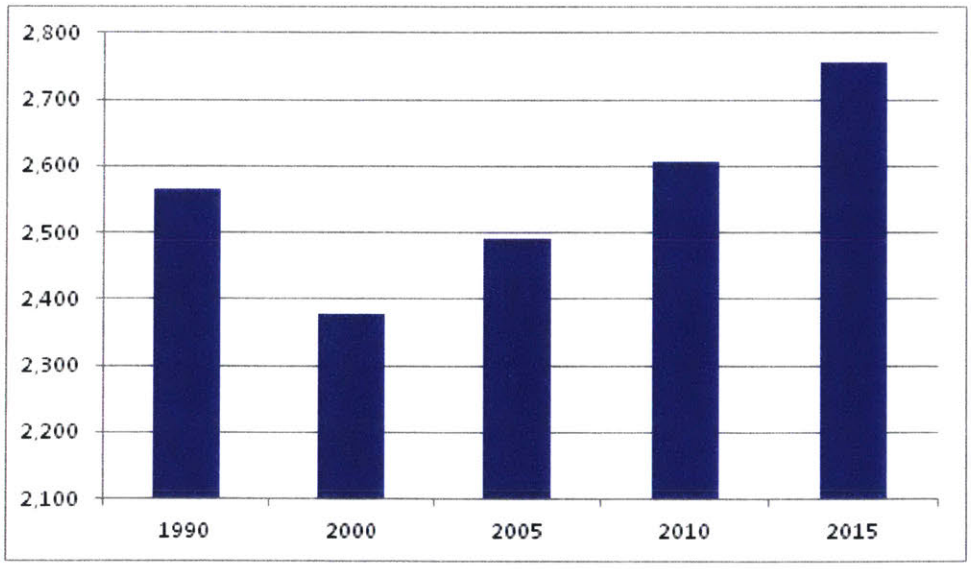
Note: It is important to consider these percentages as the best possible approximation given the technology available at the time of measurement. Specific — regional— situations could lead to variations, for instance, standing deciduous trees in the Northwest regions could lead to under accounting.

Figure 6. Maps of Forestland in Costa Rica, 1950 vs. 1987

In response to this negative trend, in the late 1980s Costa Rica eliminated reforestation subsidies because they made cutting down the natural forest and replanting it with few species, more profitable than leaving it standing. Additionally, Costa Rica changed other outdated and ineffective laws and policies. For example, before these changes took place, people treated forests as an unregulated public good; open to expropriation, and squatters, rather than to viable legitimate economic activities.

Another explanation for the forest recovery is that there was an economic crisis during that period that forced the government to eliminate perverse agriculture and cattle ranching subsidies. Since, as mentioned before, in Costa Rica, the main reason for people to cut forests down was to expand the agricultural frontier, it is safe to conclude that by eliminating agricultural subsidies the country contributed in recovering its forests. In 1996, the last forest law further removed perverse incentives and established a preference to natural over planted forest.

Figure 7 presents the changes in forest coverage from 1990 to 2015. In the decade 1990 - 2000 forest coverage decreased and from 2000 to 2015 there is a clear trend in recovering forest coverage as a result of the measures the country took to reverse the negative trend. Another reason for the fast recovery is that in the tropical regions, trees grow faster than in the other areas. For example, teak plantations reach commercial size in less than 10 years.



Source: FAO, (2015b). Global Forest Resources Assessment 2015. Desk reference. Rome: Food and Agriculture Organization of the United Nations

Figure 7. Costa Rica'sTotal Forest Coverage from 1990 to 2015 (1000s of ha)

Costa Rica's re-greening process intensified during the early 1990s, though at the time it was impossible to determine whether the reversal in the deforestation trend was going to be sustainable or not because Costa Rica implemented earlier a wide variety of reforestation incentives, with limited success in stopping deforestation and encouraging reforestation. "Nonetheless, those early incentives partially paved the way for the creation of the PES programme" as part of the 1996 Forest Law (Porras, Barton, Chacón-Cascante, & Miranda, 2013, p. 8).

4.1. Situating Policy Process in Context

Under the threat of continuing forest loss, the Costa Rican government responded with a series of actions. First, in the 70s the nation created the system of national parks with a policy of zero extraction. Second, during the 70s and 80s, the government started including privately owned lands in the regulatory framework governing forestry. Third, the country included a sequence of financial incentives into forest policies that evolved over time. Initially, the incentives were only for planted forest, next they evolved to include natural forest management, and at the end, they included natural forest preservation and recognized forest services like CO_2 fixation and water recharge.

"In 1987 Costa Rica banned the export of logs and unprocessed timber" (Brockett & Gottfried, 2002, p. 20). Combining this action with the import tariffs and permits in force at the time, the result was low domestic timber prices that went below international levels. In addition, in 1987 the country banned new sawmills, reducing the timber production, resulting in less competition and lower suppliers' incomes (World Bank, 1993) cited by (Brockett & Gottfried, 2002).

Brockett & Gottfried rightly called this period the "interventionist regime". They highlighted the fact that during this regime all tree cutting needed a permit from the Forest General Directorate (DGF- Spanish acronym) and the payment of a tax. DGF based its decisions to approve selective logging on (a) a technical study proving that the new land use was suitable and (b) a management plan prepared by a registered forester[37] (Brockett & Gottfried, 2002).

The first attempt at comprehensive forest planning in Costa Rica was the 1978-1982 Forestry Development Plan, which the country never implemented due to lack of interest in the forestry situation. Nevertheless, the plan was critical in conceiving the subsequent forest policy incentives. At that time, the government considered forestry activities as part of the agricultural sector (Segura Bonilla & Kaimowitz, 1997).

Afterward, by late 80s - early 90s, the concern for appropriately planning the use of natural resources greatly increased. The country established the Conservation Strategy for Sustainable Development (ECODES - Spanish acronym) and began a national debate on this subject. The strategy proposed the integration between conservation and development, and brought about concern for environmental issues; moreover, it contributed significantly to the proliferation of environmental NGOs that today represent a growing citizen participation in the country (Segura Bonilla & Kaimowitz, 1997).

Costa Rica made another attempt in 1989; when the country created the Forestry Action Plan (PAF-CR - Spanish acronym) as a FAO program funded by the Dutch

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[37] "The *Regencia forestal* system was first established in Costa Rica in the mid-1990s, and later adopted by Ecuador, Mexico and other countries. The system is based on the devolution of the state's forest-monitoring functions at the forest management unit level to private foresters (*regentes*) under a contract. These professional foresters conduct a series of administrative and control tasks on behalf of the state to reduce the tasks of the public forest administration. The forest *regentes* are legally responsible for managing the forests they are in charge of. If there is proof of illegal acts on this land, they lose their license and can be legally prosecuted." (FAO, 2005).

government. It listed the main obstacles for the development of the forestry sector and again called for a national debate on the forest situation and the need for further action to regulate the use of forest resources. On one hand, it allowed the creation of a significant portfolio of forestry projects to continue exploring the availability of financial resources. On the other hand, the plan was neither part of a comprehensive nor an innovative forest policy. Although the forest policy document was finished, the country never formalized it due to a change of administration; thus, leaving the country without a national forest policy (Miranda, Otoya, & Venegas, 2005).

In the late 80s, the World Bank introduced Structural Adjustment Programs that reduced subsidies and therefore the profitability of agriculture and cattle ranching in marginal forestlands, contributing to reduce deforestation rates. During the governments of former presidents Oscar Arias (1986-1990) and Rafael Angel Calderón (1990-1994), the country ended historical agricultural subsidies, domestic prices weakened for many commodities, new industries such as ecotourism took hold, and foreign direct investment rose. The country adopted an economic model based on an increased participation in the international economy. The Earth Summit held in Rio de Janeiro in 1992 introduced the modern definition of sustainable development based on the three pillars: economic, social, and environmental with equal weight for policies and development plans.

According to former president José María Figueres (1994-1998), Eduardo Lizano former president of the Central Bank and key person on the economic team of president Arias, promoted many changes that took the country away from the agro-export and the import substitution models.

"I was minister of Agriculture during the Arias government and I faced farmers going on strike and blocking roads, when subsidies, incentives, and other specific measures that supported agriculture such as crop insurance came to an end." (Figueres Olsen, 2016).

For the 1994 presidential election, public opinion had shifted in favor of forest preservation, because public perception was that deforestation was among the most important country's problems; however, "... in 1994, the Ministry of Finance decided to cut the reforestation subsidies the government had been using as its main policy tool. Decision makers had to look for a new approach." (Cameron, 2015, p. 2).

By the late 90s, officials were claiming success of recent policy innovations, arguing that reforestation and natural forest regeneration had surpassed deforestation over the prior decade (Brockett & Gottfried, 2002). In 1998, Costa Rica presented the first – remote sensing based – images to the IPCC and the press, showing the positive trend. NGOs and the civil society received the reports skeptically. We cannot forget in this context that Costa Rica signed the Kyoto Protocol in 1997 and played a very important role in introducing the concept of the role of forests to mitigate climate change.

4.1.1. Government Type and Legislation Process

To be able to analyze a policy process, it is necessary to identify the type of government a country has as well as the process to pass a new law. I present below this information.

Costa Rica is a presidential republic with seven provinces. Its legislative branch is a unicameral Legislative Assembly or "Asamblea Legislativa" with 57 seats.

The process to create a law, reform, or add existing ones typically contemplates the following stages:

a) A congressperson (individually or with other colleagues) or the Executive Branch, presents the initiative to the Legislative Assembly;
b) the board acknowledges the initiative and presents it to the plenary;
c) the plenary receives the law project and designates it to a commission for their study and dictum;
d) after its study, the commission issues the dictum and sends it to the plenary. It can be unanimous or if there is no agreement the commission issues a majority dictum and a minority dictum;
e) the board includes it into the plenary agenda for discussion;
f) to become a law it must undergo two separate debates at plenary level;
g) when the plenary votes it positively, it means that they approved the law project in first debate;
h) between first and second debates, the editorial commission checks over the drafting of the project, corrects it and shares the final document with all the congresspersons for second debate;
i) once Congress approves the bill in second debate it is sent to the Executive Branch to be signed or vetoed by the president and corresponding minister, thus becoming a law or returning to congressional study;
j) the process ends when a bill is published in the Official Gazette and becomes part of the current legislation.

A de facto individual right of veto is given to each congressperson in the form of unlimited presentation of motions, which in general, have made negotiations slower and more complex.

4.1.2. The Development of Forestry Institutions

From 1980 to 1985, there was a greater emphasis on reforestation and the creation of protected areas. The actions of the scientific community, at national and international level, and increasing concern over the threat of forests loss, lead to a great

pressure. A strong support for reforestation created a productive sector conformed primarily by re-foresters and industrial groups, that shaped the conditions for the participation and organization of the private forest sector at the national level, and the first regional organizations of forest producers was born.

In 1987 Costa Rica created the Ministry of Natural Resources, Energy and Mines (MIRENEM - Spanish acronym), and reassigned the authority over forests and national parks from the ministry of agriculture and livestock to the new ministry. In fact, MIRENEM was a merger between the Ministry of Industry, Energy and Mines with institutions such as the Wildlife Department, the National Parks Services and the DGF. After many reforms, in 1995, MIRENEM became the Ministry of Environment and Energy (MINAE - Spanish acronym). At the institutional level, MINAE decided to reorganize the management of natural resources. Administratively, the ministry integrated the DGF, the Directorate General of Wildlife, and the National Park Service in a single organization: SINAC.

Despite these enhancements, the DGF was unable, at that time, to assume proper control over all forestry activities (Brockett & Gottfried, 2002). Nevertheless, this institutional reform had several consequences. It provided an institutional recognition of the environmental and forestry sectors, and more autonomy and institutional strength in the policy arena (Le Coq, Froger, Legrand, Pesche, & Saenz-Segura, 2010).

In 1994 Costa Rica created the Costa Rican office of Joint Implementation (OCIC - Spanish acronym) to prepare for Activities Implemented Jointly. Its responsibility was to coordinate joint implementation projects. OCIC signed contracts with the US, Norway, the Netherlands, Switzerland, and Finland to allow Costa Rica to implement projects jointly.

In order to administer the funds created by the Law 7575 the Costa Rican government shaped FONAFIFO, a semi-autonomous public institution (formally attached to MINAE) to administer the PES program. FONAFIFO's Board of Trustees is the most important decision-making body over PES in Costa Rica and it is composed of government and private sector representatives, including one from small-scale businesses.

One interesting fact is that despite the payment is based on the "ecosystem services" provided, FONAFIFO does not track the flow of specific ecosystem services such as changes in water quality or carbon storage; it focuses instead on land management activities such as area reforested and protection of areas designated as conservation forest (Bennett & Henninger, 2009).

4.1.3. Legislation

In 1969, Costa Rica enacted its first forestry law. Forestry law 4465 assigned to the government the following responsibilities:

a) Declare and administer national parks and wildlife reserves;
b) Preserve soil, watersheds and water capture basins;
c) Establish and supervise land plots for research;
d) Create nurseries; and
e) Conduct studies about the forestry industry, exports and imports of forest products and timber, land reforestation and demonstration farms, and use of natural forests, (FAO, 2008).

At the same time, Forestry Law 4465 established mechanisms for the use of forest resources in areas of private and state property. It permitted the change of land use from forests to agricultural purposes. Protection actions included the ban of logging

on the banks of the riverbeds and aquifer recharge areas. Finally, this law introduced incentives for planted forest as a mechanism to ensure the future supply of raw material (wood). Law 4465 also included the reduction on income tax, this fiscal incentive was designed to compensate the costs of establishing and maintaining a new forest plantation. This policy triggered the development of large monoculture plantations (Le Coq, et al., 2010).

In 1986, Congress approved a different law, Forestry Law 7032 that (a) substituted the existing law that wrongly gave settlers land rights if they cleared public lands, (b) changed the system of national parks to a system of conservation areas, with different levels of protection, and (c) compelled landowners to obtain approval before cutting down trees on forested lands. In addition, from 1986 to 1994 Costa Rica made available to land owners a series of loan and grant programs to promote commercial reforestation and sustainable forest management on private lands. These reforms helped reduce deforestation (FONAFIFO, 2005).

It introduced the concept of forest management defining the "Forest Management Plan" as a set of technical rules, governing the actions, executed in a forest or in fields with forestry potential, in order to preserve, develop, and improve existing forest vegetation, all in accordance with the principle of rational use of renewable natural resources. Law 7032 also allowed DGF, which was now part of MIRENEM, to issue forest bond certificates to landowners who replanted trees.[38] Operation of the program started in 1988, but the incentives seldom worked as anticipated: landowners sometimes cut down older primary forest in order to plant new trees, receive certificates, and capture the payments. This legislation reflected society's aspiration to change from

[38] DGF was part of the Ministry of Agriculture and the government transferred it to MIRENEM. When MIRENEM became MINAE, DGF became part of SINAC, the new system of conservation areas.

extractive logging to forest management, supported by forestry and economic principles.

However, landowners disputed key provisions of the Law 7032[39] (1986), and in 1990, four years later, the Supreme Court contested the legality of the statute for two main reasons. First, because Law 7032 violated private property protections; and second, because it was passed by way of Executive Decree, instead of by a two-thirds majority in the Legislative Assembly. Even though Congress quickly passed provisional measures to retain the bond program, it failed to create a new, more comprehensive law, within the three-month deadline the court had set (Law 7174, 1990)[40]. Hence, the country declared the national forestry sector in a state of emergency. This, together with the prohibition to change the land use covered by forest, involved a major change concerning the use of forests (FAO, 2008).

4.2. The Policy Process

4.2.1. Agenda Setting

In 1994 Costa Rica elected José María Figueres as president.[41] From the beginning, he wanted to promote environmental issues as an important topic.

As his first action as president, José María Figueres hosted an international forum called "From Forest to Society" attended by all the cabinet members, the executive board of the Earth Council, members of Congress, and international experts (INBIO, Presidencia de la República, & UNED, 1994). "I wanted to conduct this activity the first day of my administration to set a clear and strong direction. I wanted to

[39] See (Asamblea Legislativa de la República de Costa Rica, 1986).
[40] See (Asamblea Legislativa de la República de Costa Rica, 1990).
[41] 1994 was the year in which the UNFCCC came into effect.

introduce a new development model for Costa Rica, based on the smart and nondestructive use of the country's biological diversity." (Figueres Olsen, 2016). In that activity, the new government publicly introduced and disseminated the notion of environmental services as well as the need to pay for these (INBIO et al., 1994).

Moreover, president Figueres affirmed, "I put together a highly educated and prepared team to work with me during my administration. With the full backing of people like Carlos Espinach and René Castro, we introduced sustainability into most areas of the government." (Figueres Olsen, 2016).

President Figueres also said,

> *"There was a time in which externalities were not discussed neither included in calculations. During my administration we created the carbon tax, the PES, worked on increasing renewable sources of energy with the Costa Rican Institute of Electricity (ICE - Spanish acronym), strengthen and expand the National Parks, and began the introduction of electric vehicles, which were costly, but responsible with the society and the environment." (Figueres Olsen, 2016).*

According to President Figueres (2016), one very important thing his administration accomplished from the beginning was to include Article 50 in the Constitution.

> *Article 50. The State shall procure the greatest welfare of all inhabitants of the country, organizing and stimulating production and the most adequate distribution of wealth. Everyone has the right to a healthy and ecologically balanced environment. Therefore, anyone is entitled to denounce any acts that violate that right and to claim compensation for the damage caused. The State guarantee, defend and preserve that right. The law determines the corresponding responsibilities and penalties.*[42]

[42] Source: http://pdba.georgetown.edu/Parties/CostaRica/Leyes/constitucion.pdf, retrieved March 16, 2016. Free translation from the author.

One may notice that President Figueres took office on May 8, 1994, and this article reforms the Constitution (1949) through Law 7412 on May 24, 1994, (second debate[43]) confirming his statement. This reform allows any citizen to challenge public or private projects or policies that do not fulfill sustainability criteria, and empowers the Constitutional Court (Sala IV) as the decision maker. In practice, this reform provided individuals, NGOs and other entities to ask the court to protect their rights to a "healthy and ecologically balanced environment."

In 1994, Figueres proclaimed his plan to encourage "sustainable development in alliance with nature" in all government policies (Fairman, 1998) cited by (Arpels, 2008). Figueres knew the country needed to pass a new forest law, however, as occurred with his predecessors he confronted many problems. First, to unite different constituencies who had opposed previous attempts to reform the country's forestry law; second, to deal with conservationist groups whose main objective was to consolidate protected lands and third, to find new sources of financing for its initiatives (Arpels, 2008).

As soon as elected, he nominated René Castro as the new Minister of Environment. Mr. Castro was connected to environmental economics scholars in both Costa Rica and the US (Cameron, 2015). Mr. Castro was in charge of the forestry agenda, and worked with people from the National Fund for Forestry Financing (FONAFIFO – Spanish acronym), the National System of Conservation Areas (SINAC – Spanish acronym), and some NGOs, on looking for a new way to acknowledge the benefits of the forest acceptable to society. Then, the study group drew attention to the emerging concept of environmental services to justify the need to prioritize natural forestry.

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[43] Congresspersons in the previous Administration approved this initiative on first debate and President Figueres pushed to have it approved on second debate. .

President Figueres task was to bring together different constituencies who had resisted the previous administration's attempts to reform the Country's forestry law. Conservationists groups were also pressing him to consolidate protected lands.

In 2014 René Castro said in an interview with Blair Cameron [44] that he worked the forestry law reform with his team at MINAE:

> *People like Raúl Solórzano who is now the Executive Director of the Association for Agricultural Engineers. People like Carlos Manuel Rodriguez, a person that later on became the minister in a different government. Some dissemination papers from the World Bank were useful because they portrayed the problem as competing land uses. For example, a paper—I think the name was Competing Land Uses from Mr. Luis Constantino and others. (Castro Salazar, 2014).*

4.2.2. Policy Formulation and Adoption

When former Congressperson Luis Antonio Martínez Ramírez (1994-1998) became a candidate, he decided to work on improving environmental legislation and prepared himself to carry that work. Mr. Martínez remembers that on his first intervention at the Plenary, he swore to defend the environment. Among his duties, he participated in the commission that studied the forestry law (Martínez Ramírez, 2016).

When asked about his participation on the formulation of the forestry law, he remembered that

> *On December 1st 1995, there was a meeting at the Presidential Office attended by Rodrigo Oreamuno, Vice President; René Castro and Marco González, Minister and Vice Minister of Environment; Ronald Vargas, DGF Director; Carlos Espinach, advisor to the President; and the Congress representation of the National Liberation Party (PLN – Spanish acronym). At the meeting MINAE presented and shared a draft project of the New Forestry Law, for all the participants to analyze. (Martínez Ramírez, 2016).*

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[44] From Innovation for Successful Societies, Princeton University.

MINAE, the Forestry Chamber, the Small Farmers Association, and some NGOs, such as FUNDECOR, worked together to present to Congress the first draft. The PLN fraction at the Congress started working on the draft received and some discrepancies arouse. Former Congressperson Ricardo Garrón became coordinator and tried to push the fraction to advance in a faster way. During that period, Mr. Ronald Vargas was the main contact between Congress and MINAE.

Mr. Martínez asserts that there were four main versions of the project to formulate the new law. One presented by the former Government (project 11003), which was under study in a commission[45], one presented by MINAE, one presented by Former Congressperson (1994-1998) Ottón Solís (known as Ley Culpa – Guilt Law), and one presented by Mr. Martínez.

Mr.Franz Tattenbach, former Chief Executive Officer of the Foundation for the Protection of the Central Volcanic Mountain Chain (FUNDECOR - Spanish acronym) and active participant on the formulation of the forestry law, affirmed that Ottón Solís withdrew his proposal that established a complete moratorium on logging after a tough negotiation process. In an interview conducted in 2015, Mr. Tattenbach declared:

> *"I went to many heated debates with him. He wanted to put forward a moratorium. He had quite a bit of support on the moratorium. So I think there were some people, like René might think that this was a—and I think he is right to an extent—that this was a response to that moratorium. It was not a moratorium on logging from the court, we did not want that at all. Nor did the industry. But it was a moratorium on land use change in exchange for environmental services. That was the transaction." (Tattenbach, 2015).*

Former Congressperson Humberto Fuentes presided the Congressional Commission on "*Asuntos Agropecuarios*" (agriculture and cattle ranching) that was in

[45] MINAE was against project 11003 that pretended some reforms to Law 7032. Hernán Bravo, former Minister of Environment (1990 - 1993) and Congressperson (1994-1998) sent a letter to the Congress also opposing project 11003, and started collaborating on the formulation of Forestry Law 7575.

charge of reviewing and presenting to the Plenary the new forestry law for discussion. Mr. Martínez said that on January 31st 1996, Mr. Castro, Mr. Gonzalez, and Mr. Vargas attended a meeting of the Commission to present MINAE's latest version but the Commission argued that their revisions were not ready (Martínez Ramírez, 2016). Nevertheless, the country urgently required the new law because the Constitutional Court declared several articles of the old forest Law 7032 as unconstitutional creating precariousness.

According to Mr. Martínez on February 1996, he presented to the Congressional Commission the proposed document. The Commission started deliberations with some differences of opinion among the members. Nevertheless, there was recognition on the need to move from forest to ecosystems, and from forest management to conservation, which was the base for PES. After arduous negotiations, the Commission presented to the Plenary a rare consensual accord: the draft law was part of a unanimous report.

When asked about the biggest obstacles in passing the new law Mr. Tattenbach considered the pressure from the forest industry the main one, Mr. Martínez believed that it was scarce communication between Congress members and MINAE, while Mr. Castro believed that:

> *"The biggest obstacle I would say probably was the media, traditional media, because they were concerned about inventing another state program to provide subsidies. It took us some time to develop the idea. Going back to your first question, this was no longer a subsidy, it was that we were paying services that the market was not valuing or considering. So it took us some time. I personally went to talk with most of the media, all the leaders of the opposition in Congress and out of Congress. I would say that especially with Social Christians it was important to clarify that it was no longer a subsidy but a service. If you didn't provide the service you didn't get the money; that was the main idea." (Castro Salazar, 2014).*

4.2.3. Passing a New Forestry Law

The country promulgated Forestry Law No. 7575 in February 1996, which among other actions, legally established PES. The law adapted the existing system of financial incentives for reforestation and provided the legal basis to compensate landholders for providing ecosystem services. A new Certificate for Forest Conservation (COB – Spanish acronym) rewarded landholders for their ecosystem services. FONAFIFO was set up to manage the program in collaboration with other governmental and non-governmental organizations. The law expanded the sources of financing for the program to various resources at FONAFIFO's disposal: tax (dedicated fuel tax) revenues, grants and loans from national and international institutions, debt relief, agreements with the private sector, and market instruments (Bennett & Henninger, 2009; Chomitz, Brenes, & Constantino, 1998).

In addition, Forestry Law 7575 banned all land use change of established natural forests, punishable by prison sentences rather than fines. The fact that the offer to pay land-owners for reforesting, protecting forest, or managing existing forest in private properties outside national parks, helped to enhance conservation on private lands that were not under extractive forest regimes (Porras et al., 2013).

As observed in Table 7, the Forestry Law enacted in 1996 is a fusion of regulation and MBIs, which policy makers combined to improve results. Policy makers presented a law that even included the sources of funding, in order to ensure the success and sustainability of the economic instruments.

Table 7. Summary of measures included in Law N. 7575

Regulation	Economic Instruments	General Results
• veto on land use change on those lands covered by natural forest • veto on changing forestlands into forest plantations • prison penalties between 3 months and 3 years for those violating the law (i.e. illegal logging) • ban on export of wood coming from forests, in logs and squares • special permit needed to transport timber around the country • police action to remove squatters from areas under PES • Forest rangers acquired police authority regarding forest issues	• Creation of PES, paid to landowners through the forest conservation certificate • real estate tax exemption to those receiving PES • forestland accepted as loan warranty (including the value of the forest, not just the land) • creation of FONAFIFO • establishment of the forestry fund, with the following sources: o 1/3 of the proceeds of the tax on fossil fuels o 40% of the forest tax (established in this law) o income from sale of wood/timber confiscated o user fee established on other natural resources (i.e. water)	From 1997 to 2010, 770,000 hectares were included in the program. 85% under forest protection and 15% distributed in reforestation and other modalities. • 8,500 families involved in the program. • Generate employment (day labor, forestry engineer, notary service, surveyors, etc.). • An investment that exceeds $200,000,000 in rural areas. • In that period net forest cover increased by 7.5%

Source: Prepared by the author based on Forestry Law N. 7575 (Asamblea Legislativa de la República de Costa Rica, 1996).

Disappointingly, I could not find statistics on other measures such as the veto on land use change or the prison penalties less so on the contribution of these measures to recover net forest coverage. The center of all studies has been the PES. Moreover, to be able to completely evaluate the law it is necessary to have data on compliance and enforcement of the regulatory measures. I believe that the success of this law comes from taking advantage of the synergies between legal and economic instruments, with clear objectives targeted with a combination of specific instruments to improve the overall results. When the fines were not enough to stop illegal logging, the country

introduced prison; when subsidies were not enough, the country decided to experiment with the PES, which also contributed to the self-enforcement of the law. As mentioned by Prof. Ashford from MIT it is a combination of carrots and sticks.

4.2.4. Economic Incentives

In 1986, Costa Rica appointed Mr. Alvaro Umaña as its first minister of natural resources. He worked closely with conservationists and ecologists to negotiate special agreements between donor countries and the government of Costa Rica that donated due national debt payments to invest on environmental activities in the debtor country; scholars defined this instrument as debt-for-nature swaps. Conservation International stated that the attention focused on instruments such as debt swaps "has been disproportionate to the modest funding it has generated, with the possible exception of Costa Rica" (Barzetti, 1993).

In summary, Costa Rica developed a series of instruments used to help in forest recovery. Not all of them were as successful as expected, but they opened the way to more advanced ones. It started in 1979 with the introduction of a deduction on income tax, moved to subsidies, and evolved until the country implemented in 1997 the system of payment for environmental services at the national level. I listed and condensed them in Appendix B. In reality, however, economic instruments and command and control policy have frequently operated back to back.

4.2.4.1. Payment for Environmental Services

Many countries have recognized Costa Rica as a pioneer in introducing the concept of environmental services, and going further, in applying the idea of environmental markets (De Camino, Segura Bonilla, Arias, & Pérez, 2000; Le Coq et al., 2010; Wunder, 2007). Costa Rica led the way in 1996 to a specific policy instrument:

PES included in Forest Law 7575. Other countries experimented payments in specific territories, yet Costa Rica designed PES to comprise the whole country; it was born as a national system (Wunder, Engel, & Pagiola, 2008).

By 1996, the country not only had experimented with a series of incentives for reforestation and forest management, but also more importantly created the institutions to manage them. "The Forest Law built on this base, with two major changes. First, it changed the justification for payments from support for the timber industry to the provision of environmental services. Second, it changed the source of financing from the government budget to a remarkable tax on fossil fuels and payments from beneficiaries." (Pagiola, 2008). In fact, it introduced one of the first fuel tax used for forest preservation / conservation through the payment for environmental services.

Forest Law No.7575 explicitly recognizes four of the environmental services provided by forest ecosystems, (Asamblea Legislativa de la República de Costa Rica, 1996);

a) Mitigation of greenhouse gas emissions;
b) Hydrological services, including provision of water for human consumption, irrigation, and energy production;
c) Biodiversity conservation; and
d) Provision of scenic beauty for recreation, tourism, and scientific uses.

The law designated FONAFIFO as the institution in charge of managing the funds; it also established FONAFIFO's initial endowment, and its sources of funds. In sum, the law established a mechanism to compensate landholders for providing these services, defined the sources of financing, and outlined the rules for disbursing the payments. The designation of FONAFIFO was not a surprise, because the country established the entity in 1991 –as a trust fund managed by local banks– to handle an

earlier generation of reforestation incentives financed by official development aid from countries like The Netherlands, Norway, Finland, and the US.

Former Congressperson Saul Weisleder expressed that these resources should have been allocated, according to Article 69 of the Forestry Law 7575 and Article 32 of the Roads Law, based on the national consultation agreements to provide incentives for tree planting (Weisleder, 2016).

FONAFIFO pays to landowners, who own not just the land, but also the carbon rights. In order for FONAFIFO to be able to negotiate certificates for carbon sequestration internationally, the owner passes the carbon rights to them. I believe that the important part of the PES comes from the fact that participant landowners are compensated for giving up financial returns for the sake of the common good. In general they are paid the opportunity cost of the land as compare to cattle ranching.

Table 8. Modality Allocation for PES Programs (2010)

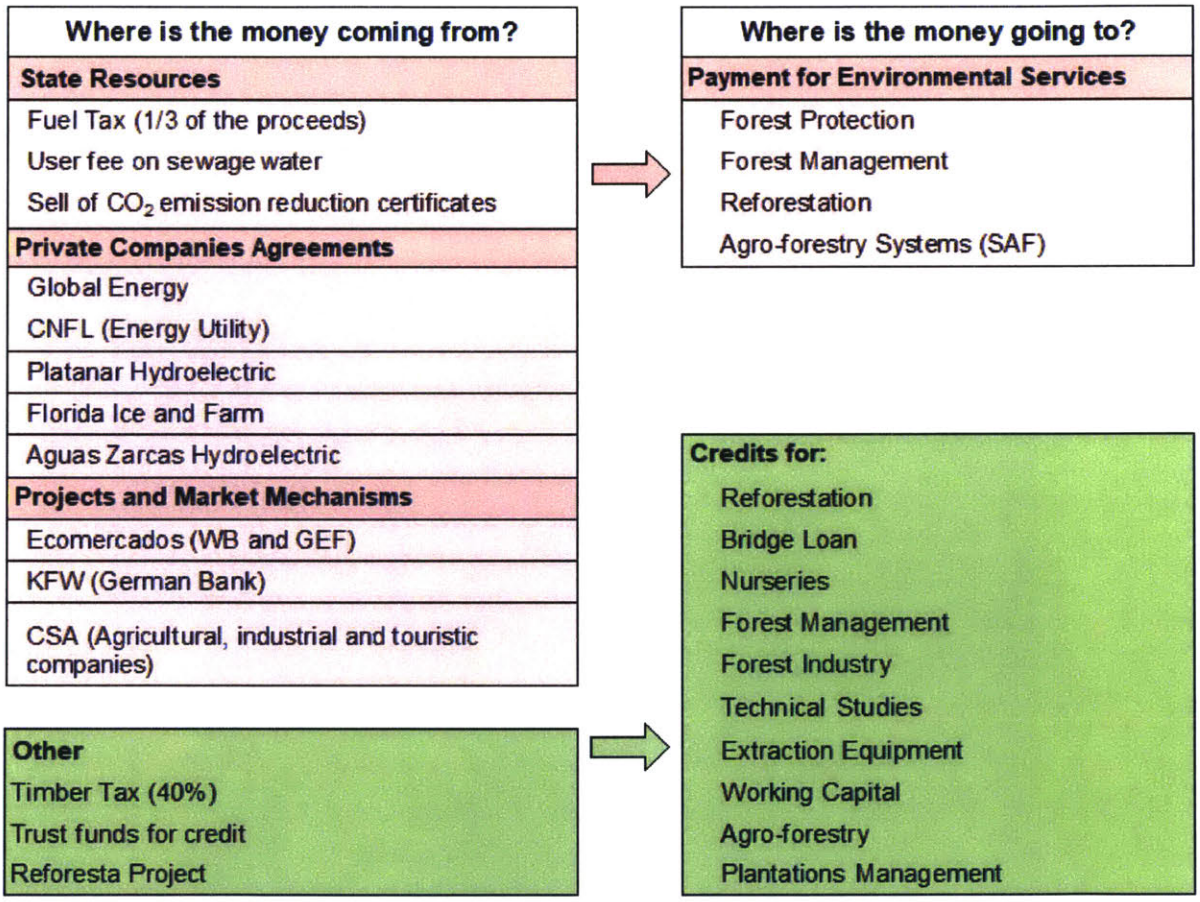
Modality	Hectares	Percentage
Forest Protection (Mature forest)	31,770	85.0%
Natural regeneration (Change land use to mature forest)	3,530	9.4%
Reforestation (Forestry plantations)	1,995	5.3%
Agro-forestry Systems (Payment to on foot tree and not by hectares)	92	0.2%
Total	37,397	100.0%

Source: Prepared with data from FONAFIFO web site (http://www.fonafifo.go.cr)

As shown in Table 8, the largest contribution of PES is for forest protection that represents 85% while reforestation is just approximately 5%. Agro-forestry systems are a new modality that has been growing and consists of a payment per tree and not per hectare.

The figure below presents a description of the flow of funds. The money that goes to PES comes from State resources, private agreements with companies mostly

on water related services, and projects and loans. The money used on commercial loans to farmers comes from the sources shown under "other" in figure 8. A loan from the World Bank and a grant from GEF, through the Ecomarkets Project were the main financial sources for PES in Costa Rica from 2001 to 2006. The finance ministry should pay the loan using the inflow from the fuel tax. In other years, the finance ministry transferred the money directly to FONAFIFO.



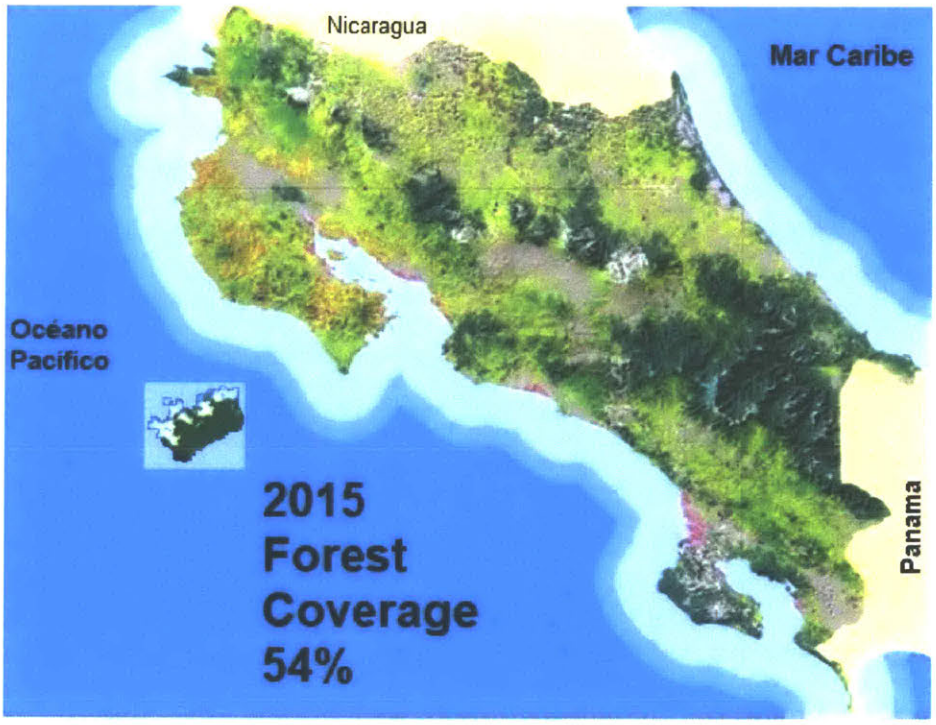
Source: Prepared by the author with data from FONAFIFO

Figure 8. Description of Funds Movements for PES in Costa Rica

The program pays landowners to conserve and sustainably manage forested areas, or to reforest degraded land. Since its creation, the program has: signed nearly 13,000 contracts; worked in nearly 800,000 hectares of forests; and distributed almost

US$280 million (FONAFIFO, personal communication August 2014). Porras *et al.* stated that since 1997, PES in Costa Rica helped to conserve nearly one million hectares of forest as a result of payments for: protection (90%), reforestation (6%), sustainable management (3%), and, lately, regeneration (1%) (Porras et al., 2013). One noteworthy fact is that PES has been part of a process seeking to address conservation in Costa Rica's private lands because the country already made a substantial effort on public lands by creating the System of Protected Areas, that are State owned lands.

After a rapid increase in net forest coverage, reaching 50% of the country, the rate has slow down, for example, by 2013, total forest coverage increased to 53% of the total land, and for 2015 it increased to 54%. Figure 10 presents year 2015.[46]



Source: Adapted from Oficina Nacional Forestal Nov. 2, 2016

Figure 9. Latest Map of Land Covered by Forest in Costa Rica (2015)

[46] FAO estimated using satellite images that the forest coverage in 2017 is 57%, however this information in not yet available to the public. (Personal communication with Danilo Mollicone).

When I use the term net forest coverage I am referring to the combination of what was lost (deforested and degraded) with what was gained (reforested and naturally regenerated). Hence, the use of net forest coverage is a more precise term to describe the net change between gains and losses in forest coverage.

Costa Rica's PES experience has been a clear example of the capacity for adaptive management because FONAFIFO, based on previous results, made major social reforms (to add to the environmental objectives) based on its experience with the first generation of PES, covering for example, indigenous communities with common property rights.

Today, one may say that three laws constitute the legal framework within which Costa Rica established the program (Sánchez-Azofeifa, Pfaff, Robalino, & Boomhower, 2007):

a) Environment Law 7554 (1995) that mandates a "balanced and ecologically driven environment" for all;
b) Forestry Law 7575 (1996) that mandates "rational use" of all natural resources and prohibits land use change in natural forest covered land; and
c) Biodiversity Law 7788 (1998) that promotes the conservation and "rational use" of biodiversity resources.

Former anti-logging command and control measures were not sufficient to change the trend in terms of net forest coverage, neither economic instruments alone. Policy makers never made a case for the use of service fees to recover forestlands.

Finally, many scholars consider Costa Rica's PES as a flexible mechanism that has financial sustainability, developed in a strong regulatory system and backed by strong institutions. Moreover, PES is currently a well-established system recognized for its transparency, credibility, financing efficiency, and successful results (Daniels,

Bagstad, Esposito, Moulaert, & Rodríguez, 2010; Zbinden & Lee, 2005). Nevertheless, statistically speaking, other scholars consider that the use of PES and the recovery in forest coverage in Costa Rica statistically represent more correlation than causality.

4.2.5. SINAC and the Protected Areas

As part of the efforts to reduce and reverse deforestation, and protect biodiversity, Costa Rica created a national system of protected areas,[47] in which there are seven different management categories, strictly protecting 26% of its land territory.

The categories most relevant to forests are: (1) national parks; (2) biological reserves; (3) national wildlife refuges; and (4) forestry reserves. The remaining categories are: (5) wetlands; (6) protected marine areas; and (7) protective areas, which are strips of territory along land borders and coastlines.

In the 60s the country had very little of its territory protected, only two national parks, and two forest reserves. In 1977, Costa Rica established its national parks system. At the time, farmers were clearing forests at the rate of 50,000 hectares per year,[48] mostly to produce beef for export to the United States (Keller, Niestroy, García Schmidt, & Esche, 2013). Between 1974 and 1978 protected areas expanded from 3% to 12% of the national territory (Castro Salazar et al., 1998).

In 1998, for the first time, the country adopted an official policy document on the management of protected areas, promoting the sustainable use of the country's natural resources, including environmental education as a strategic component of development.

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[47] The country created SINAC according to Article 22 of the Biodiversity Law Nº 7788, published in 1998.
[48] This represented one of the highest deforestation rates in the world.

Table 9. Evolution of the Costa Rican System of National Protected Areas

National 1993				National 2011			
Management category	**Number**	**Area in 1000 ha**	**% of total territory**	**Management category**	**Number**	**Area in 1000 ha**	**% of total territory**
Category I	4	15	0.3%	National park	28	629.3	12.3%
Category II	13	488	9.6%	Forest reserve	9	216.2	4.2%
Category III	0	0	0.0%	Biological reserve	8	21.6	0.4%
Category IV	9	129	2.5%	Protected zone	31	157.2	3.1%
Category V	3	6	0.1%	Wildlife refuge	71	237.5	4.7%
				Wetland	13	69.1	1.4%
				Special categories	4	21.8	0.4%
Total	**29**	**639**	**12.5%**		**155**	**1,353**	**26.0%**

Source: Year 1993: prepared by the author with data from (World Conservation Monitoring Centre, IUCN Commission and National Parks and Protected Areas, 1993).

Year 2011: Prepared by the author with data from (MINAE, FONAFIFO, & Presidencia República de Costa Rica, 2012).

As observed in Table 9, from 1993 to 2011 the national protected areas more than doubled increasing from 12.5% to 26% (MINAE et al., 2012). Since the total area covered by forest is 54%, we might therefore conclude that the area covered by forest is, as an approximation, half in private hands, and half-public—with the public land having the particularity that the government has set it aside as a protected area forever.[49]

One clarification regarding the reduction in the number of forest reserves is that many of them became national parks (see the increase in national parks), hence enhancing their level of protection. A second change is that most of the categories became a de facto "non-extraction areas" with little or no difference amongst all categories. An important point regarding protected areas is that it was not possible to compare data at different points in time from the same source. There is not a unique source that keeps statistics regularly, which make comparisons difficult, forcing

[49] The government authorized only non-extractive users like eco-tourists to enter the protected areas.

researches to compare different sources and choose the one that appears more accurate. In Table 9 the data presented in two different periods comes from two different sources, because it was impossible to obtain it from the same source at different time periods. Both sources are reliable in terms of the information published.

Costa Rica has concentrated its efforts on sustainable environmental practices, increasing the forest coverage and the protected areas, while at the same time GDP kept on growing. One might infer that those actions had positive effects such as boosting the tourism and service industries. However, calculating the effectiveness of Costa Rican protected areas in reducing deforestation is complicated because specialists cannot precisely observe the levels of deforestation that would have occurred without legal protection. Moreover, the standard methods used to evaluate the effectiveness of protected areas may perhaps be biased because (a) areas to be protected are consciously assigned and (b) protection can cause deforestation spillovers to neighboring forests.

4.3. Other Related Policies

4.3.1. Agrarian

Historically, Costa Rica relied economically on coffee, bananas, beef and sugar exports, which made the country's economy vulnerable to variations in the international market (World Bank, 1993). Costa Rica's first World Bank structural adjustment loan included the reduction, and final elimination of crop price supports, subsidized credit to producers, and subsidized prices for basic grains' consumers. The loan also pushed the Costa Rican government to create a new strategy for the agricultural sector in the mid 80s. At the same time, food aid came from the U.S., transferring North American yellow

maize and sorghum. The signed agreement prohibited Costa Rica from exporting these grains or any product derived from them (Edelman, 1999) cited by (Ibrahim, 2003).

A series of structural adjustment loans continued changing the agricultural conditions in the country. Many farmers sold or abandon their land due to the changes in the country's agricultural policy, and search for new economic activities, which also created a reversion of land uses from agriculture toward reforestation.

4.3.2. Climate Change

In 2009 Costa Rica designed a National Climate Change Strategy and acquired the commitment to be carbon neutral by the year 2021. Despite the fact that the country changed the date for the commitment to 2030, Costa Rica has had important achievements in combating climate change; such as an energy matrix with 90% renewable energy. In addition, the country adopted in 1997 a fuel tax to finance PES, which has helped in becoming the only tropical country to have reversed deforestation.

In 1997, Costa Rica traded in a voluntary carbon market and sold 200,000 tons of CO_2e to Norway at $10 per ton for a total of $2 million paid to FONAFIFO. The country used the money for forestry financing. Commentators often cite this transaction as the first CO_2 transaction in the world, under the Kyoto Protocol. Other transactions followed with the World Bank assistance. This transaction set the foundations for Certificates of Emissions Reductions, a CDM procedure implemented in 2005 in the regulated international carbon market, under the Kyoto Protocol.

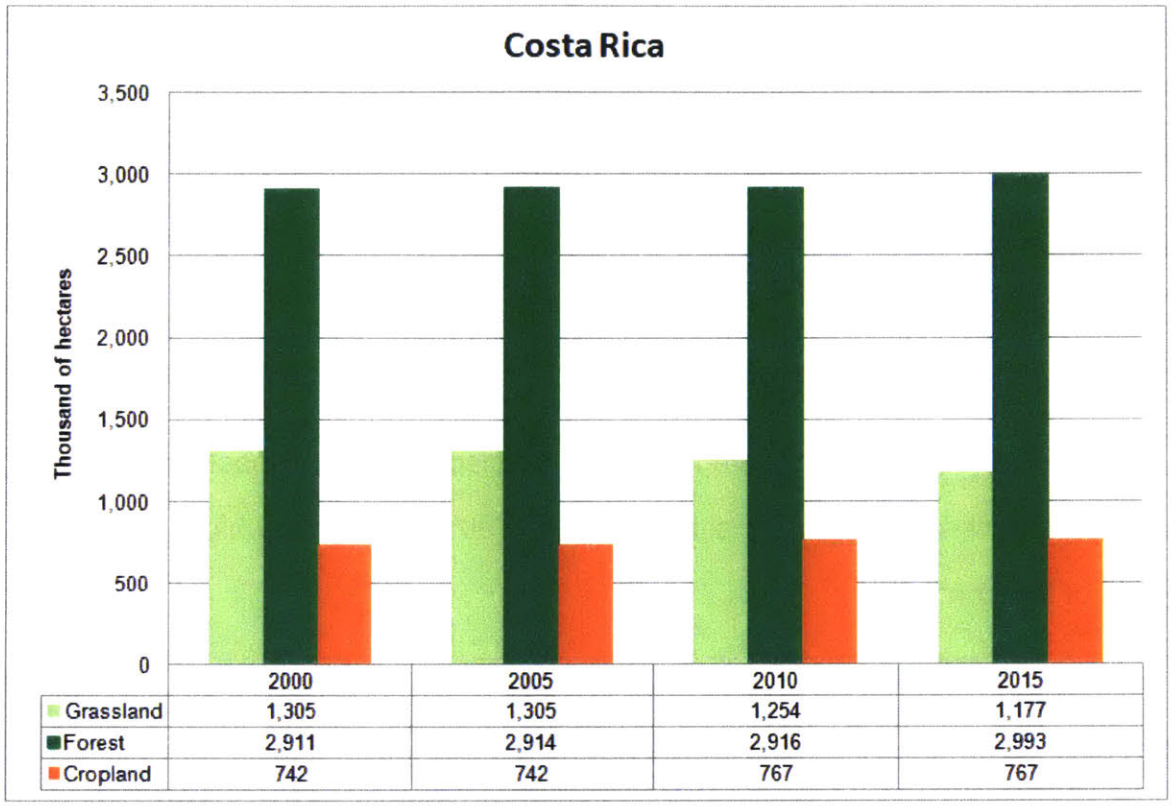
4.3.3. Land Use Change

The main change in Costa Rican land use since 1950 has been the transformation of forests into pastures and farmland. The country linked the predominant vision of development and economic growth to agro-export production, which supported the expansion of agriculture and cattle ranching.

Policies regarding the expansion of the agricultural frontier continued to grow, especially those aimed at promoting livestock, which got many subsidies. From 1950 to 1973 the livestock activity went from using 680,000 hectares to 1.558 million, which meant a conversion of 878,000 hectares of forest. Nevertheless, this situation changed dramatically when the Constitutional Court and the Congress supported the no land use change in natural forestland, introduced in the 1996 Forest Law.

As pointed out by researchers, land capability, and actual land use are different. In 1984, land capability studies on Costa Rica found that 44% of the land was suited for agricultural use and 56% for forest use; while in reality, 58% was under agriculture use and only 34% was covered by forest. Clearly, the land use composition was a consequence of market forces and policy distortions, which moved land use away from the pattern suggested, based on sustainable use of land resources (Peuker, 1992).

In sum, the evolution of land use in Costa Rica depended not only on the policies, but also on the change in the public's attitude towards forests. Different laws formalized these attitudes, according to the relative power of the various interest groups.



	2000	2005	2010	2015
Grassland	1,305	1,305	1,254	1,177
Forest	2,911	2,914	2,916	2,993
Cropland	742	742	767	767

Source: Danilo Mollicone, FAO's team leader, developing and working with Collect Earth for real time assessing of the forest and land use changes all over the world. Personal Communication (2018).

Figure 10. Costa Rica, Trends in Land Use 2000 - 2015[50]

Figure 11 above, shows that the prevalent land use in the country is forest, which represents more than 50% of the territory. The trend in land use for forests is positive (growing since 2000). Despite being an exporter of pineapple, coffee, and banana, the area used for crops is just about 15% of the country with a slight increase in 2010 due to the increase in pineapple exports. In addition, grassland has been decreasing and the land for settlements remain constant at about 2% of the country, which indicates a trend for urbanization. It also shows the country's priorities, were forest coverage for protection of ecosystem services is among the main ones.

[50] Mr. Mollicone's team produced the first report for forest in dry lands (published in Science in 2016), covering 45% of the land mass. The users and stakeholders includes Google Earth, and more than 30 countries like US, Germany, Australia, Papa New Guinea, Paraguay, Costa Rica and Mexico.

As mentioned before, the Constitutional Court and the Congress supported a clause that commanded no land change in forestland, introduced in the 1996 forest law. These two topics combined —forest/land use— contributed to an increase in land covered by forest.

4.3.4. Land Tenure

Costa Rican society has a long history of deep respect for private property and attempts to "centrally plan" private harvests have faced strong opposition in courts. In fact, the Court considered unconstitutional the 1990 forestry law, which introduced several of the controls.

Since 1934, Costa Rica has promoted the private property system through many different laws; hence, communal property has not truly developed. Only several indigenous reserves managed to have community-owned land. Indigenous Development Associations legally represented the communities in each reserve. "Indigenous reserves comprise an area of 323,868 hectares, located mainly in the Talamanca mountain range in the southern part of the country near Panama" (Morales & Calvo, 2002) as cited in (Navarro & Thiel, 2007). Previous laws allowed any small farmer to obtain a piece of land by removing its forest cover, to demonstrate that they worked that land.

Although only less than 2% of the population has self-identified as indigenous, in 1977, the government passed the Indigenous Law, which created special reserves just for them. Currently, there are a total of 24 indigenous territories located throughout Costa Rica.

While not as severe as elsewhere in Central America, landownership is highly concentrated in Costa Rica. There was a major reform in 1996 that facilitated land titling

and allowed farmers of non-titled land to obtain login permits (Brockett & Gottfried, 2002).

When asked about the importance of land tenure in recovering forest coverage, the director of FONAFIFO's Environmental Services Division said, "I believe that one advantage that the country has is legal certainty over land, and especially what goes into the contracts that has been greatly improved in recent years. Compared with neighboring countries, they may have more forest but they do not have that security that gives the peace of mind to the one who is buying the CO_2 credits, here we know what the farms are, they are geo-referenced, there is a land title registered at the cadastre, and a contract that supports it." (Sánches Chaves, 2016).

4.4. Summary

After high deforestation rates in the 1970s Costa Rica changed policies and incentives, and by the year 2015, its forest cover recovered and reached 54% of the territory (FAO, 2016b, p. 60). The changes Costa Rica made are a good example for forest preservation and recovery. Furthermore, Costa Rica has been in the forefront internationally in its efforts to stop and even reverse deforestation, and preserve wild lands and biodiversity. The Costa Rican experience has significance that goes beyond its small size. The country has special attributes, such as democratic stability, an educated and environmentally aware citizenry, and a more egalitarian culture than most developing countries (Cecchini, Filgueira, Martínez, & Rossel, 2015; ECLAC, 2010).

This study shows that the policy process went from agenda setting to rapid adoption due to several factors:

a) Direct and strong leadership from the president - top down (Former president Figueres called it conviction);

b) Strong involvement from the Ministry of Environment;
c) Balance of power between the Executive and Legislative branches of Government;
d) Alliances between leading stakeholders (few parties / actors);
e) A consensus on the country's development path (i.e. an economy not based on the extraction of natural resources);
f) A unanimous decision to design and approve a groundbreaking forest law;
g) Having previous experience with the use of economic instruments, hence, lessons learned improved decision-making.

These factors allowed for legal improvements and increased institutional strength. The resulting law is a combination of revised regulation that includes command and control mechanisms, innovative economic instruments, the framework for stronger institutions and secure financial resources to ensure its sustainability.

The forest policy applied in Costa Rica, through Law N. 7575 is in fact a policy mix, a hybrid policy that includes CAC and MBIs, that takes into account forest, land use, and climate change. In an indirect way the law also helps defining property rights, because when a farmer applies for PES it is a requisite to present the land title. In many rural regions of the country a movement towards legalizing all land titles progressed and created a clearer territorial ordering. It is also a mix of international policies with strong national ideas, which are the result of many different groups studying, testing through pilot projects, and participating in a national dialogue.

Although we cannot conclude that the fact that Costa Rica reversed deforestation is a direct result of Forestry Law N. 7575, most of the primary and secondary sources studied coincide on the importance the changes included in the law had on this positive

result. In addition, they coincide on the importance that well-defined property rights had on the results of Costa Rica's PES program.

5. MEXICO

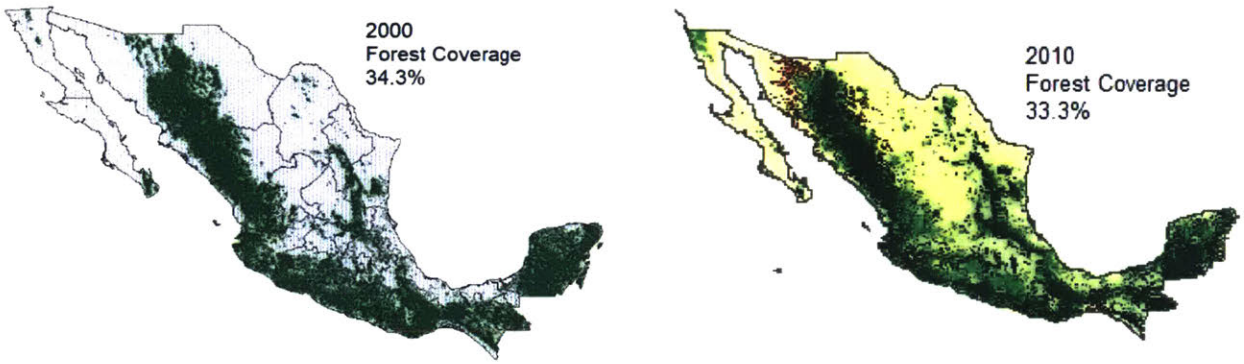
Mexico is a country with a large tropical forest area. Mexicans estimate that in the mid 1500s forests covered nearly two-thirds of the country, while at the beginning of the 20th century forest covered 52% of the land; afterwards, widespread exploitation devastated this resource. By 2015, FAO reported that Mexico has 66 million hectares of forest, covering 34% of its total land area; the largest Mexican forests are located in the tropical east and south (FAO, 2016a, p. 6).

The World Bank published various technical reports indicating that Mexico has the highest diversity of ecosystems in the Americas, being at the same time an important center of origin of agricultural crops like corn. However, along its history, Mexico's abundant biodiversity has been frequently threatened by increased deforestation, overexploitation of natural resources, uncontrolled harmful tourism, accelerated unplanned economic development, and arbitrary settlement policies (World Bank, 2011). Moreover, up until the late 80s Mexico lost more than 95% of its humid tropical forests, more than half of its temperate forests, and over half of the original cover of its arid areas (Durand & Lazos, 2004).

Regarding the causes of deforestation and degradation, several studies argue that they are different in each region and include conversion of forest to pasture and croplands, unsustainable logging, overgrazing, fuel-wood collection, forest fires, and pests and diseases. "Some of the underlying causes include insufficient alignment among policies, institutions, and programs across sectors, a deficient incentive framework for sustainable forest use, and insufficient capacity and access to markets by communities" (World Bank & CONAFOR, 2012). The Forest Investment Program claims that from 1990 to 2010 the conversion of forests to more profitable land uses, usually shifting to agriculture and livestock activities, is commonly related to deforestation

(SEMARNAT & CONAFOR, 2011). Moreover, they believe that farmers continue to reduce rainforests cultivating subsistence crops with slash-and-burn agriculture methods, and expanding pastures. Especially during dry years, agricultural fires would spread into forest destroying large areas. In a period of 20 years (1990 and 2010) Mexico lost 5.5 million hectares equivalent to 7.8 percent of its forest cover (FAO, 2010). Rates of forest loss vary across the country, with some areas continuing to experience high rates of deforestation and forest degradation.

Nevertheless, the country has been working to halt deforestation, "The country suffered rapid deforestation and degradation in the 1970s and 1980s, but forest loss has diminished since then, to roughly 150,000–200,000 hectares of deforestation and 250,000 – 300,000 hectares of degradation each year." [51] (CONAFOR, 2010, p. 1).



Source: (Alix-Garcia, de Janvry, Sadoulet, & Torres, 2005)

Source: http://www.fao.org/forestry/country/en/mex/

Figure 11. Maps of Land covered by forest in Mexico, 2000–2010

Figure 12 presents a comparison of land covered by forest between 2000 and 2010. The North Pacific region is rich in temperate forest, whereas the tropical forest is mostly located in the Yucatan Peninsula, the South and the South Pacific regions of the country. The figure shows that the deforestation rates diminished and gradually the

[51] See definition for deforestation and forest degradation in Appendix A.

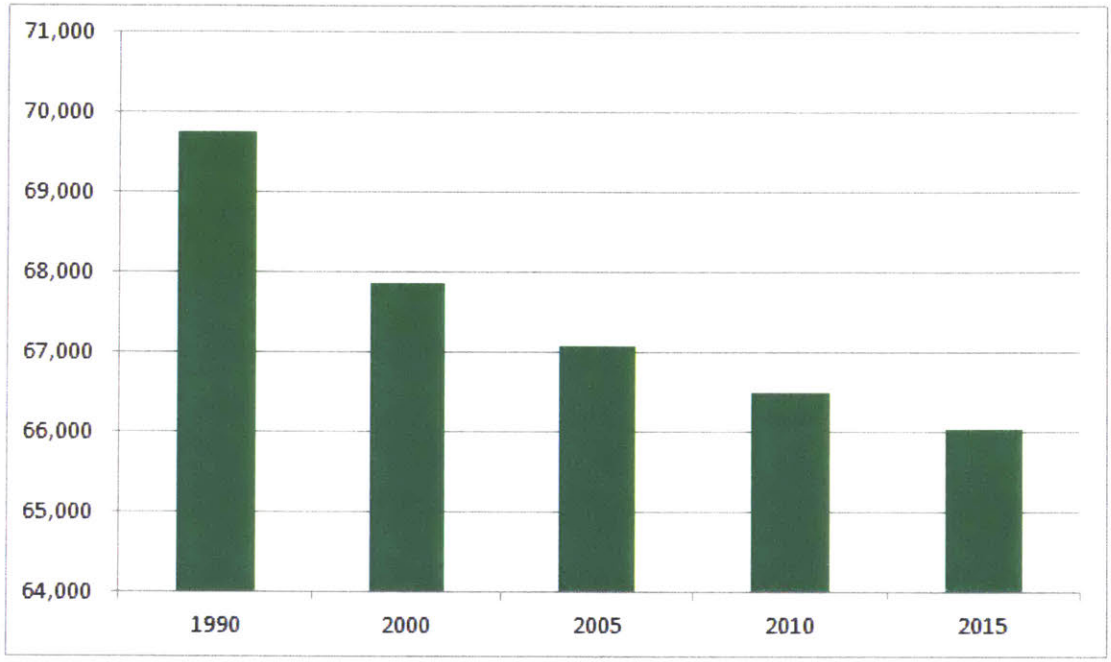
country is almost at the point were is not cutting more than what has been planted or recovered.

From 1940 to 1970, two main policies have an effect on the Mexican forest sector. The first one was to control forests by using import-substitution policies, through logging concessions on community lands established in the 1940s, which continued at different paces all through the 1970s. The second one was the policy of bans (zero extraction), formulated to halt illegal logging particularly in poor areas, while at the same time making it illegal for communities to reap timber in their own forests. By the year 1958, "total and partial bans were in effect in 21 states, covering an estimated 32% of the entire forest area of Mexico" (Bray et al., 2006, p. 474).

Costa Rica centered its effort in the previous policies on reforestation, through heavy incentives, and tax credits and exemptions on the reforestation activity, and not on conservation. Another issue that has a big impact on the forest sector was the liberalization of the banking system, which resulted in a drastic reduction in agricultural credits, reducing competing land uses. While Mexico worked on logging concessions, Costa Rica's effort was on deforestation, which I believe caused opposite effects. At the same time, while Mexico worked on bans that are difficult and costly to control, Costa Rica diminished agricultural credits reducing the transformation of forestlands to agricultural lands.

The following figure shows how in a 25 years' period Mexico has manage to reduce the rate of net loss in forest coverage based on previous efforts from President Zedillo (1994-2000) and President Fox (2000-2006). Furthermore, President Felipe Calderon (2006-2012) included in his plans the goal of zero deforestation and there was a significant reduction in deforestation partially due to his pressure for actions on

environmental issues. For example, one of the steps he took was to contact the Costa Rican government and asked for technical assistance in the implementation of the Mexican system of payment for environmental services.[52]



Source: FAO, (2015b). Global Forest Resources Assessment 2015. Desk Reference. Rome: Food and Agriculture Organization of the United Nations.

Figure 12. Mexico's Total Forest Coverage from 1990 to 2015 (1000s of ha)

About 70% of Mexico's forests belong to rural communities under a legally established collective ownership system — a tenure situation unique in the world called *ejidos* and *comunidades*. Other forests belong mostly to small, individual landowners. For rural communities, forests represent an important source of subsistence products, and of informally marketed products (Segura, 2000). For more information on this topic, refer to section 5.3.4.

[52] I was part of a Costa Rican mission that helped President Calderón with the implementation of PES in Mexico and with the preparation for COP 16, held in Cancun in 2010.

5.1. Situating Policy Process in Context

Similar to the Costa Rican case, Mexico in the 1970s and 1980s had a protectionist economic development policy, particularly in the agricultural sector. Since the late 1980s, and particularly since the late 1990s, the country moved away from the earlier closed economy and interventionist schemes that characterized the economic policy. In 1986, Mexico underwent its first attempt to favor community forestry by allowing communities to hire technical services, and prepare and implement their management plans, as well as ending its forest technical service monopoly.

In 1992, President Carlos Salinas de Gortari amended the Constitution to eliminate the allegation that community land originally belonged to the state. The amendment recognized that communities had absolute rights over forests, with the exception of privatizing or selling forestland. President Salinas de Gortari set an agenda of extensive reforms to the legislative framework that governed rural Mexico. A key innovation was to allow "*ejidos* to have their land surveyed, divided into private landholdings, and even dissolve the *ejido* if voted on by the majority." (Bray et al., 2006, p. 476). Simultaneously, the government helped communities to manage their forest resources through a series of community-based incentives and advisory programs. In many cases, these public investments—together with the decrease in agriculture profitability in remaining forestlands, and somewhat with the rural out-migration, contributed to a reduction in the rate of forest loss.

In 1998, the government launched the Program for Community Forest Development (PROCYMAF – Spanish acronym), focusing on strengthening the tenure rights and community institutions, and also making available technical and financial assistance to the communities. "Commercial forestry, such as harvesting and

processing timber, was not possible in many communities. We trained those communities for other businesses like ecotourism and bottling spring water, says Segura, who headed PROCYMAF."[53] The Federal Comptroller for Environmental Protection estimated that illegal industrial timber consumption in Mexico was approximately 80% with respect to the legal one (Ricker, 2008).

In the 2000 presidential election Mexico elected Vicente Fox, the first president elected from an opposition party since Madero in 1910, and the first one in more than 70 years to defeat the Institutional Revolutionary Party (PRI). In a speech at the National Auditorium (December 1, 2000), President Vicente Fox stated: "In my administration, water and forests will be considered matters of national security," signaling the decision to increase initiatives related to forestry on the new government's agenda (Del Ángel-Mobarak, 2012). While the government continued encouraging community forestry, it also introduced strict regulations to stop uncontrolled logging. No community could harvest timber without a management plan approved by the Secretariat for Environment and Natural Resources (SEMARNAT). Nevertheless, this approach to control illegal logging has scanty results, probably because it did not balance measures to **discourage** illegal activities, with activities that **encourage** legal behavior such as incentives and simplified regulations. In general, measures to increase control alone are rarely successful where the economic attractiveness of illegal behavior remains.

Moreover, since the beginning of the political transition in Mexico (2001) forestry gained exceptional significance in the federal political agenda leading to an increase in the sector's budget. President's Fox administration published the Forest Strategic

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[53] Source: http://www.downtoearth.org.in/coverage/forestry-the-mexican-way-48227

Program, which included the creation of the National Forestry Commission (CONAFOR) that expanded PROCYMAF to all the 12 forested states.[54]

5.1.1. Government Type and Legislation Process

Mexico is a federal presidential republic with 31 states and one mega city. Its legislative branch is a bicameral National Congress that consists of (a) the Senate or "Cámara de Senadores" with 128 seats, and (b) the Chamber of Deputies or "Cámara de Diputados" with 500 seats.[55]

The process to create a law, reform, or add existing ones proceeds according to the following stages:

a) Presentation of the initiative before the Chamber of Deputies, the Chamber of Senators, or the Permanent Commission, by those constitutionally authorized to do so, (President of the Republic; deputies and senators to the Congress of the Union; and state legislatures);
b) The President of the Chamber's Board forwards the initiative to commissions for their analysis and opinion;
c) The corresponding commissions present to the plenary (of the corresponding Chamber) their opinion with a draft law on the initiative;
d) The House plenary conducts a discussion of the draft law and votes;
e) If the Plenary approves the bill, it is sent to the Executive for publication in the Official Gazette of the Federation;
f) Or sent to the other Chamber, in which the discussion of the respective project will be turned over to the commissions for their opinion, deliberation and eventual approval;

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[54] Source: http://www.downtoearth.org.in/coverage/forestry-the-mexican-way-48227
[55] https://www.cia.gov/library/publications/the-world-factbook/geos/mx.html

g) The legislative process ends when a bill is published in the Official Gazette of the Federation and becomes part of the current legislation.[56]

Knowing the stages a country's follows to pass a new law, helps in the analysis of the policy process. For example, who presents the initiative and how many Chambers are there, might uncover the obstacles that may arise.

5.1.2. The Development of Forestry Institutions

During the presidential period of Luis Echeverría (1970– 1976) the government established (a) a large land redistribution and (b) a new wave of government activism in the rural sector. A government agrarian trust fund, the National Fund for Ejido Development, was in charge of organizing community enterprises, and making investments in social, human, and physical capital (Bray et al., 2005).

In 1992, Mexico created the National Commission for the Knowledge and Use of Biodiversity (CONABIO), which is an inter-secretarial commission with a permanent nature. The members of the Commission are: (a) the President of the country that acts as chair, presently Enrique Peña Nieto, (b) the Secretary of Environment, that holds the Technical Secretary, and (c) the holders of nine more Secretariats.[57]

[56] Source: http://www3.diputados.gob.mx/camara/content/view/full/8767
[57] Source: https://www.gob.mx/conabio

In 1994, the Mexican government created a new ministry, Secretariat of Environment and Natural Resources (SEMARNAT). As was the case in Costa Rica, the ministry of agriculture was previously in charge of environment and forest-related issues until the creation of SEMARNAT. Julia Carabias, was appointed as the first secretary of the ministry.[58]

In April 4, 2001, the government created CONAFOR. Since its foundation CONAFOR has as a priority promoting a reform of the forestry legal framework, both at national and local levels. With the entry into force of the General Law of Sustainable Forest Development (2003), state and federal governments have worked on the legislative reforms of each entity, and have approved 26 state laws so far. Other federal entities such as Baja California, Federal District, Nuevo Leon, Oaxaca, Sinaloa and Yucatan are waiting for their respective legislation on forestry (PROFOR, 2017).

5.1.3. Legislation

In 1988, the Mexican Congress approved the General Environmental Law, which constitutes the legal framework of the National System of Protected Areas (SINAP) and of all natural protected areas in the country in general.

In the forestry sector, Mexico had seven laws since the Political Constitution of 1917, forestry laws of 1926, 1942, 1947, 1960, 1986, 1992, and an amendment in 1997 (Arias García, 2008).

While in 1947, Mexico included funds in the law for reforestation; in 1986 forestry production and permits for forest exploitation was at the center of the law. This variation contributed to change areas somehow disturbed by totally intervened areas. By 1992

[58] Source: http://www.downtoearth.org.in/coverage/forestry-the-mexican-way-48227

the country introduced incentives for sustainable management, as a way to correct previous measures.

Next, I present a summary of the main changes included in forestry laws adopted since 1960:

a) 1960 Forestry Law – Pres. Adolfo López Mateos: Creates the forest regions and its supervision by selected technicians. Authorize forest owners to associate with each other, and with private entrepreneurs;
b) 1986 Forestry Law – Pres. Miguel de la Madrid: It establishes the restriction to transfer ownership of forest exploitation permits, impeding changes in land use and incorporating a spirit of conservation. It seeks to increase production through the social sector;
c) 1992 Forestry Law – Pres. Carlos Salinas de Gortari: Deregulation oriented to transport permits. Initiate incentives for sustainable management;
d) 1997 Forestry Law – Pres. Ernesto Zedillo Ponce de León: Introduces requirements for the classification of forest uses. Legally defines reforestation and afforestation. Prohibits commercial afforestation that could replace natural vegetation. Seeks to resolve three main issues: i) illegal logging, ii) non-regulated commercial plantations, and iii) the obligations of the Forest Technical Services.

In 2003, the government published a new General Law for the Sustainable Forest Development (LGDFS – Spanish acronym), followed by its rules and regulations in 2005. This law presents for the first time a terminology for the sector, which helps to avoid different interpretations and ambiguities that were previously present on the legal debate (Arias García, 2008).

In April 2012, the government passed a series of reforms to the Environmental Law and the LGDFS in order to facilitate the implementation of REDD+. At the same

time, the enactment of the General Law on Climate Change in June 2012 placed the country on a path toward a low-carbon economy. The 2012 reforms contributed to create a climate change fund comprised of a number of sources (including certified emissions reductions), and the funds were to be used for different adaptation and mitigation actions, including forest and in particular REDD+.

On July 18, 2016, in an interview with Rafael Pacchiano Alamán current Minister at SEMARNAT, he mentioned that the ministry was working on the formulation of a new law for sustainable forest development, because they wanted to improve the one from 2003 (Pacchiano Alamán, 2016). Since it was still in the idea stage, it was not included in this research. Nevertheless, on April 26, 2018, the Chamber of Deputies endorsed the Senate's new LGDFS bill and put an end to the one published on February 25, 2003. The main improvement consists in eliminating the historic conflict between the agrarian and the environmental sectors, and including the community forestry management as a public policy instrument. Moreover, despite the modifications that the 2003 LGDFS has undergone, policy makers insisted on the need to update the law, in order to be consistent with the new regulatory framework on climate change and ecosystem services. In addition, they wanted to reduce the bureaucracy of the procedures related to forest exploitation, warnings and preferably forestlands, to increase the productivity and diversification of timber and non-timber products, the certification of productive chains without increasing the administrative burden, and guaranteeing communities and small-owners, access to resources and maintenance of forest cover. I believe that this is a shift back to a greater concern on production than on increasing net forest coverage.

They also reformed article 105 of the General Law of Ecological Equilibrium and Environmental Protection in order to avoid land use change from forest to agriculture or

livestock. Among other objectives, the country expects that this new law would contribute to the Zero Deforestation commitment for 2030.

5.2. The Policy Process

5.2.1. Agenda Setting

In 1995 a World Bank's mission carried out the Mexican Forest Sector Review and Resource Conservation Study. Among the conclusions and recommendations the report included "capturing the values of forest resources through a more complete and creative governmental strategy to promote sustainable management and conservation activities with the collaboration of the government, the private sector, as well as local and non-governmental institutions." (Del Ángel-Mobarak, 2012, pp. 137–138). This recommendation was taken into account in the Forestry Strategic Program 2025, and after the creation of CONAFOR in 2001, a consulting company developed a study for the constitution of the Mexican Forest Fund (FFM – Spanish acronym), based on the background, the legal framework, and the needs and ideas of various actors in the forestry sector.

Even though CONAFOR had positioned itself to be a player in the environmental services game, the mandate for developing a PES program was given directly to the Department of Policy and Environmental Economics of the National Ecology Institute (INE – Spanish acronym) and to academics from the Iberoamerican University (Alix-Garcia et al., 2005).

In fact, a group of academics set the agenda for the LGDFS, some of them were from within the government and others from different universities. They proposed, designed, and promoted the program of payment for hydrological services.

Professor Juan Manuel Torres, who was part of the team, explained that the work started with a small group:

> *So the group of three that were working on this was Carlos Muñoz Piña, Alejandro Navara and myself [sic]. Carlos was still a student at Berkeley at that time and he finished, and he got involved in the team in late 2000. (Torres, 2016)*

The group started working on the design of the PSHA, Professor Torres explained the process as:

> *Well, we put together a pilot project basically. We asked for help from some professors in Berkeley, Alain de Janvry and Elisabeth Sadoulet, and we asked also for help from guys like Stefano Pagiola at the World Bank. A couple of friends in Costa Rica gave us a lot of help in the design of the program. (Torres, 2016).*

The design team recommended the creation of a fiscal instrument that would confer financial resources for the PSHA. They preferred the use of an environmental fee (user fee), indicating that environmental services' beneficiaries would contribute to their maintenance. The federal water fee was the ideal candidate. Congress set this fee every year, and could raise it; thus, they could allocate a percentage of it for the payment of environmental services. The idea was that water intensive consumers would be making bigger contributions (Del Ángel-Mobarak, 2012).

During the period in which the country enacted the LGDFS 2003 the head of SEMARNAT was Victor Lichtinger. It was at the end of 2001, when he accepted the basic idea, and requested support from the World Bank's Environment Department; "which channeled a donation from the government of Japan to finance data gathering and analysis, and whose staff provided advice and feedback throughout the different stages." (Muñoz-Piña, Guevara, Torres, & Braña Varela, 2008, p. 5).

5.2.2. Policy Formulation and Adoption

In Mexico we cannot talk about a forest policy alone because it is totally link to water. The country was suffering rapid environmental degradation; water supply as well as quality, and extensive deforestation were two of the main important environmental challenges Mexico faced.

Therefore, the federal government had two policies, one for water and one for forest. Regarding water scarcity, the government mainly worked on the expansion of physical infrastructure, financed through general taxes, and complemented with the revenues from users on the industrial and service sectors. The overexploitation problem was the result of (a) ineffective enforcement on the extraction limits for agricultural and ranching users, (b) zero pricing of water, and (c) extensive electricity subsidies given to this sector for pumping water out of the aquifers.

As for the forest policy, it included a succession of programs that subsidized forest plantations and other commercial forestry, helped poor forest-owning communities to build capacities, so they can have their own community forestry firms and invest in reforestation (Muñoz-Piña et al., 2008). At that time, the forest strategy was incomplete because it focused entirely on forests with high commercial value, ignoring well-preserved forests with little or no commercial value (León, Bauche, Graf, Cortina, & Frausto, 2012).

"The program for Payment of Hydrological Environmental Services (PSAH - Spanish acronym) seeks to complement these policies by becoming an interface between the forestry and water policy." (Muñoz-Piña et al., 2008, p. 4). In fact, they designed it to harmonize both policies: PSAH provided economic incentives to avoid deforestation in areas where water problems were severe.

In a study conducted 3 years after the adoption of PSAH, researchers found that the payments did not reach areas where the aquifers were overexploited. Basically, zero percent of the hectares under PES were forests in aquifers qualifying as extremely or strongly overexploited, and a small amount went to aquifers that qualify as moderately overexploited (Alix-Garcia et al., 2005). In another study conducted a few years later, researchers found that the program was effective in reducing deforestation, although some slippage may have occurred (Alix-Garcia et al., 2010).

CONAFOR's General Director at that time, Alberto Cárdenas Jiménez (April 2001 - August 2003), was frustrated with the conditions found when appointed. He was in fact a key player in the adoption of a new forestry law, because he fully supported the development of the idea, and latter provided the political backing it needed to pass through the Congress, and the agricultural lobbying groups (Del Ángel-Mobarak, 2012; Muñoz-Piña et al., 2008).

In the course of the lobbying process in the Mexican Congress, "several key members of the Environment, Natural Resources, and Tax Commissions became very supportive of the PSAH, to the point that they declared their intention of presenting the initiative as their own if the Finance Ministry did not integrate SEMARNAT's proposal into the fiscal package." (Muñoz-Piña et al., 2008, p. 726). Several political parties showed considerable interest, which helped in getting the required consensus to pass the initiative through the Review Commissions and at the end to have it approved by a majority vote in the general session.

Jorge Rescala Perez, General Director at CONAFOR (2012 -2017) expressed about the process:

> *I believe there was a balance of power. The process included analyzing the initiatives and contributions collected through public consultations, and multiple meetings of the*

Technical Secretariats of the consultative commission with representatives of the parliamentary groups of the PRI, PVEM, PRD and PAN.[59] Officials from SEMARNAT and CONAFOR attended those meetings, achieving valuable consensus in the generation of a text close to the purposes of all stakeholders in improving forest legal framework. (Rescala Pérez, 2016).

The proponents managed the process in a very smooth way, and at the end, all participants agreed on the proposal presented and approved by Congress.

5.2.3. Passing a New Forestry Law

Congress needed to reform another Law in order to provide funds to PSAH, the Federal Rights Law. This law allows the federal government to charge a fee for water use and maintenance (the water sources include lakes, lagoons, aquifers and rivers). The proposed modification of article 223 of the law, initially allocates a specific share of water revenues for payments for forest environmental services, set at 2.5% of the annual revenues. Latter negotiations with the Ministry of Finance, left the allocation in nominal terms: $200 million Mexican pesos ($18.2 million USD) per year.

In fact, it was a difficult political decision, since staff from the National Commission on Water, and the Ministry of Finance strongly opposed the allocation of water fees for PSAH. Their opposition was because in a previous negotiation with municipalities, they promised to restore 100% of what they paid to the federal government, with the purpose of investing it in water supply infrastructure that was in shortage (Muñoz-Piña et al., 2008).

The new Forestry law approved in 2003 represents a mix of regulations, but the most important changes during this period were on its impact in the forest programs.

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[59] PRI: Partido Republicano Independentista, PVEM: Partido Verde Ecologista de México, PRD: Partido de la Revolución Democrática, and PAN: Partido Acción Nacional

For example, PROCYMAF's budget increased ten times, expanding into the states of Guerrero, Michoacan, Durango and Jalisco.

Among the changes, the law includes forest zoning as a technical instrument in the national forest policy to improve administration and contribute to the sustainable forest development (Arias García, 2008). One of the most important innovations of the 2003 law was the introduction of the concept of environmental services; the ones included were water provision (quality and quantity), carbon sequestration, oxygen generation, reduction in natural hazards impacts, climate regulation, biodiversity protection, soil recovery, and landscape and recreation among others.

In the next table I summarize the most important measures included in the law. I also noticed that some things where not a decision, but a recommendation for future actions.

Table 10. Summary of measures included in the LGDFS (2003).

CAC	Economic Instruments	General results
• Zoning in forestry areas, to avoid land use change • Land use change requires authorization • Sanctions include o Admonition o A fine o Temporary suspension, partial or total, of forest exploitation o annulment of the authorization o Confiscation of the wood and equipment used o Temporary or definitive, partial or total closure of the facilities,	• Creation of PES paid to providers of environmental services • Tax exception to those contributing to the forestry fund • The forest Federation <u>should</u> create: o Fiscal incentives o Credit mechanisms, preferential interest rates o Long term insurance • The Federation and other agencies <u>will</u> design, develop and apply other economic instruments • A bond for conservation <u>could</u> be created	By the end of 2010, 2.5 million ha were under environmental service contracts, financed by existing sources that contributed to increases in hydrological, biodiversity conservation and carbon sequestration services. The PSAH program was established successfully, providing an instrument for leveraging public resources by bringing together buyers of environmental services and service providers. (World Bank, 2011)
• Creates National Forestry Service to integrate and coordinate efforts • Provides clear mandate to CONAFOR • Assign responsibilities to the Mexican Forestry Fund • Includes a chapter in terminology		

Source: Prepared by the author based on (Congreso General de los Estados Unidos Mexicanos, 2003).

Unfortunately, there are no statistics available on the specific impact of other measures such as zoning and restrictions on land use changes, in recovering net forest coverage. The center of all studies has been the PES. Once again, to be able to completely evaluate the law it is necessary to have data on compliance and enforcement of the regulatory measures.

The LGDFS, defined in his articles 142 and 143 the creation of the Mexican Forestry Fund as an instrument to encourage the conservation, increase, sustainable use, and restoration of forest resources and their associated resources. The federal

government expected that this fund would improve the access to financial resources in the market, promoting projects that develop payment mechanisms for environmental services, and contributing to the integration and competitiveness of the sector.

5.2.4. Economic Incentives

When the *ejidatarios* finally obtained rights to the forested land in the 1970s, the government promoted agricultural growth by encouraging clear-cutting to expand productive land and by paying subsidies on agricultural goods such as maize or beef.

From 1988 to 1992 Mexico underwent some changes in the forestry sector. For example, they oriented the participation of the owners and safe keepers of the resources towards their management, use, conservation, and development. In 1995-2000, the Forestry and Soil Program provided the forestry sector with development tools that included:

a) Forest Development Program (PRODEFOR – Spanish acronym), included subsidies for forest development;
b) the Forest Plantation Program (PRODEPLAN – Spanish acronym); and
c) the strengthening of the National Reforestation Program (PRONARE – Spanish acronym).

In addition, the government established a fiscal incentive program, as well as a support program for the construction of forest roads, and the National Program for Rural Areas Support (PROCAMPO – Spanish acronym) emerged (Del Ángel-Mobarak, 2012). After the creation of CONAFOR in 2001, the government transferred them the administration of PRODEFOR. PROCYMAF followed the same fate; it became part of CONAFOR at the end of 2001.

As a result of PROCYMAF's first experiences, the agency developed procedures and instruments for the communities, such as the community territorial ordering, the revision and updating of the communal regulations, market studies and development of community forestry companies, the certification of forest products and management procedures, nature tourism and the payment of environmental services (Bray, Antinori, & Torres-Rojo, 2006).

It was in 2003, that CONAFOR introduced its first PSAH as a response to the deforestation threat and the water scarcity.[60] Forest conservation was encouraged by making payments to owners - resident of land with large ecological value.

The government implemented in 2004 a second initiative, the Program for Markets Development of Environmental Services for Carbon Capture and Derived Biodiversity (PSA-CABSA) that also promoted the introduction and improvement of agro-forestry systems. Policy-makers considered this a step forward, because PSAH main concern was water, whereas PSA-CABSA introduced other environmental services.

By 2008, "ProÁrbol" was the main support and subsidy program to the forestry sector. Its objective is to "fight poverty, recover forest mass and increase the productivity of Mexico's forests and jungles." (Ricker, 2008, p. 2).

5.2.4.1. Payment for Environmental Services

In the context of international agreements to contain global climate change, the Mexican federal government formed a working group (between 1995 and 2000), composed of representatives from various environmentally related ministries, in order to

[60] According to the National Water Commission, 66% of the most important aquifers in Mexico are over-exploited, with an average extraction 190% above the replacement rate (Muñoz-Piña, Guevara, Torres, & Braña Varela, 2005).

discuss issues related to climate change. The participants in this group were all key actors in the environmental policy arena, and much of their discussion concerning water services and forest conservation during this period set the scene for the current PES program.

Josefina Braña, who worked with the INE-CONAFOR team of experts and was in charge of the REDD+ program, stated:

> *The PSAH analysis and design phase took from mid 2001 to May 2003. The INE-CONAFOR team was supported by a group of researchers from the Universidad Iberoamericana, the Centro de Estudios y Docencia Económica (CIDE), and the University of California at Berkeley, led by Professors Alain De Janvry and Elizabeth Sadoulet. The staff at the World Bank's Environment Department provided additional support. (Braña Varela, 2016).*

Lastly, in 2003 Mexico developed the PSAH—financed with resources from water fees collected under the Federal Voting Rights Act—to make payments aimed at preserving forests and jungles associated with water supply. Mexico designed both the PSA-CABSA and PSAH to recognize the environmental services of forest ecosystems, such as water quality, climate regulation, prevention of landslides, soil formation, biodiversity maintenance, carbon sequestration, and scenic beauty (Alix-Garcia et al., 2005). CONAFOR administers these PES programs and is in charge of managing the funds. Payment levels were derived from opportunity cost assessments, and differentiated by forest type (cloud forests received a higher payment than other forest types).

> *CONAFOR started to work in 2003 and basically they got the idea, they bought all the concepts and everything, and Alberto Cardenas was very successful in selling the project to CONAGUA, the National Commission for Water. They convinced some part of the Congress to approve a change in the law of water rights to transfer, if I remember*

well, 300 million pesos a year from those rights to CONAFOR to be spent in this pilot for PES. (Torres, 2016).

The PES system in Mexico enables local communities and *ejidos* to combine sustainable forest management with socioeconomic development through environmental conservation, land use, and restoration programs. The program helped to reduce deforestation rates between 1% and 4% in the countryside, *ejidos* and *comunidades* (Alix-Garcia, de Janvry, Sadoulet, & Torres, 2005). By 2013, the program claimed to have reach 2.5 million hectares of forest, making it the largest PES program in Latin America.

Although there is still room for improvement, Mexico's community forestry approach is increasingly recognized as a reference worldwide. The government sees this approach as a central piece of its social development and poverty alleviation strategies in forested regions. According to the government, it also served as a foundation of Mexico's strategy for REDD+.

Since at the beginning the geographic/socioeconomic aims of the payments was not very clear, the Mexico PSAH funding targets were shifted away from key overexploited watersheds, toward broader coverage to distribute the program benefits more widely (Kelsey et al., 2008).

5.2.5. SINAP and the Protected Areas

Responding to the biodiversity threats, in the late 1980s the government of Mexico developed a strategy for protecting critical habitats, creating the National System of Protected Natural Areas (SINAP – Spanish acronym) comprising parks, reserves, and monuments. "The creation of the National Commission for Protected

Areas (CONANP- Spanish acronym) in June 2000 elevated and strengthened the institutional management of SINAP." (World Bank, 2010, p. 11)

According to the law, the system of Protected Natural Areas includes the following categories: (1) biosphere reserves, (2) special biosphere reserves, (3) national parks, (4) natural monuments, (5) marine national parks, (6) areas of protection for natural resources, (7) areas of protection for flora and fauna, (8) urban parks, and (9) zones subject to ecological conservation (Pérez & Salcido, 1995). However, in reality they use only six of those categories.

Table 11, presents the evolution of national protected areas from 1993 to 2009. From 5% of the land protected in 1993, the country moved to 12.3% in 2009. The category that increased the most is biosphere reserves.[61] According to the World Bank in a document that analyses several grants given to consolidate the protected areas system, in 2010, the number of protected areas increased from 170 to 173, and the total area became 24.4 million hectares. They added that Mexico's commitment to SINAP has been persistent since its creation. Moreover, the Government has demonstrated its commitment to SINAP not only through capital contributions, but also through increased budgetary allocations over the years. More importantly, the Government's commitment has been continuous, across three Presidential administrations (World Bank, 2010).

[61] It compares UN data found on IUCN's last report, with data from CONABIO's Web site. It was not possible to obtain all the data from the same source.

Table 11. Evolution of the Mexican System of National Protected Areas

National 1993				Federal 2009			
	Number	**Area in ha**	**Percentage**		**Number**	**Area in ha**	**Percentage**
Category I	6	316,498	0.2%	Biosphere reserves	39	11,992,450	6.2%
Category II	33	1,597,788	0.8%	National Parks	68	1,505,643	0.8%
Category III	3	9,558	0.0%	Natural Monuments	4	14,093	0.0%
Category IV	12	3,886,725	2.0%	Protected areas of natural resources	7	3,467,386	1.8%
Category V	11	3,918,163	2.0%	Protected areas of Fauna and Flora	34	6,565,417	3.4%
				Sanctuaries	18	332,988	0.2%
Total	**65**	**9,728,732**	**5.0%**		**170**	**23,877,977**	**12.3%**

Source: Year 1993, prepared by the author with data from (WCMC & IUCN, 1993).
Year 2009: prepared by the author with data from CONABIO,
http://www.biodiversidad.gob.mx/v_ingles/region/areasprot/proctectedMexico.html

In sum, Mexican national protected areas of terrestrial ecosystems have grown significantly. Along with the federal protected areas; state protected areas, *comunidades*, *ejidal* and private nature, have also been created that increase the protected national territory.[62] Private protected areas, like *ejidos* and *comunidades* areas are of relatively small size and are present in much smaller numbers than those of public ownership.

5.3. Other Related Policies

The Mexican political arena presented some intersectoral policy conflicts; for example, agricultural subsidy programs promoted high-value crops and basic grain production, which in the past encouraged forest clearance.

5.3.1. Agrarian

The process of agrarian reform resulting from the Mexican Revolution led to as much as 80% of Mexican forests being in the hands of local communities. Reforms to

[62] http://www.biodiversidad.gob.mx/v_ingles/region/areasprot/proctectedMexico.html

agrarian law in 1992 encouraged a transition from state-led to a community-led community forestry sector (Bray, Antinori, & Torres-Rojo, 2006).

In the 1980s and 1990s, federal programs of clearing, colonization, and agricultural development, lead to a strong process of deforestation that historically affected tropical regions, such as the Yucatan Peninsula. Based on data from CONAFOR, between 1993 and 2002 the states of Campeche and Yucatan in the Yucatan Peninsula, stood out among the most affected, with forest cover losses of 30,968 and 23,007 ha / year respectively (Ellis, Hernández-Gómez, & Romero-Montero, 2017).

Until 1990 the characteristic of the Mexican agricultural policies were direct market interventions, with domestic prices kept above world prices, through tariffs and import quotas. The situation changed in 1991. Although some price support cases stayed in place, government started to base payments on land owned or inputs used, which encouraged the functioning of markets. NAFTA played a part in Mexico's trade liberalization, because in 2005 the country eliminated almost all trade barriers with the United States. In 2007, the main agricultural policy in place was direct income payments to farmers (Soloaga & Lara, 2007).

5.3.2. Climate Change

Mexico signed and ratified the UNFCCC, in 1992 and 1993, respectively. In addition, Mexico signed the Kyoto Protocol in 1997 and ratified it in 2000 as a Non-Annex I country (developing countries). Moreover, the international community has recognized that Mexico has been one of the most influential nations to face climate change. One of the most important efforts was the promotion of the proposal for the creation, at the global level, of the Green Climate Fund as the financial mechanism of

the Convention, to support the adaptation and mitigation actions of the developing countries.

In May 2007, the government published the National Climate Change Strategy (ENACC –Spanish acronym), whose objectives are:

a) Identify opportunities for emissions reduction, and develop mitigation projects;

b) Recognize the vulnerability of each sector and initiate projects for the development of national and local response and adaptation capacities; and

c) Propose lines of action, policies and strategies that serve as the basis for the preparation of a Special Program on Climate Change.

The National Climate Change Strategy is the basis for the Special Climate Change Program, proposed for the 2009-2012 period. The program describes the actions to reduce or mitigate greenhouse gas emissions and presents public policies for adaptation to climate change through 294 specific goals set by the Federal Public Administration.

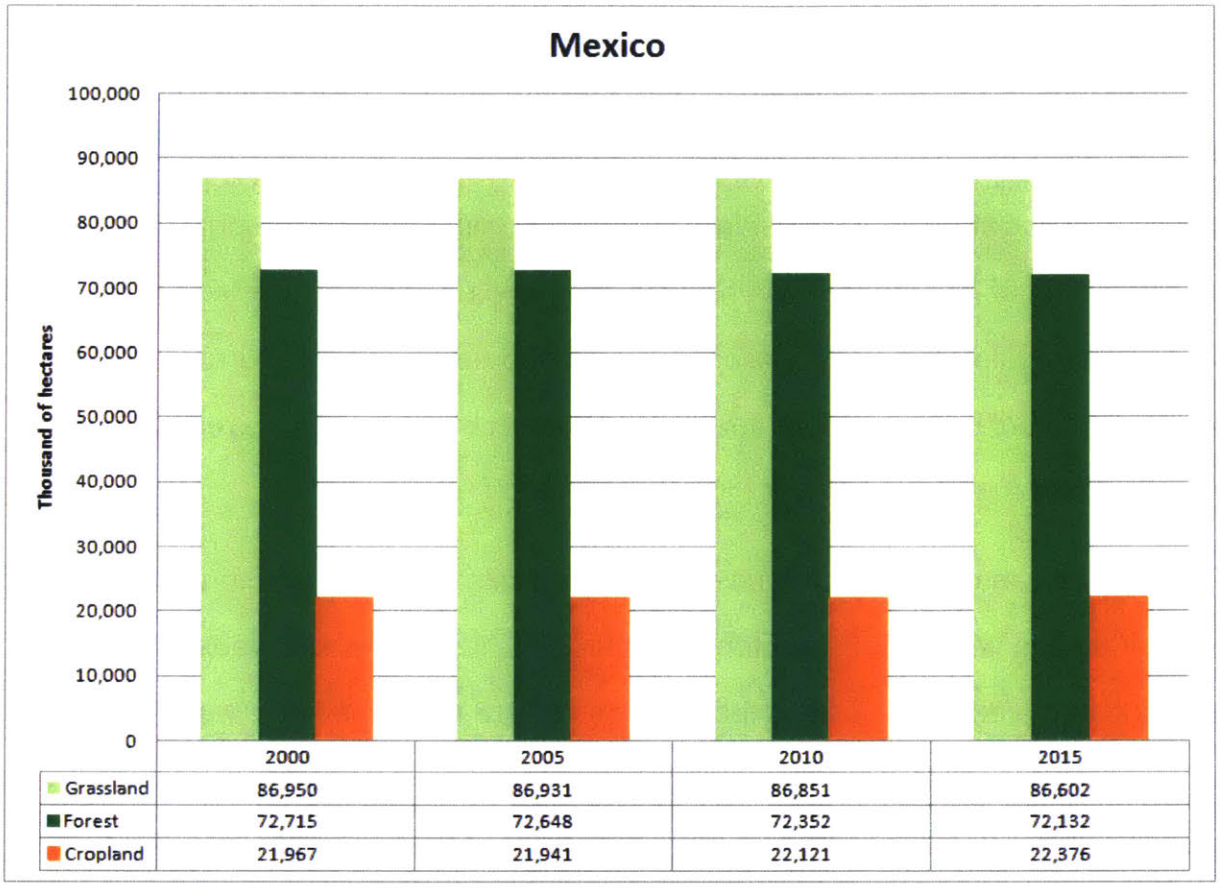
5.3.3. Land Use Change

Among the main problems facing the forestry sector is the deforestation caused, in large part, by processes of expansion of other land uses due to the development of other productive activities. The reasons related to this dynamic basically refer to the fact that the owners of forest lands chose to use their lands in alternative economic uses to forest use, with the purpose of having incomes in short terms, not necessarily permanent or sustainable. According to León *et al.*, "... changes in land use have led to increased deforestation and ecosystem degradation and reduce environmental service production." (León et al., 2012).

Illegal logging represents 8% of the causes of deforestation, and according to estimates by the Federal Environmental Protection Agency (PROFEPA), the production of illegal wood represents 30% of the annual authorized volume in the country. Illegal logging is associated with several factors such as: insufficient operational capacity for the application of forest and environmental legislation, problems of governance and land tenure, overregulation and restrictions to join the forest harvesting, corruption, failures in the application of justice, lack of adequate market controls and, more recently, organized crime.[63]

As we can observe in the next figure, Mexico's grassland and forestland are both diminishing at a very slow rate. From 2005 to 2015, the cropland increased in 435 thousand hectares, which is less than the loss of 516 thousand hectares in forest cover for the same period. There are not up to date statistical analyses that can prove strong causality or significant correlation between increase in agriculture and decrease in forestlands. Nevertheless, one of the new studies claim that the immediate causes of deforestation are mainly associated with livestock expansion, followed by agriculture, mostly in the states of Campeche and Yucatán (Ellis et al., 2017).

[63] Martes 29 de abril de 2014, DIARIO OFICIAL, (Tercera Sección).



	2000	2005	2010	2015
Grassland	86,950	86,931	86,851	86,602
Forest	72,715	72,648	72,352	72,132
Cropland	21,967	21,941	22,121	22,376

Source: Danilo Mollicone, FAO's team leader, developing and working with Collect Earth for real time assessing of the forest and land use changes all over the world. Personal Communication (2018).

Figure 13. Mexico, Trends in Land Use 2000 – 2015.

Due to the extensive Mexican land territory it is also important to note that the processes of changing coverage and land use, as well as its causes can be very complex and diverse within the different eco-regions and states in Mexico (Ellis et al., 2017). Finally, with such a small relative loss in net forest coverage, one may assume that the efforts the country is doing to achieve zero deforestation are well underway.

5.3.4. Land Tenure

The Mexican Revolution of the 1910s and Article 27 of the Constitution of Mexico (1917) are the origins of the current Mexican land tenure system. Article 27 stated that

all lands and waters originally belonged to the nation and that the nation would grant private property rights under certain conditions. It limited the size of private properties and parceled large private landholdings. Furthermore, this article granted land rights to rural communities and groups of families in order to meet their development needs or to restore long-established rights held before the nineteenth century.

However, not all post-revolutionary governments showed the same commitment to land redistribution. For example, the share of social property increased every year until 1982; however, governments only pursued re-distribution significantly during the second half of the 1930s, the mid 1960s and the early 1970s.

The Mexican Constitution of 1917 established three forms of rural property: national lands, private property, and the common property, composed of *ejidos* and *comunidades*. The literal translation to English of *comunidades* is communities, however in Mexico it refers to an agrarian law term, which means **indigenous communities** with confirmed long occupation of the land. In contrast, *ejidos* are a group of people that receives a new land grant, that comes from the land that was redistributed through the agrarian reform process (Bray, Antinori, & Torres-Rojo, 2006).

In 1992, Mexico's General Congress amended Article 27 of the Constitution to indicate the new tenure regime, which allows the certification, transfer, and privatization of *ejidal* and *comunidades* land. Moreover, some historians alleged that Article 27 is a form of devolution or decentralization of control over natural resources, manifested by the agrarian history of Mexico (Bray, Antinori, & Torres-Rojo, 2006).

In diverse regions, experiences of community forest management surfaced and expanded, which at different times received attention from sectoral public policies and the civil groups' support (Merino Pérez & Ortiz Merino, 2013). Nevertheless, the

governmental recognition of peasant property over land did not prevent the removal of rights due to the implementation of different forest policies and conservation of communities settled in the forest areas.

On one hand, private lands embody 37% of the Mexican agrarian landscape and are owned and/or managed by companies, sharecroppers[64], and landless peasants, although this amount only includes 26% of the country's forests. On the other hand, federal or regional public agencies as well as public enterprises, own public lands that correspond to more than 8% of the agrarian landscape and includes 4% of forested areas, mainly including protected areas and bodies of water. The country designated agrarian communities and *ejidos* as social property, and together they represent 52% of the agrarian landscape and roughly control 70% of the forests (Chapela, 2012; Corbera, Estrada, May, Navarro, & Pacheco, 2011).

5.4. Summary

In the last two decades Mexico had one of the largest deforestation rates in Latin America. Its forest sector went through a severe crisis, in which production declined, and imports had to increase. Nevertheless, triggered by International environmental concerns, such as the ones expressed at the Rio Summit, the country started to review and change its forest policies and law. However, from 1986 to 2003, the laws changed every 5 to 6 years, which scholars considered unstable and dangerous.

The idea of introducing PES in Mexico was born more for the growing scarcity of water resources than from forest itself. In fact, policy makers conceived protecting forest

[64] A farmer who does not own the land he or she works on but who pays as rent a share of the crop.

more as a solution to protect watersheds and secure water provision. On a positive note, through changes in a different law it secured some fund for PES operation.

Mexico is a good example to show that countries need well-defined property rights; it is not strictly the form of land tenure that affects forest coverage; if there is an owner, public or private, individual or common property, it works favorably towards protecting forest resources. Moreover, the analysis of available data on land use changes and forms of tenure, and the use of forest resources, does not allow establishing a statistically significant correlation between the proportion of forests managed collectively and the rates of change in forest cover.

This study shows that the policy process moved from agenda setting to policy formulation and adoption in a period of about four years. Nevertheless, its success derives from unanimously approval by Congress of the LGDFS in 2003.

Several factors are important to highlight:

a) Direct and strong leadership from President;
b) Strong involvement from the Ministry of Environment;
c) Strong participation of the academia;
d) Support from the World Bank;
e) Strong support from different parties in Congress;
f) Previous experience with pilot projects at the State level;
g) The law was not very detailed in terms of defining PES, which allowed for later revision of the instrument's specifics

Mexico studied and obtained help from countries like Costa Rica and Ecuador that went through the process of creating an economic instrument to contribute in

halting deforestation. In addition, the country created strong institutions that worked under the CONAFOR umbrella, and combined efforts.

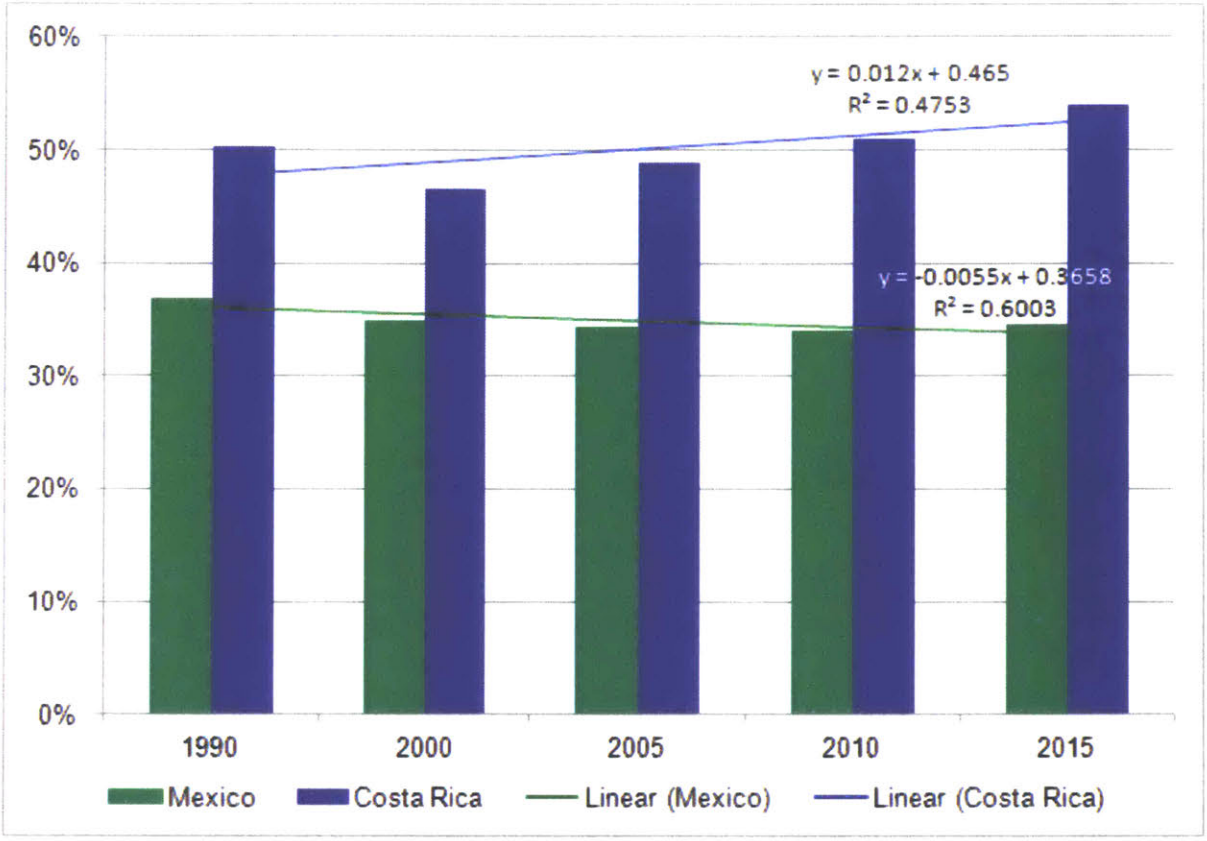
Its 2003 LGDFS combines regulation with economic instruments and clarifies the role of institutions. As a result of the law, the country took measures to improve land registration in the official cadastre. Finally, Mexico's regulation is transforming from a forestry law that helped the forest industry, to a forest conservation endeavor.

6. COMPARATIVE ANALYSIS

In order to conduct the comparative analysis I used information from both, (a) data from the literature review conducted that included FAO's open source data; and (b) information collected through the interviews conducted, and analyzed using Atlas.ti, one of the most popular Computer Assisted Qualitative Data Analysis (CAQDAS) software programs.

6.1. Forest Coverage Change

In terms of net forestry coverage in both Costa Rica and Mexico—based on data from FAO, one may conclude that Costa Rica reversed its situation from a net forest-cover loss from 1990 to 2000, to a net forest-cover gain between 2000 and 2005, and from then on, has kept its position as a net grower until 2015. Mexico has not been able to completely revert the condition of net forest cover loss, however, as observed in Figure 15 it has reduced the rate of net forest cover loss for every period measured. Using Excel, I added to the graph a linear trend in both countries, the slope of the line is positive in Costa Rica depicting an increase in forestlands, and negative in Mexico, which represents a reduction in forestlands.



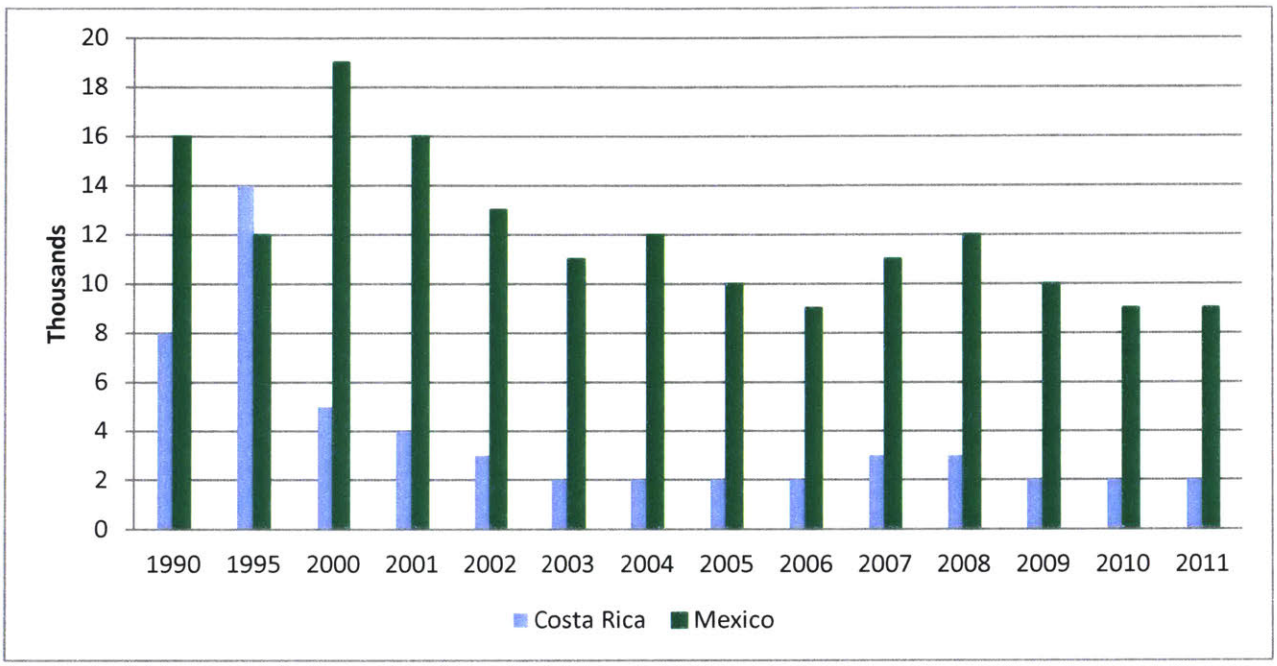
Source: (FAO, 2015b, pp. 10, 12).

Figure 14. Comparison of Trend in Forest Coverage in Costa Rica and Mexico (%)

6.2. Social and Economic Contribution

According to the World Bank, the level of sub-employment in the forestry sector, presented in Figure 16, comparing employment in the forestry subsector from 1999 to 2011, shows that the employment in Costa Rica has decreased since 1995, remaining at low levels, while in Mexico it peaks in 2000 and then has a up-and-down behavior. Also, every year but 1995, Mexico has had more employment than Costa Rica, these higher levels of employment in Mexico than Costa Rica might represent the larger scale of the Mexican forest industry. In addition, I believe that the Costa Rican peak in 1995 was due to market expectations that caused an excess forest harvesting, because the

forest industry thought that the imminent enactment of the new forestry law in 1996 might include a total ban.



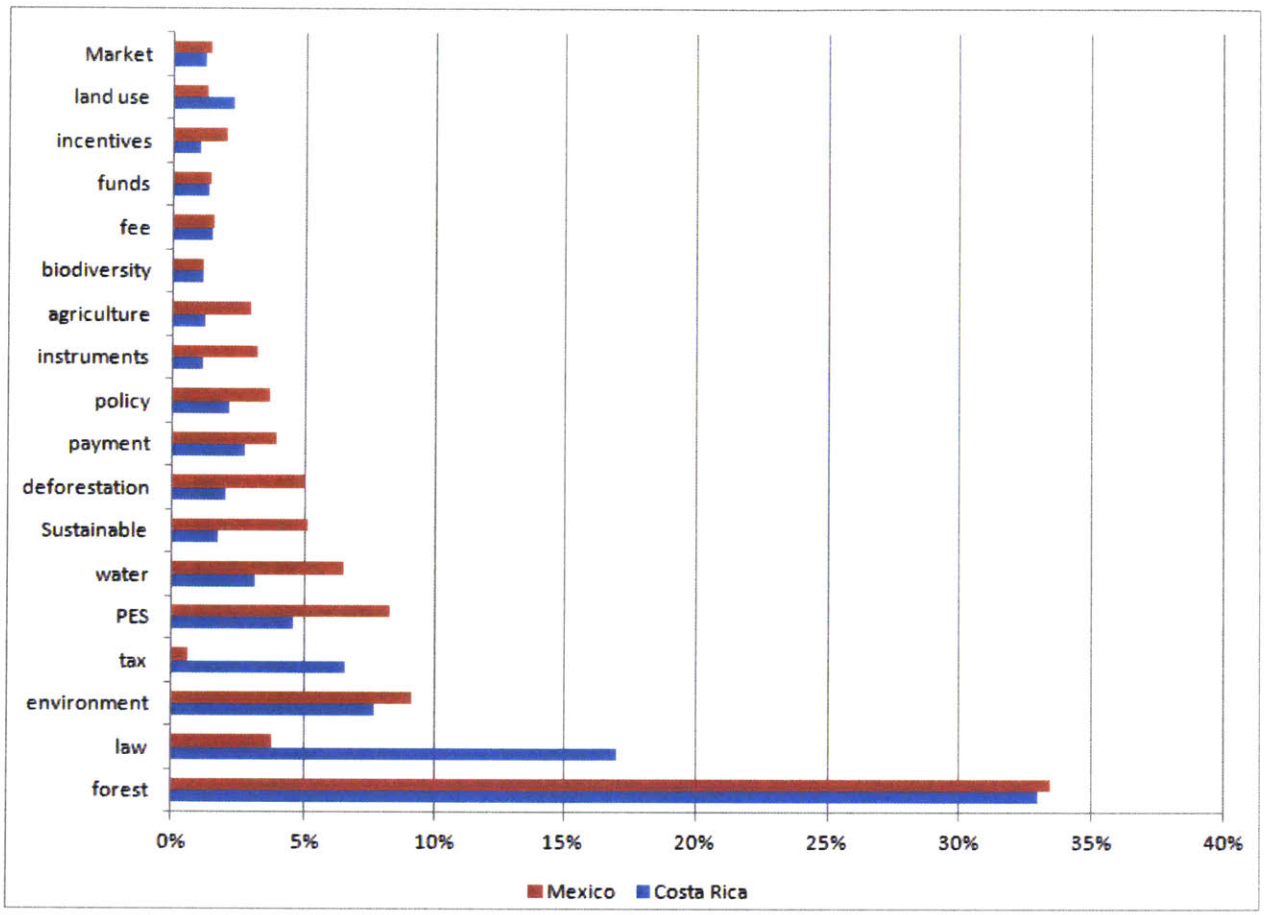
Source: (FAO, 2014a).

Figure 15. Comparison of Forestry Sub-sector Employment, 1990 - 2011

6.3. Main Similarities and Differences

In Chapter 4 we saw that in Costa Rica the Constitution states that everyone has the right to a healthy and ecologically balanced environment. Mexico included a constitutional reform to article four, which stated that everyone has the right to an adequate environment for their development and well-being.

Costa Rica has a traditional central government whereas Mexico has a federal government type. In addition, the legislative branch in Costa Rica has one Chamber while in Mexico it has two Chambers making the policy process more complex.



Source: Codes resulting from Atlas.ti analysis conducted by the author on individual interviews, grouped by country (2018)

Figure 16. Comparison of Codes from Mexico's and Costa Rican Interviewees

According to the codes presented in Figure 16, based on Atlas.ti results, the dominant agenda-setting topic is "forest" for both countries. The interviews, from then on, reveal some changes. For example, based on the interviews, "law" is 4 times more present in Costa Rica than in Mexico, whereas interviewees mentioned "PES and water" more in Mexico than in Costa Rica. In contrast, "tax and land use" are topics worth mentioned in the Costa Rican analysis, while in Mexico, "sustainable and deforestation" are some of the common topics. In both countries, interviewees discussed "fees and funds" with the same frequency.

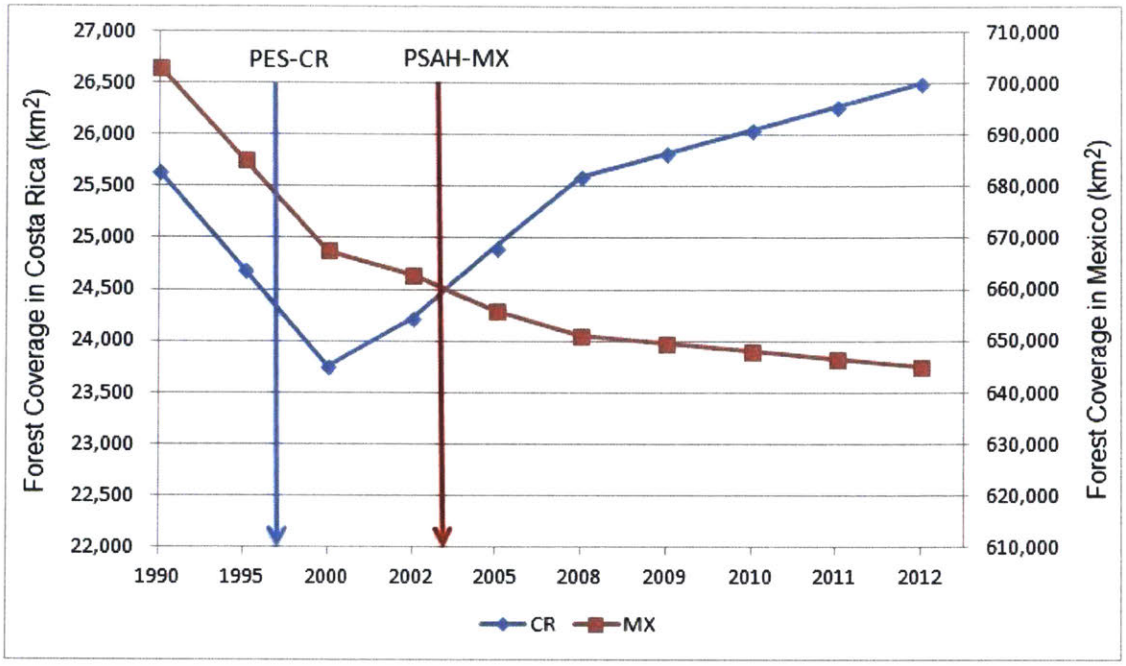
6.3.1. Payment for Environmental Services

In both countries, PES was one of the instruments included as part of a more comprehensive legal reform. Reviewing each last law studied, I found that Costa Rica presents the instruments in a more detailed way than Mexico. I believe this is a strategy Mexico used to have the law approved, and hence, more freedom to develop the instruments later. The excessive detail found in the Costa Rican law, might show the need to have a clear and well-defined mandate, with less flexibility for administrative maneuvering, that might be more important in a federal administration

Table 12. Comparison of the Articles in the Law that Created the PES[65]

MEXICO:
ARTICLE 142. The Mexican Forest Fund shall be the instrument to promote the conservation, increase, sustainable use and restoration of forest resources and their associated resources, facilitating access to financial services in the market, promoting projects that contribute to the integration and competitiveness of the productive chain and developing the collection and payment mechanisms for environmental goods and services.
COSTA RICA:
ARTICLE 22.- Certificate for the Conservation of the Forest The Certificate for the Conservation of the Forest (CCB) is created, with the purpose of giving back, to the land owner or possessor, for the environmental services generated by conserving their forest; provided that there has not been timber exploitation in the two years prior to the certificate request nor during its validity; which may not be less than twenty years. The National Fund for Forest Financing will prepare, issue, and subscribe these certificates annually and the Ministry of Environment and Energy will determine who the beneficiaries are. In accordance to the available resources and the relative importance of the environmental services that are to be maximized, the Executive Power will establish the order of priority for the granting of the certificates and will distribute them in proportion to the area of each owner or possessor. The certificates will be registered securities that can be negotiated or used to pay taxes, national taxes or any other tax.
Sources: (Asamblea Legislativa de la República de Costa Rica, 1996; Congreso General de los Estados Unidos Mexicanos, 2003)

[65] Free translation from the author.



Source: Prepared by the author with data from the World Bank, World Development Indicators database. Last updated: 11/12/2015. Retrieved from http://databank.worldbank.org/data/home.aspx

Figure 17. Forest Coverage in Costa Rica and Mexico and the Inclusion of Payment for Ecosystem Services (1990–2012)

Figure 18 shows the moment in which each country introduced PES schemes. Notice that the values for Costa Rica are in the left axis, whereas the values for Mexico are in the right axis to make the comparison in absolute terms possible. Between the years 1990 and 2000 the net forest coverage was diminishing in Costa Rica. In 1996, a strong commitment from the government top levels moved the country to enact a new law that introduced PES and other necessary regulation changes. The data shows that in the year 2000, the country reversed the negative trend and the net forest coverage continued growing until 2012. Between 1990 and 2000, the behavior of the curve in Mexico is very similar to that of Costa Rica; however, from 2000 to 2002, the slope of the curve diminished, still showing a decreasing net forest cover, but at a smaller rate. In 2003, the government introduced the LGDFS that included PSAH. The data shows

that from 2005 to 2012, the net forest coverage kept diminishing at an even smaller rate (reducing the deforestation rates). Although, one may not conclude any statistical causality or correlation from the data series presented, at least it describes facts that show positive changes in both countries. One increased the net forest coverage, and the other one is diminishing the rate of loss in net forest coverage. In general studies evaluating the impact of PES on forest coverage present mixed results and reveal a great number of limitations. In addition, other studies evaluate the link between PES and poverty as well as other social issues. An impact analysis conducted in Mexico in 2014 found that despite the small payment given to communities, participants took on more forest management activities. For example, researchers found that participating communities were more active in patrolling against deforestation, building firebreaks, and fighting soil erosion.

In Mexico 70% of the land is communal, and in the application of the PES, 85% of the payments have been assigned to *ejidos* and *comunidades*,

There are several reasons that might explain Costa Rica's greater success as compare to Mexico's. I believe the most important one is that the laws were set with different goals, in one to recover net forest coverage; in the other to achieve zero deforestation. In addition, Costa Rica has often found ways to protect important policies from the unpredictability of daily politics, while the laws change in Mexico faster. For example, one way of protecting forest policies from the political sway in Costa Rica is that a board that includes both private and governmental actors governs FONAFIFO. Also, the institutions in charge of a specific program in Mexico change more often than in Costa Rica, hence the learning curve reduces the speed of the change. Finally, in Costa Rica the population was already educated enough to understand and support conservation.

As Pagiola notes about PES in Costa Rica, learning from experience and responding in a timely way have been critical, indicating a need for the ability to adapt on a case-by-case basis, rather than treating PES as a rigid approach. Costa Rica's PES experience also reveals evidence of the capacity for adaptive management, given that FONAFIFO made major antipoverty reforms based on its analysis of the experience with the first-generation of PES (Pagiola, 2008).

In 2010 Mexico began to make a distinction in payment amounts, accounting for the importance of the ecosystem as compared to the provision of environmental services, which has helped to strengthen the criteria for determining eligibility and priority areas. Today, CONAFOR incorporates new areas to the PES system based primarily on social and environmental criteria.

Despite of apparently low levels of payment, PES is popular with farmers in both countries, and there is an eagerness to enter PES schemes (both Costa Rica's and Mexico's schemes are over-subscribed). This enthusiasm is an indication that those involved perceive PES schemes as advantageous.

Both Costa Rica and Mexico have made some progress in building a supportive legal, policy, and governance framework for PES to work with REDD+ projects, but also face some challenges. For example, Costa Rica has recognized carbon and other ecosystem service rights as belonging to landowners, and has a clear legal and institutional framework for PES under Forestry Law No. 7575. It faced the problem that initially fewer than 50% of forest "owners" had a clear land title; however, FONAFIFO provided legal advice to help solve this problem. In recent years Mexico developed a series of national strategies and programs, to strengthen forests' capacity to respond to climate change; however, Mexico's laws do not specify ownership of sequestered

carbon and overlapping laws make it difficult for communities to access REDD+ benefits.

6.3.2. Land Use Change

The land tenure organization in both countries respond to a historical land-use change process, first moving towards agricultural and cattle ranching, and more recently for the conservation of forests and their biological diversity.

Table 13 below, shows a comparison in relative terms between the different land uses in each country. On one hand, Mexico uses 11.42% of its land for arable purposes, whereas Costa Rica uses 14.71%. On the other hand, Mexico's grassland account for 44.11% of the total land, while Costa Rica uses only 22.55% (half the relative size). The total forestland in Costa Rica is 57.35%, versus 36.74% in Mexico. This information is based on remote sensing studies conducted by FAO using the same methodology for each country and not on the data reported by the countries that could differ in terms of methodology.

Table 13. Land Use Comparison between Costa Rica and Mexico, 2017

Land Use	**Costa Rica**	**Mexico**
	Area (%)	Area (%)
Forest	57.35%	36.74%
Grassland	22.55%	44.11%
Cropland	14.71%	11.42%
Wetland	2.45%	1.96%
Settlement	2.45%	1.84%
Other land	0.49%	3.93%
Total	100.00%	100.00%

Source: Danilo Mollicone, FAO, personal communication (2018). Prepared based on satellite information.

It is important to note that although Costa Rica has more land covered by forest in percentage terms, given the size of the country as compared to Mexico (Mexico is 38 times the size of Costa Rica), in absolute terms Mexico has more land covered by forest.

6.3.3. Land Tenure

Both in Mexico and in Costa Rica, interviewees argue that linking PES schemes to local property rights has been essential for successful PES outcomes. In PES schemes, informal rights holders are more likely to be excluded from benefits than formal rights holders (Springate-Baginski & Wollenberg, 2010).

Due to the land reform, Mexico dispersed more than 100 million hectares from large farms to groups of households organized into *ejidos.* In addition, in this period we observed how indigenous groups gained rights to their commonly held land, which they organized into *comunidades.* As a result, land and forest tenure in Mexico clearly shows that communities own 70% of the forest area (FAO, 2010a).

One of the main differences that I found between the two countries relates to forest ownership and management. As shown in Table 14, state forest in Costa Rica is 45%, whereas in Mexico it is 4%. In addition, in Mexico, communities own 70% of the forest, compared to a value close to 0% in Costa Rica.[66] As for forest management, in Costa Rica the public administration (MINAE/FONAFIFO) manages 100% of public forests, as opposed to community management in Mexico.

[66] The Government has recently assigned ownership rights to indigenous reserves, however the percentage they represent is very small and is not available at this point.

Table 14. Forest Ownership and Management Rights 2005 (%)

	Ownership pattern			Holder of Management Rights of Public Forest	
	Public Ownership	Private Ownership	Communal and Other	Public Administration	Other
Costa Rica	45%	55%	0%	100%	0%
Mexico	4%	26%	70%	-	-

Source: Prepared by the author with data obtained from (FAO, 2010a).

In fact, in Mexico most of the forest is community owned. Costa Rica only presents that situation in the indigenous areas, though they represent a fairly small portion of the program, whereas in Mexico community owned, either *ejidos* or *communidades* are the dominant form of forest ownership accounting to about 85% of the land in the PES program. So that is a huge difference.

Land tenure is an important factor affecting land use and forestry management. However, it is argued that when property rights are well defined no form of tenure, property regime, or governance arrangement is necessarily more effective than other, whether private, public, communal, or any combination – all have had failures, all have had successes. Rather, specific contexts appear to shape which forms of tenure regime are more or less likely to be effective for a given human-forest system.

Finally, in 2011, a World Bank report indicated that the Mexican government had not engaged enough with conflicts over land and forest tenure, illegal logging, and other illegal activities. However, by 2014, WWF reported that Mexico achieved a solid legal framework, and the land tenure pending issues, with local communities and indigenous people, have been generally resolved.

6.4. Summary Report Based on Atlas.ti Analysis

a) **Deforestation**: Both countries had a history of large deforestation rates which they managed to change. One country was a pioneer and the other was an early follower in the use of economic instruments as part of a forest policy.

b) **Funds**: Both laws included the creation of an agency to manage PES directly, FONAFIFO AND CONAFOR. The difference was that FONAFIFO was the entity to manage the program and the funds, whereas CONAFOR only managed the program. Mexico created a separate fund to manage the financial resources. Both experiences illustrate the importance of including a financial mechanism to fund the program, in the Costa Rican case the fuel tax and in Mexico the water fees.

c) **Instruments**: In both countries the new law included the instrument of payment for environmental services, as a way to reduce deforestation.

d) **International Influence**: The international environmental agenda influenced both countries. Conventions, treaties and protocols helped the countries decide to move towards forest protection, which included the protection of water sources, biodiversity, and many other ecological services.

e) **Opposition**: Despite the fact that there was initial opposition towards the new law, mainly from the wood industry, in both cases they managed to negotiate an acceptable proposal

f) **Starting point**: Both countries had previous experiences that helped shaped the new law and instruments.

g) **Support**: Both countries had support from World Bank experts. Those that worked in Costa Rica, helped Mexico define its instrument using the Costa Rican experience as a starting point.

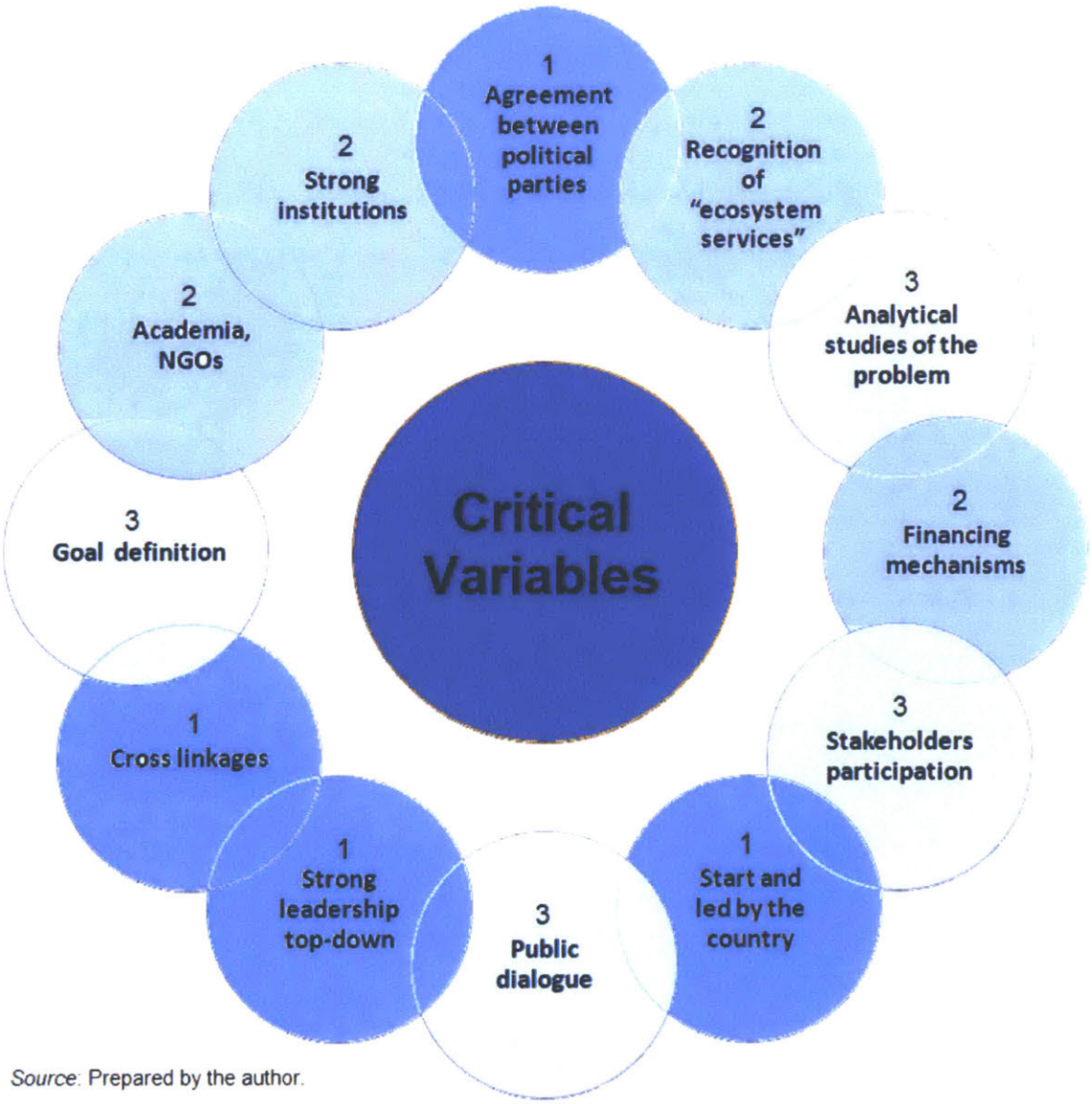
h) **Unanimous**: It was interesting to find that in both countries, Congress unanimously approved the forest law.

7. CONCLUSIONS AND NEXT STEPS

Although Costa Rica and Mexico historically suffered very high rates of deforestation, shifts in public policy have led to reductions in deforestation in some regions and forest recovery in others. As the empirical work has shown, a successful forest policy process is more likely to occur when different political parties agreed on the final target. In addition, the support of the institutions is critical. Both Costa Rica and Mexico are highly institutionalized and have policy practices that in a way guided the forest policy process into the latter stages of the process. Costa Rica and Mexico dealt in the previous laws with commercial exploitation; management plans, property rights, illegal logging, and some sort of payment too, i.e. subsidies. The problem with the subsidies was that they were designed in general to plant trees, not to conserve forest; therefore, people cleared the land to get the subsidy to plant. These countries have experienced in the past that an incentive alone, without fines or prison for those conducting illegal activities, is not enough to change the deforestation trends, neither regulation alone.

So, what makes Law 7575 and LGDFS different? Both forestry laws studied are the result of a combination of regulation and economic instruments. With these laws the two countries corrected past mistakes, worked to better combine and create cross linkages between issues like land tenure, land use change, more stringent sanctions, logging controls, and a very important step; the recognition of "ecosystem services". This recognition allowed them to include a different type of payment; a payment to compensate landowners for the positive externalities provided by conserving and protecting their forest, whose participation is voluntary. This identification permitted the countries to change the nature of the payments that were previously insufficient, when applied in isolation. Furthermore, the combination of forestry laws with the incentive

provided by the payment for environmental services has been more powerful in obtaining each country's goals. If we look back at the discussion in Chapter 2 section 2.3.3 it is as if by combining them we reduce the weaknesses and increase the benefits of each policy instrument. Hence, the need arises for a combination of policy tools, because none of them alone would have achieved the expected results in either country.



Source: Prepared by the author.

Figure 18. Critical variables in the policy Process

Figure 19 presents a summary of the critical variables during the policy process. I marked them as 1, 2, and 3 in order to show the relative importance given by the interviewees, 1 signaling more important and 3 less important, although they were all considered critical in the process. In this chapter I discuss these critical variables.

Along this research I learned that each country has to start and lead any policy process, the initiative cannot come from external parties or partners; this happened in Costa Rica and Mexico confirming for these cases what the theory says. It also requires political support at the highest levels, presidents and ministers at the executive branch and a group of senators promoting and negotiating in the Congress. Leadership is one of the critical variables to go through the process in a smoother way. Therefore, a new forest policy should be adopted at a high enough political level to be effective in achieving the goals set. It works top-down. Leaders at the national, federal or local level may be a significant driver of a robust forest policy process. However, the policy process cannot succeed exclusively with the promotion of a leader; strong institutions must support the whole process in order to successfully implement the forest policy and other policies in general.

Moreover, the institutional acceptance of a policy change is a main factor that might affect the country's ability to change a problematic situation such as deforestation. Without such acceptance, countries cannot successfully decide upon, or implement, strategic policy changes.

The use of analytical studies can be crucial to the success of a policy process. Analytical studies can be essential mechanisms in the search for new information or as an objective way to problem-solve. Analytical studies can help strategy and policy participants better understand the shortfalls of previous strategies and policies. Analytic

studies increase knowledge about complex issues such as the impact of a program of payments for environmental services and the role of the leadership. Moreover, accurate data, maps, and other forms to determine the state of the forest, help to increase support for a new law. Furthermore, it is crucial to keep collecting data and other information to show results in the long run.

An additional factor to consider is that the process by which policy makers developed a new policy needs to be broad based, well informed, and based on consensus. Participation is necessary to ensure that the policy meets the needs of society, it is vital to achieve agreements among participating stakeholders. The participation of the academia reinforces the seriousness of the proposed policy.

Another critical factor is that the formulation of a forest financing strategy should be an integral part of the forest policy development process. Both Costa Rica and Mexico accompanied their proposal with secure financing mechanisms.

In addition, international actions have become a motivation to act locally. Global concerns kindle national environmental responsibility. In both countries, actions such as the Earth Summit, various conventions, protocols, and the need to achieve the Sustainable Development Goals, served to elicit new environmental and forest policies. Moreover, improving governance for the forestry sector has become more important than ever before, because of the impact it has on the global climate change by increasing carbon sequestration and reducing emissions by keeping the forest standing; and the local role for water and biodiversity.

I also found that the time spend in the whole process is not a measure of success. Mexico took longer than Costa Rica in studying and designing the law and accompanying instruments, though both have successfully approved the laws.

As mentioned before, it is important to deal with land use change, land titling, and sanctions, as well as the correct incentives to promote a forest protection behavior. The literature analyzed, refers to this as a shift towards a policy mix, and not a struggle to choose for example between command and control mechanisms and economic instruments isolated (Brockett & Gottfried, 2002; Robinson et al., 2014).

Through the literature review I found that scholars coincide in the fact that land tenure security is a necessary condition for preventing deforestation. In addition, the literature shows that individual land rights are not different from communal land rights, what is important is to have well-defined property rights. The cases of Costa Rica and Mexico show strong differences in terms of public, individual, or communal land tenure, and in both countries it was possible to implement a mechanism of payment for environmental services that contributed to reduce deforestation.

In both cases there is still a debate between those that claim that there is no causality between the use of the economic instrument and changes in forest cover, and those that defend that there is a positive correlation between the two factors. I found that most of the studies support that both positions are correct. From a statistical point of view, it has not been possible to prove causality, mainly because of the difficulty in isolating one variable; however, several studies proved correlation between the two things. In my interviews, I found that those that participated in the process strongly believe in the positive results of the adopted policy. Moreover, by looking at the changes in net forest coverage from two different sources (a) reports from countries to FAO, and (b) studies using satellite images, one observe a positive trend in both countries after the PES mechanisms were introduced.

There are other benefits derived from the application of PES schemes:

a) Contribute to the establishment of monitoring systems and models of governance and social participation;
b) Generate employment in rural areas, being in many cases the main source of income for local populations;
c) Contribute to an adequate property registry, through a correct delimitation of the land and its certification of ownership;
d) Sensitize the population in relation to the conservation and value of ecosystems and their contribution to mitigating climate change;
e) Identify vulnerable zones or ecosystems with the risk of deforestation, and prioritize actions;
f) Play an important role on emissions reduction, so they could be enabled as quick start actions within the framework of REDD +;
g) They can play an important role in the construction and implementation of REDD + Strategies; and
h) Contribute to empowerment of communities.

Another important factor is to clearly define how to measure success and what objectives we want to achieve. I believe that Costa Rica had results faster than Mexico because Costa Rica started its new law that includes a PES program with a strong forest conservation objective and later on, added social well-being; while Mexico had water protection, forest conservation and social well-being from the beginning. The use of one instrument for several objectives might reduce its direct impact. Future uses of this policy instrument should take this into account and clarify from the beginning the weight of the objectives, in order to define the expected results accordingly.

It is also essential to know in order to design the correct policy what type of forest change wanted each country – clear goals. Simplifying, this study presents two different

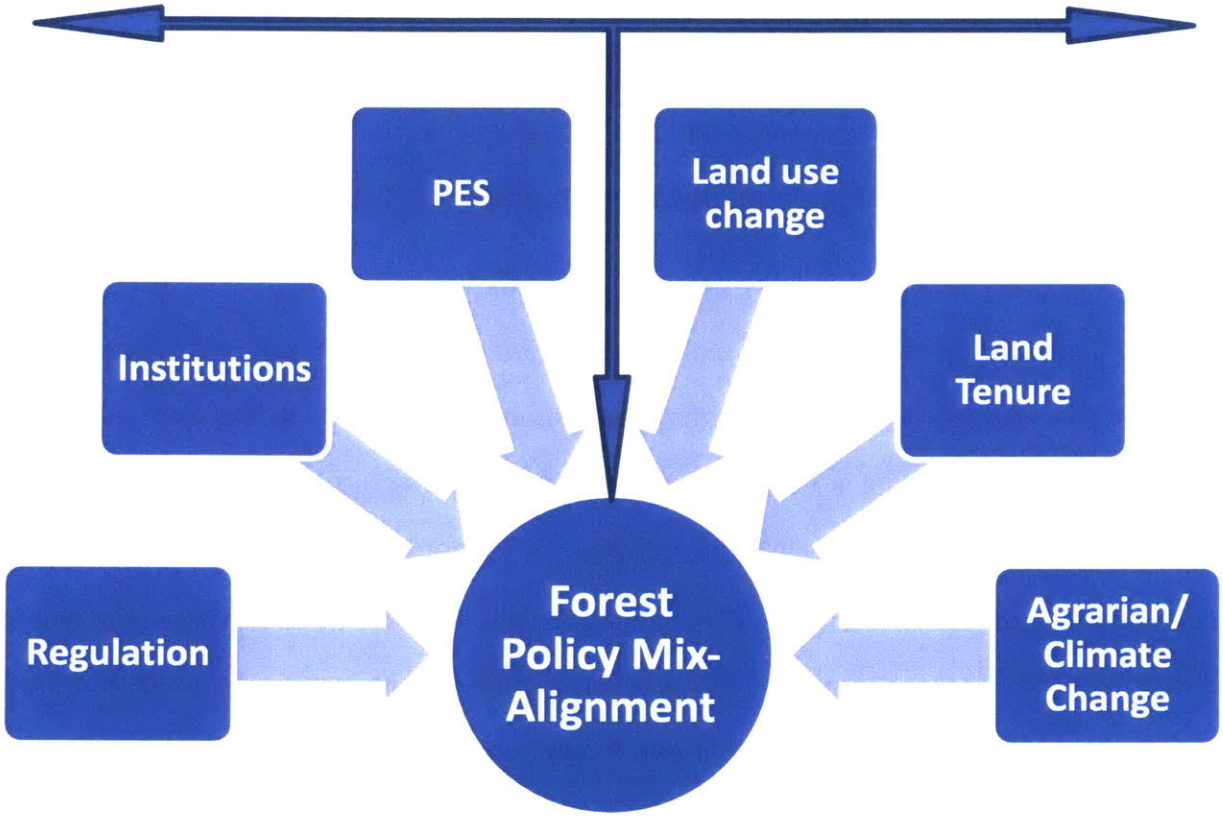
goals; Costa Rica wanted to increase net forest coverage by reversing the deforestation rate, and reforesting, while Mexico wanted to recover forest coverage by halting deforestation (Zero deforestation).

In general policy makers believe that with each new forest policy they correct negative externalities, and compensate for positive externalities. Despite their vast knowledge, I believe that the need to take into account cross linkages between forest and other policies is not explicit.

This study is important for global deforestation and more so for the one taking place in the tropics, which is still higher than in any other region in the world. At the same time tropical forest is richer in biodiversity and particularly useful in mitigating climate change. Finally, the UN adopted the SDGs that have already harnessed considerable political commitment in the international sphere. Countries are implementing many mid-term actions at the national and global levels to put them into practice, and for the first time halting deforestation is a global and formal objective. Forest policy processes, like the ones studied in Costa Rica and Mexico, may provide useful examples for other tropical countries. SDGs did not really drive this process, because they were approved, after both countries started their policy process; however, they contribute to today´s work to recover net forest coverage.

I believe the main contribution of this dissertation has been to find critical variables during the policy process that could increase the probability of policy approval and to confirm the need for a policy that combines several instruments and not just regulation or economic instruments alone. In addition, it contributes to draw attention to the need to have well-defined property rights to increase net forest coverage, moreover,

property rights should be recognized, honored, and enforced, because the lack of land tenure tends to favor immediate extraction of resources including wood.



Source: Prepared by the author

Figure 19. Forest policy mix / alignment

Figure 20 depicts my recommendation for a forest policy. On one hand, the recommended forest policy should combine direct regulation measures with, in this particular case, payment for environmental services, and the institutions to carry this work in a transparent and competent way. On the other hand, it has to be aligned with all the other policies that are interrelated with forest such as land use change, land tenure and others. Failure to do so will send conflicting messages and leave doors open to conduct illegal activities. In addition, it is very important to have a strong supervision

capacity to enforce the regulatory measures. I believe that the fear of loosing the PES income has moved landowners towards a self-enforcement attitude.

When we overcome the threads on tropical forest and learn a path to manage and promote net increase in forest coverage, through a well-conducted policy process, deforestation might not disappear, but will certainly diminish.

7.1. Lessons Learned

Thought this research I found some lessons that will help policy makers in the future development of forest policies.

a) Acknowledge and account for the need to adapt regulations, based on forest results and country needs and variations in socioeconomic conditions;
b) Design a framework with consistent terminology to allow for greater comparability across studies in order to achieve more robust, precise and conclusive findings;
c) Include indicators to measure compliance with specific regulations such as veto on land use change;
d) Include sustainable, long-term financing mechanisms to achieve the desired results over the long-term;
e) Create a system of robust monitoring and evaluation to ensure a program's credibility;
f) Create a flexible PES mechanism that might allow for differentiated payments, variations on eligibility rules, and inclusion of sectors with difficulties to demonstrate land tenure, for example indigenous populations, or abandoned women with land title under the name of the missing partner; and
g) Remove barriers to participation by the rural poor and marginalized groups, especially through training and capacity building activities.

7.2. Next Steps

There remain many scientific challenges for ecologists, economists, and other social scientists to understand how human actions affect ecosystems, the provision of ecosystem services, and the value of those services. A big challenge is to measure the results of a system of payment for environmental services based on the change of the environmental quality and quantity of those services, and not on the forest coverage. Another challenge is to increase the accuracy in the methodologies to measure forest cover, because presently, countries may have different results depending on which sources they use. Scholars can conduct future research for example on including policy processes in the analysis of associations between policy and socio-technical transformation. Uncover the disperse surroundings of a policy processes may help to develop policy recommendations that are better informed about the politics and implementation of policymaking, and therefore increase the probability of being adopted and sustained. I believe that a partnership between scholars and practitioners in studying policy processes will improve the quality of the results.

In order to establish a clear link between the policy formulated including the Law enacted, and the policy performance outcomes, I recommend that a study team continuous working on data follow up, working on isolating the rest of the variables to be able to determine a statistical correlation with a strong level of confidence. Additional studies using a similar framework and approach might be useful in other communities and around other forestry policies. In addition, scholars should study policies over time, as social relations within stakeholders continuously change, and new linkages and alliances are constantly being forged.

Future studies of policy processes should explore the topic from the national, the federal, the state, and the local levels. The consideration of all levels of policymaking are important, to show how countries formulate and implement their policies. This might show the full effect of the statues, laws, regulations, economic instruments, executive decisions, and government programs. However, such a detailed approach was not feasible in this study, given the time and resource constraints.

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8.3. Internet Sites:

CIA	https://www.cia.gov/library/publications/the-world-factbook/fields/2097.html#cs
CIFOR	http://www.cifor.org/
CONABIO	http://www.conabio.gob.mx/
CONAFOR	http://www.conafor.gob.mx/web/
FAO	http://www.fao.org/home/en/
FONAFIFO	http://www.fonafifo.go.cr/
MINAE	http://www.minae.go.cr/index.php/es/
SEMARNAT	http://www.gob.mx/semarnat
UNEP	http://www.unep.org/
UNFCCC	http://unfccc.int/2860.php
World Bank	http://data.worldbank.org
Grounded Theory	http://www.groundedtheoryonline.com/what-is-grounded-theory/

9. APPENDIXES

A. Glossary[67]

Afforestation	Planting of trees on land that was never forested (UNEP et al., 2009)
Command-and-control regulation	CAC requires polluters to meet specific emission-reduction targets defining acceptable levels of pollution. This type of regulation often requires the installation and use of specific types of equipment to reduce emissions. CAC regulations usually impose the same requirements on all sources, although new and existing sources, taken as groups, are frequently subject to different standards.
Deforestation	Refers to change of land use with depletion of tree crown cover to less than 10%. Changes within the forest class (from closed to open forest) which negatively affect the stand or site and, in particular, lower the production capacity, are termed forest degradation. Degradation is not reflected in the estimates (FAO, 1995).
Ecological economics	The study of the interactions and co-evolution in time and space between ecosystems and human economies.
Economic policy	The intervention by a regulator through policy instruments in private markets so that a desired market outcome is attained.
Externality	An externality is a cost or benefit resulting from an action that is borne or received by parties not directly participating in the action.
Forest (1990)	are defined as ecosystems with a minimum of 10% crown cover of trees and/or bamboos, generally associated with wild flora, fauna and natural soil conditions, and not subject to agricultural practices (FAO, 1995).
Forest (2010)	Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use (FAO, 2010).
Forest degradation	Removing part of the vegetation cover leading to reduced capacity of the forest to provide specific goods and services (UNEP et al., 2009).
Forest fragmentation	Splitting of a contiguous forest area into smaller pieces through conversion (UNEP et al., 2009).
Internalization of an externality	A situation in which the agent who generates the externality bears the cost that the externality imposes on other agents.

[67] Sources: (FAO, 2010; UNEP, FAO, & UNFF, 2009; Xepapadeas, 2009).

Market failure	Market failure is a condition where the allocation of goods and services by a market is not efficient. Causes of market failure include: externalities, concentration of market power, information asymmetry, transactions costs, and the nature of the good (e.g., public goods). For environmental conditions, externalities are the most likely causes of the failure of private and public sector institutions to correct pollution damages.
Market-based incentives	Market-based incentives include a wide variety of methods for environmental protection. Instruments such as taxes, fees, charges, and subsidies generally "price" pollution and leave decisions about the level of emissions to each source. Another example is the market permit system, which sets the total quantity of emissions and then allows trading of permits among firms.
Net change in forest area (loss and gain)	Sum of all changes in forest area over a specific time period, including reductions due to deforestation and disasters, and increases due to afforestation and expansion of forests during the period (UNEP et al., 2009).
Pareto optimum	A situation in which it is not possible to make someone better off without making someone else worse off.
Protected Areas	Areas especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.
Public good	A commodity for which use of one unit of the good by one agent does not preclude its use by other agents.
Reforestation	Planting of trees on land that was forested before (UNEP et al., 2009).

B. Description of forest economic incentives applied in Costa Rica

Year introduced	Last year applied	Description
Income tax deduction		
1979	1991	This was a deduction of income tax for natural or legal persons who develop commercial forest plantations. The deduction period was for five years, although plantation owners could enjoy an additional incentive to the tenth year to cover maintenance and management.
Reforestation Payment Certificate (Certificado de Abono Forestal-CAF)		
1988	1995	Aimed at individuals and companies interested in developing commercial forest plantations specifically saw logs. Participants were also granted the enjoyment of capital goods, used in the construction and repair of infrastructure and the purchase of vehicles, horses and other goods, necessary for the development of the plantation.
Advanced Payment Reforestation Certificate (Certificado de Abono Forestal por Adelantado-CAFA)		
1988	1995	Aimed at promoting forest plantations by small and medium forest producers, which were grouped in different organizations, such as cooperatives, agricultural centers, and development associations, among others.
Forest Management Payment Certificate (Certificado de Manejo de Bosques - CAFMA)		
1992	1995	Created to promote the management of forests owned by natural or legal persons. This method was applied to promote forest management subject to management practices or already under management plans.
Forest Protection Certificate (Certificado de Protección - CPB)		
1995	1995	This mode was intended to contribute to the increase of the forest covered areas and the permanence of natural forest in those areas whose primary function is the protection of water resources for human consumption and in protected areas and priority biological corridors. It benefited natural or legal persons, individually or grouped in any type of organization. This method was applied to manage or managed forests. Like the previous three, the amount was granted per hectare, distributed in five percentages.
Reforestation with own Resources		
1987	1995	Article 87 of the Forestry Law 7174 (amendment of 4465) stated that those who reforest without make use of CAF, enjoyed exemption from land tax, (currently real estate), and income tax obtained from the sale of plantation products. In addition, the total exemption from taxes and import charges in the case of equipment, vehicles, machinery and inputs, but from 1991 the latter incentive was removed.
Forest Development Fund (Fondo de Desarrollo Forestal - FDF)		
1989	1995	In 1989 with the conversion of foreign debt between Costa Rica and the Netherlands starts the "Forest Development Fund" program, aimed at promoting forest plantations and agro forestry systems for small and medium producers. In 1992 this program was strengthened through the cooperation of the government of Sweden, and since 1994 also the government of Finland. It should be noted that from 1996 this program supported the management of plantations of about 43,000 funded through CAFA and FDF The CAFA and FDF benefited approximately 10,300 land producers grouped in 60 grassroots organizations.
Forest Conservation Certificate (Certificado de Conservación de Bosques - CCB)		
		In Article 22 of Forestry Law 7575, the State creates the CCB as retribution to the landowners or landholders, for the environmental services provided by forests, it establishes a twenty years commitment. Additionally, it grants tax deduction of property and assets by incentivized area, and protection against squatting.

Voluntary Forest Regeneration (CCB)		
		Article 24 of the Forestry Law 7575 establishes the same benefits given for the CCB, for those owners of land suitable for forestry denuded and degraded, and who voluntarily wish to regenerate it back to forests.
Forest Management		
1996		For those owners of natural forests that manage them, the state offers as a reward for the environmental services they generate, exemption from payment of taxes on real estate and on assets, and protection against squatting. Article 23, of the Forestry Law 7575
Incentives to Reforest		
1996		For forest plantations established with own resources the State offers as incentives the deduction of property taxes, uncultivated land and assets, protection against squatting, and exemption from income tax on profits obtained from trading of plantation products. Articles 29 and 30 of the Forestry Law 7575
Eviction (protection against squatting)		
1996		Article 36 of Forest Law 7575 grants protection against illegal occupation of land to those properties under the forest regime or voluntarily devoted to forestry.
Investment in Forest Plantations		
1996		Article 70, Forest Law 7575, granted the category of resident investor to those who invest in forest plantations, an amount not less than $100,000 (US).
Forest as guarantee to the National Bank System		
1996		The forestland owned by individuals, serve to guarantee mortgage loans to the National Financial System. Article 25, Forestry Law 7575
Forest Plantations and individual trees as guarantee for loans		
1996		Land with plantations and planted individual trees standing on the land, owned by individuals, serve as a guarantee for mortgage loans and secure chattel mortgage. Article 32, Forest Law 7575.

Source: http://www.fao.org/docrep/007/ad102s/AD102S07.htm, retrieved July 28, 2016. Free translation from the author.

C. Interview guide

What factors motivated you to be more concerned about environmental issues
Legislation
What triggered the creation/presentation of the last forestry law? --Ley General de Desarrollo Forestal Sustentable 2003
Were the international agreements and environmental concerns a catalyst?
Who were the main actors and which was their role?
What was the role of the government?
What was the role of the Congress members related to the party in government?
What was the role of the opposition at Congress?
What was the role of the President?
Who promoted the new law from the executive branch and from the Congress
Who was against the new law?
How actors interacted? How they communicate?
Who leaded the process?
Was there a balance of power?
Was any specific support essential?
What were the main obstacles to approve the law?
What triggered the creation of a new forestry law? 2016
Who is leading the process?
What issues includes the new law that were not in the last one, or what main changes are included?
Payment for Environmental Services
What were the main concerns related to the payments?
Who was part of the discussion: Presidency, Ministry of Environment, Members of Congress, Gov. Org., NGOs
Who dominated the discussion?
What was more important personal leadership or institutional leadership?
Were substantial changes made to the initial proposal?
Is there a pro-protection attitude among landowners?

D. Interviews and other contacts

Interviewee	Title or Position and Organization	Interview date
Jose Maria Figueres	President of the Republic of Costa Rica, (1994-1998)	January 26, 2016
Luis Antonio Martínez	Congressperson (1994-1998), Costa Rica	February 4, 2016
Saul Weisleder	Congressperson (1994-1998), Costa Rica	January 22, 2016
Rene Castro Salazar	MINAE Minister (1994–1998), Costa Rica	December 16, 2014
Alexandra Saenz Faerron	FONAFIFO Project Manager (2000–2014) Costa Rica	January 25, 2016
Oscar Sanchez Chaves	FONAFIFO Director Environmental Services, (1996–2018) Costa Rica	January 22, 2016
Franz Tattenbach	FUNDECOR Chief Executive Officer (1993-2010), Costa Rica	December 13, 2015
Rafael Pacchiano Alaman	SEMARNAT Minister (2015-2018), Mexico	July 18, 2016
Juan José Guerra Abud	SEMARNAT Minister (2012-2015), Mexico	April 4, 2017
Jorge Rescala Perez	CONAFOR General Director (2012-2017), Mexico	August 19, 2016
Juan Manuel Torres	CONAFOR General Director (2009-2011), Mexico	March 24, 2016
Ikramm Nancy Sánchez López,	CONAFOR Directora de Normatividad y Consulta, Coordinación General Jurídica., Mexico	August 18, 2016
Josefina Braña Varela	INE-CONAFOR Team of experts (2005-2012) Mexico	August 20, 2016
Other people consulted:		
Carlos Manuel Rodriguez, MINAE Minister (2002–2006), Costa Rica; David Kaimowitz, Director Natural Resources and Sustainable Development at Ford Foundation. <u>FAO:</u> Danilo Molliconi, Team leader developing and working with Collect Earth for real time assessing of the forest and land use changes all over the world. Thaís Linhares-Juvenal, Team Leader Forest Economics and Statistics. Anssi Pekkarinen, Team leader of the Global Forest Resources Assessment. Irina Kouplevatskaya-Buttoud, Forestry Officer (forest policy).		

There were other short contacts with people in Costa Rica and Mexico, there where people impossible to contact, or who could not help me due to time limitations.

This is the Document Report I prepared from the Interviews

Interview Juan Jose Guerra Abud

In the interview he highlights a couple of things;
1. Strong role of Academia;
2. Agriculture had higher incentives than forest protection;
3. Smooth negotiation among the two Chambers and the executive branch; and
4. Importance of president's volition. fundamental political will.

Interview Juan Manuel Torres

Among the important things are:
1. The process started with the academia, a group of researchers;
2. They decided that it was important to have a pilot project to test PES;
3. Mexico intent to also have an impact on wellbeing not just deforestation; and
4. PES alone is not sustainable. It has to be part of a package that includes among other things secure financing and capacity building.

Interview Alexandra Saenz

She stated a few interesting points:
1. Recognition of the need to compensate in order to avoid forest loss;
2. The creation and definition of responsibilities of FONAFIFO was essential for its success;
3. The 1996 law obtain majority support at Congress, despite political differences; and
4. The importance of leadership along the process.

Interview Rafael Pacchiano Alaman

His main points are:
1. Trigger for the 2003 law was international: conventions, treaties, and protocols, as well as the summits;
2. The support of the Ministry in the adoption of the new law 2003 was decisive; and
3. The support of the World Bank in financing and participating in studying the instruments was important.

Interview Saul Weisleder

Among the things that he mentioned are:
1. President Figueres was very interested in this new law;
2. Initial concern in Congress was funding for the program;
3. Importance of fossil fuel tax to solve the issue of funding; and
4. As part of the political fraction of PLN in Congress, he helped facilitate agreements with the other political parties.

Interview Rene Castro Salazar

His main points are:
1. Importance of international actions in Costa Rica's decision;
2. based the program in the concept of competing land uses;
3. deforestation still a problem in people's mind, hence pressure to the government to act accordingly;
4. President Figueres was convinced that the country needed to move to a sustainable development strategy; and
5. to get the fuel tax approved was tough, people do not like taxes.

Interview Jose Maria Figueres

He highlighted the following:
1. He wanted a highly educated team working on environmental issues;
2. As Minister of Agriculture witness the impact of changing the incentives son the farmers, PES was an alternative;
3. Strong international influence;
4. Importance of the fuel tax; and
5. Strengthening of the National Parks System.

Interview Luis Antonio Martinez Ramirez

His main points:
1. His main concern was that the law should concentrate more on forest than wood;
2. he wanted more communication with the executive branch, this was one obstacle to a faster approval;
3. Law was urgent because the country was in a state of precariousness;
4. his work at the Congress was parallel to the one that MINAE, FUNDECOR, and other think thanks were doing; and
5. The draft law was part of a unanimous report from the commission.

Interview Jorge Rescala Perez

His comments were:
1. Global trends motivated the new law;
2. Many stakeholders participated in the idea and design of the new law;
3. Other senators worried about bureaucratic procedures as an obstacle to PES;
4. The new law was promoted by different political parties; and
5. The bill was unanimously approved.

Interview Oscar Sanchez

His main observations:

1. Importance of previous experience with incentives to developed a better one;
2. Need for a participatory instrument;
3. Importance of the fuel tax to finance the program;
4. pillar are institutions, legal framework and resources; and
5. importance of responsibilities of FONAFIFO, all environmental/forest trust funds were merged into one.

Interview Franz Tattenbach

Among the main points are:
1. Land ownership is critical;
2. To give incentives to private forest owners is better than more public protected areas without budget;
3. Importance of opportunity cost to farmers; and
4. Initial opposition from the forestry industry.