

7-1-2014

# Costa Rica- Planning for Climate Change Through Forward- Looking Policy

Rachel Helen Erickson

Follow this and additional works at: [https://digitalrepository.unm.edu/arch\\_etds](https://digitalrepository.unm.edu/arch_etds)



Part of the [Architecture Commons](#)

---

## Recommended Citation

Erickson, Rachel Helen. "Costa Rica- Planning for Climate Change Through Forward- Looking Policy." (2014).  
[https://digitalrepository.unm.edu/arch\\_etds/16](https://digitalrepository.unm.edu/arch_etds/16)

This Thesis is brought to you for free and open access by the Electronic Theses and Dissertations at UNM Digital Repository. It has been accepted for inclusion in Architecture and Planning ETDs by an authorized administrator of UNM Digital Repository. For more information, please contact [disc@unm.edu](mailto:disc@unm.edu).

Rachel Erickson

*Candidate*

Community and Regional Planning

*Department*

This thesis is approved, and it is acceptable in quality and form for publication:

*Approved by the Thesis Committee:*

Caroline Scruggs, Chairperson

William Fleming

Rebecca Erickson

**COSTA RICA- PLANNING FOR CLIMATE CHANGE THROUGH  
FORWARD-LOOKING POLICY**

**by**

**RACHEL ERICKSON**

**BACHELOR OF ARTS ENVIRONMENTAL PLANNING AND DESIGN**

THESIS

Submitted in Partial Fulfillment of the  
Requirements for the Degree of

**Master of Arts  
Community and Regional Planning**

The University of New Mexico  
Albuquerque, New Mexico

**August, 2014**

## **Abstract**

Using Costa Rica as an example, this paper will address the problem of climate change and analyze the strengths and weaknesses of the climate change planning policies that are utilized in Costa Rica. This study reveals how the Costa Rican government has been proactive in terms of its climate change policies. The Costa Rican government has always been an active participant in international conferences on climate change. Costa Rica aims for carbon neutrality by the year 2021.

As Costa Rica is so far ahead in terms of developing effective climate policy, other countries can look to Costa Rica as an example. Costa Rica's current policies that address climate change include the National Development Plan (2010-2014), the Forestry Law of 1996, and Costa Rica's Payments for Environmental Services Program (PPSA). The Forestry Law of 1996 listed four environmental services: carbon sequestration, protection of water, biodiversity protection and ecosystem protection. The PPSA is a leading effort that has made great strides in charging water users for ecosystem services.

Though Costa Rica had begun to regain forest before PPSA was implemented, the program has been instrumental in helping Costa Rica rebound to 2.67m ha, or 52.4%, forest cover in 2010. However, the program could be improved with better targeting and the use of undifferentiated payments. Needs include: (1) accounting for land use and its affect on climate change patterns, and (2) collecting data about the extent to which the PPSA program is actually generating environmental services.

## Table of Contents

<b>Chapter 1 – Introduction.....</b>	<b>1</b>
The Problem.....	2
Who Does Climate Change Affect? .....	2
Response and Planning .....	3
Why This Study Matters to Me .....	4
Deliverables/Outcomes .....	5
<b>Chapter 2 – Literature Review .....</b>	<b>6</b>
Contextualizing the Climate Change Problem .....	6
Climate Change Planning .....	8
Evolution of Climate Change Policies in Costa Rica .....	8
Economic Benefits of Environmental Services .....	14
Recent Trends in Climate Policy in Costa Rica .....	17
<b>Chapter 3 – Data and Methods .....</b>	<b>20</b>
Framing This Study .....	20
Methods .....	20
Presentation of Data and Analysis .....	21
<b>Chapter 4 – Costa Rica’s Recent History with Climate Change Policy .....</b>	<b>22</b>
Policy .....	22
Carbon Neutrality .....	24
<b>Chapter 5 – A Planning Analysis of the Strengths and Weaknesses of Costa Rica’s Current Climate Policies and Practices .....</b>	<b>28</b>
What the Costa Rican Government Has Done Right .....	28
Ways In Which Costa Rica’s Climate Policies Could Be Improved .....	29
<b>Chapter 6 – Recommendations and Conclusions.....</b>	<b>32</b>
Costa Rican Policies that Address Climate Change .....	32
Policy Impact- What Costa Rica Has Achieved So Far .....	32
How Ecological Services of Green Space Have Been Quantified .....	33
Results of Payment for Ecosystem Services (PES) Payments .....	35
Costa Rica Impacting Policies Around the Globe.....	36
Lessons for the United States .....	36

Recommendations for Enhancing the Implementation of Costa Rica's Policies...41

**Glossary- Abbreviations and Acronyms..... 45**

**List of References .....46**

## **Chapter 1-Introduction**

Costa Rica provides an important example of environmental policies related to climate change. In this thesis, I examine climate change mitigation planning and current climate change policies in Costa Rica. Further, I explain how Costa Rica's policies on climate change can help to inform the creation of new policies in other countries, or make existing policies more effective.

The Costa Rican Government has been very active in what is known as "the carbon market." The carbon market allows other countries to buy emissions reductions through permit trading, therefore allowing countries to meet obligations for reduced emissions under the Kyoto Protocol. The Costa Rican government has also been very active in dealing with climate change through landowner actions and groundbreaking policies that establish national reserves and support sustainable living practices. Costa Rica is at the forefront of ecotourism, defined as "responsible travel to natural areas that conserves the environment and improves the well-being of local people" (TIES, 1990).

Two major examples of ecotourism in Costa Rica are the establishment of extensive national parks and reserves through visitor fees, and support of sustainable living practices through stays at secluded eco-lodges. These ecotourism opportunities have allowed the country to stand out as a leader in environmental protection and sustainability. One of the most important and pivotal aspects in the country's climate change planning is the goal of achieving net carbon neutrality by 2021 by taking the necessary actions to reduce its emissions. The climate change efforts on the part of the government of Costa Rica provide an example of what the United States (US) and other countries could consider in terms of effective climate change mitigation.

### ***The Problem***

Current studies reveal the dire extent of climate change and its consequences as critical environmental and social problems. Since the Industrial Revolution, levels of greenhouse gas emissions have increased exponentially, precipitating the Greenhouse Gas Effect, global warming, and rising sea levels. These phenomena have caused, and continue to cause, grave and numerous problems for natural and social worlds alike, and for the entire global ecosystem. I will detail these studies in Chapter 2: Literature Review.

### ***Who does Climate Change Affect?***

Climate change affects everyone and everything on earth. This includes not only humankind, but also every living organism and all of earth's systems. As time moves forward, the problems associated with climate change will only get worse and the effects will become greater (Canale, 2012). These problems are already having a huge impact on how the world ecosystems are functioning.

Beyond the global impact, the problems of climate change disproportionately affect people of lower social and economic status: marginalized segments of society are already disadvantaged and less equipped to handle various severe weather events or other environmental issues that result from climate change. For example, not everyone has the resources to move to a different city or different part of the city when the sea levels rise in the future. Scholars predict that this sea level rise will result in the displacement of the 634 million people who currently live in low-elevation coastal areas worldwide (Greenfieldboyce, 2007). Such a shift will affect everyone living in these areas, as well

as the areas to which they may migrate; but it will have the greatest impact on socially, economically, and politically disadvantaged groups (Canale, 2012).

### ***Response and Planning***

Climate change is an important environmental issue that has become a growing concern over the past half-century. It is imperative to understand the processes that are driving climate change and how climate change affects the natural systems on the earth in order to plan for our future. Climate change planning is one of the newer and arguably most important forms of planning. These dramatic changes in climate conditions are happening at ever increasing rates; it is inevitable that the future will be shaped by our climate change planning actions today.

The logical and necessary response is to reduce our greenhouse gas emissions and transition to ways of living and technologies that are associated with lesser (or, preferably zero) emissions of green house gases. Choosing to live in a city and in an apartment instead of a suburban house, using public transportation or riding a bike instead of driving a car, and telecommuting instead of flying are all ways to reduce our greenhouse gas emissions. Shifting energy production to renewable energy sources such as solar and wind would help reduce our greenhouse gas emissions without demanding too radical a change in lifestyle.

In the battle against climate change, adaptation strategies that address and reduce the vulnerability of biological systems to climate change's effects are very important. Climate change mitigation is also very important as a central tactic in taking a proactive approach to climate change and its consequences. Mitigation strategies attempt to

intentionally reduce human-produced greenhouse gas emissions through changes in behavior or technology.

Ultimately, it is reasonable for all of us to be accountable and responsible for our actions. It is important for people to realize that their behaviors not only affect them personally or in small circles, but that their actions ripple out and affect every other living thing and natural system on earth.

### ***Why This Study Matters to Me***

This project matters to me personally because I am passionate about earth systems and processes. I am fascinated by how the natural environment works- it is so incredible that this planet has been able to sustain so many different species of plants and animals. I am also invested in designing, planning and enacting responsible human practices that harmonize with those earth systems and processes. I am passionate about protecting our environment and ecologies for our continued use and especially for future generations' use. The growing evidence of climate change's negative impacts on biodiversity is undeniable. As a planner and a global citizen, I want to contribute to creation of a future that is sustainable and viable for future generations. I want to help create a future where the world is still thriving for my grandchildren and great-grandchildren, not one where shortsighted, unrestrained human actions have made it unlivable.

I also have had a deep connection to Costa Rica ever since I was fortunate enough to travel there for a month in the summer of 2007. I volunteered on a bird-banding project in Kèköldi, which is located on the southern Caribbean coast. Kèköldi is one of the most beautiful places that I've ever been- it is incredibly lush and green! My project

group stayed in the Kèköldi Scientific Center in the middle of the jungle. I loved getting to see all of the gorgeous birds; I especially loved holding the hummingbirds as we logged them all. I then traveled around the rest of the country, examining the beauty of cloud forests and quetzal birds in Monteverde, enjoying hot springs heated by the Arenal volcano, exploring a jungle in a kayak and riding on horseback through a coffee plantation. I am grateful for Costa Rica's leadership in setting an example for effective climate change planning efforts.

### ***Deliverables/Outcomes***

This study will summarize the current climate change mitigation policies in Costa Rica, which will inform recommendations for strategies of implementation in the U.S. The study will analyze the positive and negative parts of these policies, as well as provide recommendations for correcting some of these issues. The purpose of this paper is to meaningfully address and communicate climate change issues and planning in a way that is accessible to a wide audience.

Climate change is one of the largest environmental and social issues of my lifetime. It is important to look for examples like Costa Rica that can help the US deal with specific climate change issues in effective and practical ways.

## **Chapter 2 Literature Review**

A great deal of literature from many fields has explored and documented the causes and effects of climate change. The parts of the literature that are most relevant for this study are general knowledge about climate change, the evolution of climate change policies within Costa Rica, and the economic benefit of ecosystem services. Current news coverage in the mainstream media relating to climate change policies in Costa Rica also helps to inform this thesis.

### ***Contextualizing the Climate Change Problem***

Climate change is the dramatic shift in weather patterns and climate zones that has been caused by human actions such as land use change, urbanization, deforestation, industrialization, fossil fuel burning, transport, energy production and electricity (Canale, 2012). These human activities have created carbon cycle disturbances and huge amounts of greenhouse gas (GHG) emissions (specifically, carbon dioxide, methane and nitrogen dioxide). These have fueled the greenhouse gas effect, which has in turn caused global warming and sea level rise (Canale, 2012).

Climate change emerged as a social and environmental problem around the time of the industrial revolution. The intense rate of inventions and production began the trend of increasing human-induced greenhouse gas emissions. The main issue is that the greenhouse gases that we emit as a byproduct of our daily actions in the modern industrialized world are being collected in the atmosphere at ever increasing concentrations. These collected gases are extremely damaging: they have fueled the greenhouse gas effect, which has in turn caused global warming and sea level rise

(Castro, 2000; Galland, 2012; Ringhofer, 2013; Subak, 1999; Pielke, 2002; Nolan, 2007; Greenfieldboyce, 2007).

Global warming, one of the major effects of the increased greenhouse gas emissions, is causing the ice caps to melt, precipitation patterns to change, and cloud cover to change. Resulting changes in water temperature and salinity is causing ocean circulation system upheaval (Castro, 2000). These changes are creating abrupt climate change, monsoon disturbances and Gulf Stream modification. Major threats and concerns are associated with sea level rise. This includes but is not limited to: increasing environmental disasters, environmental refugees, animal and human casualties, spreading of diseases, instability in subsistence farming and fishing, and economic and biodiversity losses (Canale, 2012).

At the UN Climate Change Conference in Copenhagen in 2009, a giant multi-media art installation was unveiled, which shows what one metric ton of carbon dioxide (CO<sub>2</sub>) looks like. Figure 1 is a picture of the UN Climate Change Conference art installation of one ton of CO<sub>2</sub>. Measured and stored at standard atmospheric pressure, one ton of CO<sub>2</sub> occupies a cube the size of a three-story building: 8.2m x 8.2m x 8.2m (27ft x 27ft x 27ft). This is the amount of CO<sub>2</sub> the average person in an industrialized country emits each month (UNEP, 2009).



Figure 1- Measured and stored at standard atmospheric pressure, one ton of CO<sub>2</sub> occupies a cube the size of a three-story building: 8.2m x 8.2m x 8.2m (27ft x 27ft x 27ft). Photo taken from UNEP (2009)

### ***Climate Change Planning***

The importance of incorporating both bottom-up and top-down approaches to climate change planning has been well documented (Sabatier, 1986, Fraser, 2006). In order to make truly effective progress on climate change it will be important to build support on the ground level- strengthening bottom-up initiatives - as well as strengthen existing protocols- top-down approaches, such as the Kyoto Protocol and the EU Emissions Trading Scheme. Climate change is not confined to political boundaries and as such requires action from both grass roots organizations as well as cooperating governmental agencies on all levels (Dirix, 2013).

### ***Evolution of Climate Change Policies in Costa Rica***

Costa Rica is an interesting place for a case study in climate change policy, in part because it has undergone a well-documented and dramatic loss of forest that began around 1947. Deforestation rates peaked in Costa Rica during the 1970's at 50,000

hectares (ha) per year (that is over 1% per year). By the mid 1980's less than one-third of Costa Rica was under dense forest cover (Umaña, 2007). Because of this intensive forest loss there has been active government engagement, including a series of incentives beginning in 1972. One of the strategies of this approach was to implement a system of payment for ecosystem services (PES), which was initiated in 1985. By 1997 Costa Rica was the only developing country in the world to have made a turnaround in forest loss. Figure 2 shows the changes in forest cover in the country of Costa Rica from 1940 to 1997. Forest cover was the most abundant in 1940 and 1950. Forest cover was at a minimum in 1983, but rebounded a little by 1997.

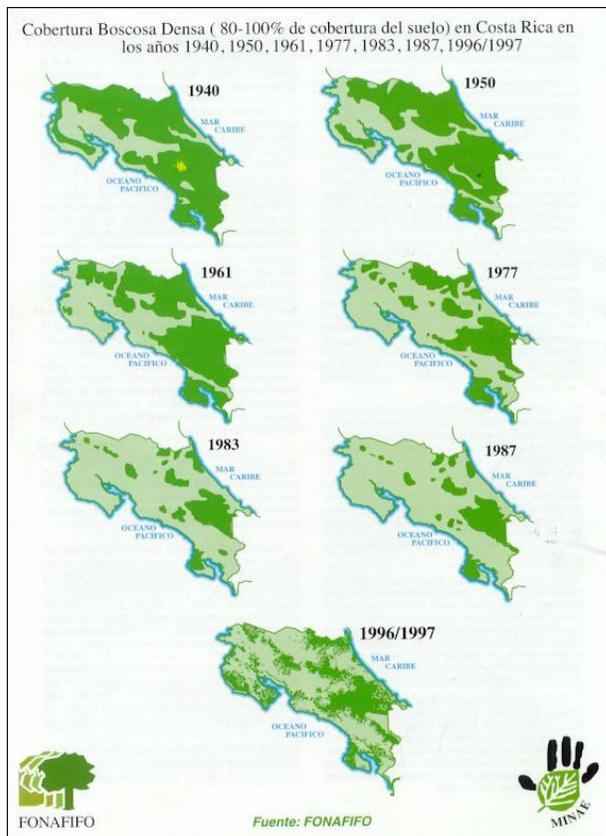


Figure 2. Forest cover changes in Costa Rica from 1940 to 1997 (Source: FONAFIFO 2001).

Costa Rica's Forestry Act of 1969 initiated a set of incentive based policies that were not implemented until a decade later. In 1979 there was a \$2,000 per ha incentive to reforest. Forestry Law in Costa Rica has changed a number of times since its original inception (in 1986, 1990, and 1996). There was a new system of incentives implemented by the Environment Ministry starting in 1988, which included tax breaks, targeted grants and PES. In the last 41 years the government tried a number of different financial mechanisms, including soft loans, designated trust funds, tax breaks and different types of grants (Chomitz, 1998).

The Costa Rican Government created the Forestry Development Fund (FDF) in 1989 with proceeds from a Dutch debt-swap. The most important feature in the present FDF system is that it instituted a 3% tax on fuels, which goes to fund PES. The first generation of forest incentives that were effective from 1979 to 1996 had a number of positive results. These results included over 204,000 hectares (ha) of forest planted or managed. Several different mechanisms were used to obtain these 204,000 ha of forest (Umaña, 2007):

- Forest Bond Incentives (CAFs) accounted for 45,500 ha
- Advanced payment CAFs accounted for 40,750 ha
- Forest Management CAFs accounted for 45,200 ha
- Forest Development Fund accounted for 12,800 ha
- Forest Protection Certification (CPBs) accounted for 22,000 ha
- Income tax deduction accounted for 35,000 ha

The Foundation for the Development of the Central Volcanic (FUNDECOR) was founded in 1989. FUNDECOR is a private not for profit NGO, created by the Costa

Rican Government and aid money from the US, that “believes conservation and development complement each other and should coexist in harmony” (Tattenbach, 2006). The development of payment for environmental services is a FUNDECOR pilot program that began in 1991. Forestry Law of 1996 ratifies National Forestry Financing Fund (*Fondo Nacional de Financiamiento Forestal* -FONAFIFO) and payment for environmental services (Umaña, 2007). FONAFIFO’s main objective is to “finance the management of existing forests, reforestation processes, forestation, forestry nurseries, agroforestry systems, recovery of denuded areas and technological changes for the use and industrialization of forestry resources for the benefit of small- and medium-sized land owners” (REDD, 2014).

Some of the positive things that have stemmed from FONAFIFO include that in 1997 Norway purchased 200,000 tons of carbon from Costa Rica at \$10/ton and thus \$2 million went to fund PES. The fuel tax negotiation yielded its first results in 1998. In three years more than 200,000 ha were reforested, protected or put under sustainable management (Umaña, 2007). FONAFIFO has an annual budget of approximately \$15 million from timber and fuel taxes, international cooperation and the sale of credits (REDD, 2014).

Second generation incentives include a FONAFIFO mandate for management of PES for the government. FONAFIFO was created as a fund with an autonomous board that includes the private sector. Initially there were four services that were provided by forest ecosystems: greenhouse gas mitigation, protection of water, conservation of biodiversity and scenic beauty. The beneficiaries are private landowners and systems of protected areas (SINAC). SINAC is the acronym for Costa Rica’s National System of

Conservation Areas. Reducing Emissions from Deforestation and Forest Degradation (REDD) is “an attempt of linking reducing emissions from avoided deforestation and degradation to international carbon markets, and sustainable forest management” (Ringhofer et al., 2013). Within Costa Rica’s Payments for Ecosystem Services Programme (PPSA) and REDD, SINAC's two main roles are: “(i) monitoring and controlling deforestation and verifying that the owners of private forest have complied with their forest management plan and (ii) mapping forest cover and preparing the forest inventory” (REDD, 2014).

The first decade of PES resulted in FONAFIFO managing over \$110 million dollars and the protection of 400,000 ha, which amounts to 8% of total land area in Costa Rica. PES pays a flat rate to farmers and landowners to encourage conservation, reforestation and sustainable management. From 1995 to 2007 close to 8,000 landowners have benefited financially from PES. Multiple funding sources for PES have been developed including projects, market instruments and agreements with business (Umaña, 2007).

The cumulative impact of these efforts is that Costa Rica has provided forest incentives or PES to 12% of its land area. The efforts are responsible for the turnaround in forest cover since 1987. The government has provided support for over two-thirds of the needed resources. Two large loans from eco-markets (markets that trade permits or credits related to ecosystem services) (\$30 million) and a grant called Scaling-Up PSA (\$90 million) from the World Bank have been the main sources of support (Umaña, 2007).

Table 3 shows the total area of land under PES by year from 1997 to 2001, as well as the contract type (forest conservation easements, sustainable forest management and reforestation) and the number of participants. The largest numbers of contracts were awarded in 1997 (1,531), with fewer and fewer contracts being awarded each passing year. Forest conservation easements make up the majority of PES contracts regardless of year. With the exception of the year 2000, sustainable forest management is the second most utilized contract type, making reforestation the least utilized of PES contracts from 1997 to 2001. In the year 2000 there were 0 sustainable forest management contracts.

Table 3. Total area and number of participants by PES contract type and year (Malavasi, 2014).

Year	Forest Conservation Easements	Sustainable Forest Management	Reforestation	Total	Number of contracts
<b>1997</b>	<b>88,829.8</b>	<b>9,324.5</b>	<b>4,629.4</b>	<b>102,783.7</b>	<b>1,531</b>
<b>1998</b>	<b>47,803.8</b>	<b>7,620.4</b>	<b>4,172.5</b>	<b>59,915.7</b>	<b>1,021</b>
<b>1999</b>	<b>55,776.0</b>	<b>5,124.8</b>	<b>3,156.0</b>	<b>64,782.0</b>	<b>925</b>
<b>2000</b>	<b>26,583.2</b>	<b>0</b>	<b>2,456.8</b>	<b>29,040.0</b>	<b>501</b>
<b>2001</b>	<b>20,629.0</b>	<b>3,997.0</b>	<b>3,281.0</b>	<b>27,997.0</b>	<b>483</b>
Total	<b>23,9621.8</b>	<b>26,066.7</b>	<b>17,695.7</b>	<b>283,384.2</b>	4,461
%	<b>84.6%</b>	<b>9.2%</b>	<b>6.2%</b>		

Climate policies have had a large effect on the country of Costa Rica. Before the Rio+20 Conference and the Framework Convention on Climate Change (FCCC) the main concern was the loss of forest cover in Costa Rica. Forestry was always seen as the key to mitigation because of Costa Rica's low levels of emissions from transportation and energy production. In the Kyoto protocol the inclusion of a useful definition of forest management itself took a lot of negotiations (Rotherham, 2003). Costa Rica pushed for the inclusion of forest carbon management in the FCCC and the Kyoto protocol but was unsuccessful. Forest carbon management is a technique that includes among other

management techniques, avoiding deforestation (Rotherham, 2003). Deforestation in Costa Rica accounts for 25% of carbon emissions. As a way to help reduce emissions the Clean Development Mechanism (CDM) is used. The CDM is an arrangement made under the Kyoto protocol that creates emissions reduction credits through emissions reduction projects in developing countries. CDM included mostly energy and forestry plantations, but not avoided deforestation.

Costa Rica is a good example of a country that focuses on climate change and utilizes policies for future international climate change compacts and agreements. Costa Rica is the only developing country to have adopted a “carbon tax;” this was done over two decades ago. Revenues from the carbon tax go to buy forest carbon (i.e., carbon sequestration or emissions reduction potential of forests) from private landowners. Costa Rica is the largest buyer of forest carbon in the world. Costa Rica is one of the few countries to adopt a national PES, along with Honduras, Mexico and Ecuador (FONAFIFO, 2012). Costa Rica also has a very forward thinking Carbon-Neutral Initiative (Umaña, 2007). The goal of Costa Rica’s Carbon- Neutral Initiative is for the country to become a carbon neutral by 2021. This means that Costa Rica will take necessary actions to reduce emissions in order to reach net carbon neutrality.

### ***Economic benefits of Environmental Services***

Putting a price tag on environmental and ecosystem services is an important step in protecting these services for the future. For far too long people have regarded ecological goods as free and have treated them as such, with very little forethought. It is important to catalog the sources and the consumers of the ecosystem services, as well as

local, regional and global service flows (Daily et al, 2000). Table 4 shows the types of benefits that are gained from ecosystem services including sustainable wood production, hydropower production potential, water supply, watershed protection, scenic beauty, carbon sequestration and biodiversity. Table 4 also shows who benefits the most, the owner of the land, the country where the land is, and/or the world, from those ecosystem services.

Most of these benefits, with the exception of sustainable wood production, water supply and watershed protection, benefit multiple parties. Scenic beauty, Carbon sequestration and biodiversity are all benefits that affect the owner of the land, the country that the land is in as well as the world.

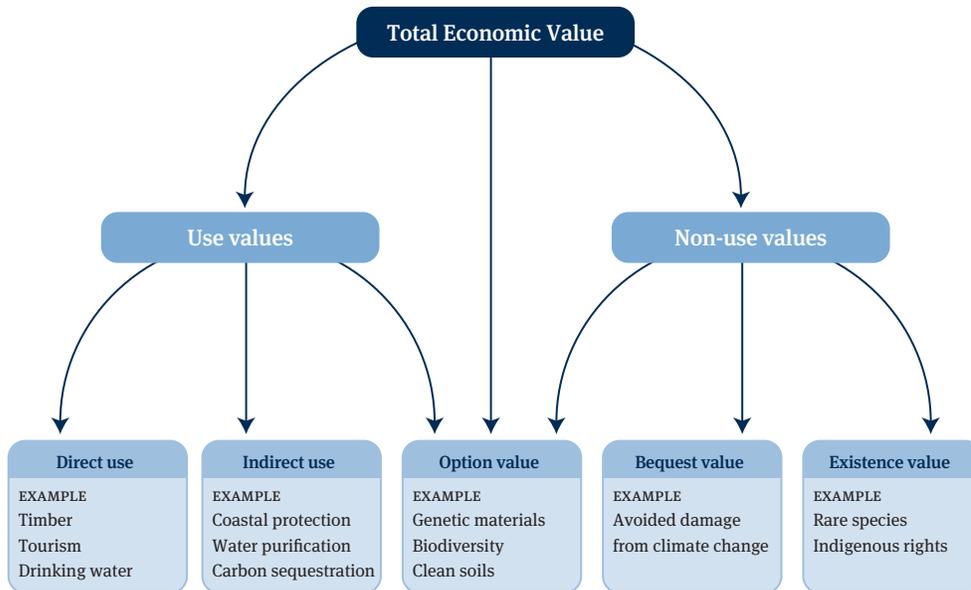
Table 4- Trend towards internalization of benefits from environmental conservation activities in Costa Rica (Castro, 2000).

Types of Benefits	Benefit internalized by:		
	Owner	Country	World
Sustainable wood production	X		
Hydropower production potential	X	X	
Water supply		X	
Watershed protection		X	
Scenic beauty	X	X	X
Carbon sequestration	X	X	X
Biodiversity	X	X	X

Figure 5 shows an example of how to determine the total economic value of ecological services. It is important to look at both use and non-use values when attempting to obtain the total economic value of ecological services. Use values can be divided into three subsections: direct use, indirect use and option value. Non-use values can also be divided into three subsections: option value, bequest value and existence value. The examples

given in these value categories, such as indigenous rights and avoided damage from climate change, show how complex some of these issues are that need to be integrated into the economic valuation.

Figure 5- Valuation of Environment (Slootweg, 2008).



Source: Boukidou et al., 2007

Costa Rica has also formed a partnership with WAVES (Wealth Accounting and the Valuation of Ecosystem Services) in order to help develop tools for green growth in Costa Rica. The WAVES partnership will likely prove to be beneficial for Costa Rica as a country as well as the rest of the world as an example of how to value ecosystem services. A large benefit of the WAVES partnership includes critically evaluating the complex benefits that arrive from protecting and maintaining ecological services around the globe in order to help the global community understand how to value ecosystem services.

For more than 30 years people have been trying to conceptualize natural capital in economic terms. There have been a number of issues however in translating this concept into practical use. A few of these barriers to implementation include: “(i) the lack of internationally agreed methodologies for ecosystem valuation, (ii) a lack of uptake of natural capital accounting by policy makers, especially finance ministers, (iii) capacity limitations in many developing countries, and (iv) lack of leadership in moving ‘beyond GDP (Gross Domestic Product)’ ” (WAVES, 2014). Unless these barriers are removed, the transition of natural capital into economic terms may never happen.

There is critical work being done this year that will help in the goal of translating natural capital into economic terms, including establishing consistent forest cover maps, preparing a forest inventory and establishing a reference level and monitoring system. These will be crucial in furthering the process of determining economic values of ecosystem services in Costa Rica. With the help of these basics it will be much more possible to quantify the ecological services of green space on a countrywide scale.

### ***Recent Trends in Climate Policy in Costa Rica***

On September 10<sup>th</sup>, 2013, an agreement was signed between the Costa Rican government and the Forest Carbon Partnership Facility (FCPF). The FCPF is a “global partnership of governments, businesses, civil society and indigenous peoples focused on reducing emissions from deforestation and forest degradation, forest carbon stock conservation, the sustainable management of forests, and the enhancement of forest carbon stocks in developing countries (activities commonly referred to as REDD+)” (FCP, 2013). The agreement included a purchase of an Emission Reductions Payment Agreement (ERPA) worth \$63 million US dollars (FCPF, 2013).

An ERPA is a transaction type that has standards set by the International Emissions Trading Association, which is a non-profit organization that is dedicated to the establishment of effective systems for trading in greenhouse gas emissions by businesses. An ERPA allows a purchaser to pay a seller an amount of cash in return for carbon credits. These carbon credits allow the buyer to emit additional units of carbon dioxide into the air (Business dictionary, 2013).

In May of 2008 there was a workshop with key members of Costa Rica's Climate Change Working Group in order to discuss the goal of carbon neutrality. There were a number of recommendations that emerged from the workshop that could help the country to reach the ambitious goal of Carbon Neutrality by the year 2021. One recommendation includes taking the time to clearly define "carbon neutrality," as well as the methodology that will be employed to measure emissions. Another significant recommendation was to incorporate an effective biofuels strategy and closely examine the entire transport sector. One large issue that has to be addressed is that as a country Costa Rica attracts a lot of ecotourism, which by its jet fuel consumption alone has as a detrimental effect on the country's emissions equation (Powell, 2008).

In November of 2013 Costa Rica's Environment Minister, René Castro, made a speech at the U.N. Climate Change Conference in Warsaw, Poland introducing a Climate Change Action Plan. Castro is currently serving as president of the U.N.'s Climate Vulnerable Forum (CVF). "The action plan is an international joint plan designed to combat the effects of climate change in the financial, health, human rights, labor, migration and science sectors" (Fendt, 2013). The new action plan is designed to look at the effects of climate change in a number of different sectors. It is important to have a

comprehensive approach to this issue; it is often easier to obtain agreement on small-scale separated issues. Sometimes the larger problem of climate change is ignored because it can create political opposition and complications.

The results of the April 2014 Costa Rican presidential elections are important because the goal of Costa Rica obtaining carbon neutrality by 2021 depends on the actions that the country takes now. In order for Costa Rica's "Carbon Neutrality by 2021" goal to be reached, the winner of the election will have to give it priority. Experts and officials consulted by Inter Press Service news agency acknowledged that, "the government that takes office May 8 will face complex challenges in transport, energy, institutional organization and agriculture in order to meet that (Carbon Neutral by 2021) deadline" (Ortiz, 2014). Experts agree that there are significant changes that need to be made in the transport, energy, institutional organization and agricultural sectors in order to make the Carbon Neutral by 2021 goal a reality. Without a specific plan to address all of these sectors, carbon neutrality will take much longer to achieve, or may not be achieved at all (Ortiz, 2014).

## **Chapter 3- Data & Methods**

### ***Framing this Research study***

The central question that guides my research is: how can Costa Rica's policies on climate change help to inform the creation of effective climate policies in other nations?

The operational questions that will enable me to collect information and perform my analysis are:

- What are the specific policies and overall practices occurring in Costa Rica?
- How can these examples serve as a model for other nations?
- How can environmental benefits be put into economic terms?

These questions will help me to find appropriate information to answer my research question because it will help me to categorize the different approaches and actions to better understand effectiveness and impacts. The information I will use includes any descriptive statistics, information and expertise from organizations, and information about specific places where these policies have been particularly effective at mitigating or adapting to climate change.

### ***Methods***

For this thesis I intend to analyze climate change policies from Costa Rica in order to suggest areas for possible improvement. For this study I will use quantitative and qualitative secondary data sources about Costa Rica. This secondary data will be drawn from reports and articles about the context of climate change and environmental policies in Costa Rica.

Another objective of this thesis is to communicate my findings. I intend to communicate my findings through graphics and figures where possible. This way my findings will be easy to understand and interpret by a wide audience. I hope that my thesis will help not only individuals to understand climate change and policies that address it, but also government officials in all levels to critically evaluate what could work for their jurisdiction based on Costa Rica's example.

### ***Presentation of Data and Analysis***

I will communicate physical and social attributes of climate change-related proposals, design and policy options for my thesis defense and the professional thesis. I will show the relevant data in tables, graphs, charts and maps. I will examine case study information in order to understand the complexity of Costa Rica's system of climate-related policies. Maps and photographs will illuminate the text for my case study of Costa Rica. I intend to fully utilize graphic representations that will make the climate change impacts more relatable and understandable to my audience of classmates, professional planners, interested community members, and environmental scholars. I will graphically represent a way of determining the economic value of the environmental services that are occurring in Costa Rica.

## **Chapter 4 – Costa Rica’s Recent History with Climate Change Policy**

### ***Policy***

Despite the fact that Costa Rica is considered to be a developing country, the country is at the forefront of climate change policy. Costa Rica has created a number of policies as well as economic incentives that help to persuade people to be more forward thinking (including conserving resources, reforestation, etc.).

Forests are an extremely important ecosystem that not only hold incredible amounts of biodiversity, but are also home to many indigenous tribes. It is vital to protect our forests to maintain and care for these resources. Forest ecosystems not only help combat climate change, as they take in carbon dioxide, but they also help to control stormwater runoff, and help with other air quality issues such as reducing particulates in the air.

Worldwide, ecosystems are being protected or restored to control floods, filter water, enhance soil fertility, stabilize climate, offer human enjoyment, and even recycle orange peels. Such efforts are being rewarded with innovative financial mechanisms, whose scope and variety are expected to grow (Daily, 2000).

In practice, valuation of ecosystem assets involves some of the oldest problems in economics: revealing and aggregating preferences, and addressing uncertainty (Daily, 2000). It is important to recognize the value of forests to society. Forests have a number of extremely important ecological and environmental services that they provide, including biodiversity, carbon sequestration, watershed protection as well as ecotourism and scenic values. These valuations have effects at all levels - local, national and global.

The forestry law of 1996 explicitly states that forest ecosystems provide environmental services (Pagiola, 2010). This law that was enacted in 1996 allowed landholders to be compensated for providing certain forest services: carbon fixation, hydrological services, biodiversity protection and the provision of scenic beauty (Chomitz, 1998). These initiatives are generating demand for, and spurring the development of, integrated ecological-economic-social approaches to managing ecosystem assets, and the potential for such approaches is tremendous (Daily, 2000).

The national policies that address climate change include Costa Rica's National Development Plan (2010-2014). Nationally the Costa Rican government is attempting carbon neutrality, as well as a carbon neutral economy. A carbon neutral economy is an economy that has zero net carbon emissions (Ringhofer et al 2013). Costa Rica is attempting to offset all of the carbon that the Costa Rican citizens and ecotourists produce. The plan is that Costa Rica will be able to obtain a carbon neutral economy through a voluntary tax that values carbon at \$10 dollars per ton.

Costa Rica has been extremely active in climate change mitigation strategies. "Costa Rica's Climate Change Mitigation actions include (a) *emission reductions by source* (i.e. energy, transportation, agriculture and land-use), (b) *carbon sinks enhancement* through reforestation and natural forest regeneration, as well as avoided deforestation, and (c) *carbon markets* development at the local and international level through PES schemes" (Ringhofer et al, 2013). These mitigation actions in combination have helped Costa Rica to be a leader in climate change planning.

PSA (*Pagos por Servicios Ambientales, or Payments for Environmental Services*) is a broad term that applies around the world, whereas the PPSA is Costa Rica's

Payments for Ecosystem Services Program. Costa Rica was the first country to set up a payment for environmental services using a nation wide system of payments, i.e. the PPSA (Pagiola, 2006). This PPSA is based on older policies that were already being used in Costa Rica. The PPSA program was created in 1997, in order to monetize the environmental services that are provided by Costa Rican forest ecosystems.

The program recognizes that there are “four environmental services that are provided by forest ecosystems: mitigation of greenhouse gas emissions; hydrological services including provision of water for human consumption, irrigation, and energy production; biodiversity conservation; and provision of scenic beauty for recreation and ecotourism” (Pagiola, 2006). These four environmental services show that reducing the levels of greenhouse gases is just a small part of the benefits that we are all getting from the forests of Costa Rica. FONAFIFO has put in time and resources negotiating with water users and there have been a number of agreements because of it. In fact hydroelectric plants are the largest private sector contributors to the PES program (Blackman, 2010).

### ***Carbon Neutrality***

The establishment of a National Climate Change Strategy, which incorporates both mitigation and adaptation techniques, is just one of many proactive initiatives that Costa Rica has put forth. Costa Rica is attempting to become the world’s first carbon neutral country by the year 2021, which will help to commemorate the bicentennial of its independence.

There is skepticism among Costa Ricans and climate scientists regarding the ability of Costa Rica to meet the goal of carbon neutrality by 2021. This skepticism can be seen in the current political climate of the country. There are presidential elections taking place in April 2014 that will have an effect on whether and how policy goals are met. One concern is that neither of the major candidates has discussed the carbon neutrality goal in their campaigns. This important issue not showing up in an extremely crucial election may signify that neither of the candidates has a set action plan for attaining the goal. A large amount of power is held in the political arena and it is extremely important for the issue of carbon neutrality to be continually discussed at the forefront of politics.

Payment for environmental services is the precursor to REDD. “First put forward in 2003, REDD links reducing emissions from avoided deforestation and degradation to international carbon markets. REDD expanded to include REDD+ in 2007 in order to also cover activities of sustainable forest management. A consensus was reached on the need for implementing national REDD+ schemes based on participatory multi-stakeholder processes. The UNREDD program financially and technically supports the efforts of developing countries to become ‘REDD ready’. To date, the main challenges for implementing REDD policies and programs are: (1) the question of finance, (2) the scale of implementation (i.e. a national, sub national or a nested approach), and (3) the difficulty with establishing correct baseline scenarios” (Ringhofer, 2013). These challenges can be addressed and rectified by careful planning and preparation through UNREDD in order to be able to fully implement REDD throughout the world.

As Costa Rica is so far ahead in terms of developing effective climate policy, other countries can look to Costa Rica as an example as REDD/REDD+ policies are being developed. Ringhofer et al. (2013) examine the concept of REDD/REDD+ in detail. The authors describe REDD as “an attempt of linking reducing emissions from avoided deforestation and degradation to international carbon markets.” They state that REDD+ deals with “reducing emissions from deforestation and forest degradation in developing countries and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries” (UN-REDD, 2009).

REDD+ is a climate change mitigation solution that is currently being developed and supported by many initiatives, including the UN-REDD program. “Other multilateral REDD+ initiatives include the Forest Carbon Partnership Fund (FCPF) and Forest Investment Program (FIP) hosted by The World Bank” (UN-REDD, 2009). These initiatives are ongoing. In 2014 work will be done to standardize historical forest cover maps, prepare a forest inventory and establish a reference level and monitoring system (REDD, 2014).

Costa Rica has been engaged in the international conversation about climate change since the beginning of UN conferences on the subject. The international policies that address climate change include the Kyoto protocol as well as the follow up policies that have been ratified at the international UN conventions on climate change, such as the Bali road map, and the Cancun agreements (UN-REDD, 2009).

Costa Rica has also formed a partnership with WAVES (Wealth Accounting and the Valuation of Ecosystem Services) in order to help develop tools for green growth in Costa Rica. The partnership with WAVES will “promote the valuation of natural capital,

ecosystem services, and integrated economic-environmental accounting to generate accurate information on the current use of natural resources for national policy planning. WAVES will expand available information and indicators to monitor the progress of specific policy action at regional or national levels” (WAVES, 2014). WAVES will also help to improve the analytical and decision-making tools for green growth in Costa Rica.

## **Chapter 5 – A Planning Analysis of the Strengths and Weaknesses of Costa Rica’s Current Climate Policies and Practices**

An analysis of policies that are currently being implemented in the country of Costa Rica has shown that Costa Rica is doing an effective job of utilizing policy tools to protect forest ecosystems and working towards carbon neutrality, and could be cited as an example of how climate change planning can be accomplished effectively.

### ***What the Costa Rican Government has done right:***

1. The policy analysis shows that the Costa Rican government is at the forefront of climate change planning. The Costa Rican government has always been an active participant in international conferences on climate change. All of the past and current climate change policies aim to do what is best not only for the country of Costa Rica, but also for the larger global community.
2. The Costa Rican government has done a lot of things very well in terms of climate change policies. For example the PSA has been able to make great strides in terms of charging water users for ecosystem services (Pagiola, 2006). Publicly owned hydroelectricity plants are the largest contributors to user financing, followed by privately owned hydroelectricity plants (Blackman, 2010).
3. The aim for carbon neutrality by the year 2021 is proceeding well. René Castro, the environment and energy (MINAE) minister, made an

announcement in February 2014 that “plans for carbon neutrality have gone forward 75 to 80 percent.”

***Ways in Which Costa Rica’s Climate Policies Could Be Improved:***

While these policies have been effective, there remain a few opportunities for improvement. Two policy analysts, Pielke (2002) and Carranza (2013), identify one of the largest issues being that there is no accounting for land use and its effect on climate change patterns. Pielke (2002) talks about this in terms of land use country wide, whereas Carranza (2013) talks about it in terms of importance of coastal land use management. There is a need for increased awareness and incorporation of the complete picture of human induced climate change into the policies in Costa Rica. It is important to realize which economic sectors (electricity, transportation, industry, agriculture, commercial and residential) have the largest effects on greenhouse gas emissions in order to decrease emissions from the biggest problem sectors to fully and effectively address climate change.

Even with its vast strides there a few areas where Costa Rica could put more effort, particularly regarding upgrades to the transport system, which accounts for the majority of the country’s carbon emissions. Costa Rica’s transport system is very dependent on fossil fuel; it consists of hundreds of bus lines and a recently restored railway that links the major cities (Ortiz, 2014). This system also incorporates taxis in metropolitan areas and airlines that fly both internationally and within Costa Rica itself (World headquarters, 2014). Proposals of upgrades to Costa Rica’s transportation sector

include an electric railway in the capital city as well as renewed bus and taxi fleets (Ortiz, 2014).

Pagiola (2006) examines Costa Rica's payments for environmental services, as specified in its PSA program, in detail. The author found a number of things that could be improved in the current system, such as better targeting and the use of undifferentiated payments. The author also examines whether or not environmental services have been created to see if the program has been effective. Pagiola found that there is a lack of data about the extent to which the PSA program is actually generating environmental services. In fact only one PSA project has been monitored to understand its impact on biodiversity conservation and carbon sequestration (Pagiola, 2006).

Another issue Pagiola (2006) mentions is that the PSA has inherent flaws that transferred because of the continued use of older policies, which were developed in the 1970s over concern of dwindling timber supplies. These policies led Costa Rica to provide incentives for timber plantations in the form of tax breaks and then later using Forest Credit Certificates (Certificado de Abono Forestal, CAF). In 1995 an important shift occurred with the introduction of the Forest Protection Certificate (Certificado para la Protección del Bosque, CPB). The introduction of the CPB demonstrated a shift from incentivizing timber production to incentivizing forest conservation. However, these older policies that centered on timber production carried with them an undifferentiated payment scheme as well as a lack of targeting incentives to address where these new policies can do the most good. For example, while the PSA program has been very good at charging water users, the program is less effective at charging users of biodiversity in

terms of biodiversity and carbon sequestration. These issues can be slowly adjusted through time as these policies evolve.

One other large issue is that the interest in participating in these programs is greater than what the available funding will allow. FONAFIFO has a long waiting list of applicants that want to enroll in the PSA program. There is more possible good that could be done if there were more funds from companies and taxes being invested in these payment programs (Pagiola, 2006).

The PSA program has been criticized for its inability to reach smaller landowners and lower income communities. The program is built on land ownership and focuses on the management of forest ecosystems. The PSA program also has large transaction costs. Grazing and some other traditional uses are not recognized or financially encouraged. There have also been issues with land being planted with non-native species that will be cut in a few years time. This is not an effective way to deal with carbon sequestration in the long term.

In the carbon neutrality 2021 plan it is important to realize that Costa Rica's transport sector accounts for 42 percent of the national CO<sub>2</sub> emissions (Ortiz, 2014). There will need to be significant improvements in the transport sector in order to achieve carbon neutrality. As time moves forward priority will be to reduce Costa Rica's dependence on fossil fuels and to modernize the now obsolete public transportation system. Some of the proposals include an electric railway in the capital city as well as renewed bus and taxi fleets (Ortiz, 2014).

## **Chapter 6- Recommendations and Conclusion**

### ***Costa Rican Policies that Address Climate Change***

Climate change is integral in Costa Rica's National Development Plan (2010-2014) and the PPSA. The National Development Plan calls "environment and land-use planning" one of its four national priorities for 2010-2014. The PPSA consists of putting a value on ecosystem services, creating new global funding sources, and identifying champions for the national policy and a managing institution to drive the program.

Costa Rica has pioneered incorporating sustainable development into national level decision-making. Costa Rica utilizes several strategies relating to sustainable development including (but not limited to): the Biodiversity Strategy, Biological Corridor, Law 7779 on Use and Management of Soil Conservation, National Plan of Environmental Policy, the National Plan to Reduce Poverty, and the Plan for Equal Opportunities between Men and Women (IISD, 2004). The Figueres administration and Capacity 21 helped to establish national institutions that uphold sustainable development principles regardless of the political agendas of elected officials (IISD, 2004).

### ***Impact of Policies- What Costa Rica Has Achieved so Far***

Though Costa Rica had begun to regain forest before PPSA was implemented, the program has been instrumental in helping Costa Rica rebound to 2.67m ha, or 52.4%, forest cover in 2010 (FONAFIFO, 2012). The reduction of greenhouse gas is directly tied to forest cover. For example, Table 6 shows measured carbon offsets from the Virilla basin in Costa Rica. With 2000 protected ha, there is a stock of carbon of 67 t/c in the forest. Adding in the deforestation rate of 7.5% per year, the estimated annual carbon

fixation is 2 t/c/ha in the Virilla basin. This means that every year 2 tons (or cubes, referring back to Figure 1) of carbon are fixated per hectare in the Virilla basin.

Table 6-Carbon offsets from Forest Protection (Subak, 2000)

<b>Factors</b>	<b>Amount</b>
Protected area (accumulated hectares)	2000
Stock of carbon in forest (t/c)	67
Deforestation rate (% per year)	7.5
Estimated average annual carbon fixation (t/c/ha)	2

***How Ecological Services of Green Space have been quantified***

The ecological services of green space have been quantified in a number of different ways. Table 7 shows one example of the estimated environmental value of primary forests based on the type of benefit that the forest is providing.

Table 7-Estimated environmental values of primary forests, in 1989, \$US/ha (Castro, 2000)

<b>Type of Benefit</b>	<b>Average Annual Value</b>
<b>1. Hydrologic benefits</b>	
a) water supply for urban centers	2.3 - 4.6
b) loss of hydroelectric production potential	10 - 20
c) protection of agricultural land	0.25 - 2.0
d) flood control	4 - 9
<b>Total</b>	~17 - 36
<b>2. Carbon sequestration</b>	60 - 120
<b>3. Ecotourism</b> (non-consumptive use values)	~13 - 25
<b>4. Future pharmaceuticals</b> (option values)	0.15
<b>5. Funds transfers</b> (existence and option values)	~13 - 32
<b>Total</b>	~102 - 214
Net present value at 8%	~1277 - 2671

As seen from the table, these benefits include: 1) hydrological benefits (e.g., water supply for urban centers, loss of hydroelectric production potential, and protection of agricultural land and flood control); 2) carbon sequestration; 3) ecotourism; 4) future pharmaceuticals; and 5) funds transfers. Table 7 shows the benefit that has the largest

average annual value is carbon sequestration at \$60-120 (in 1989 US dollars) per hectare, while the benefit that has the smallest average annual value is future pharmaceuticals at \$0.15 (in 1989 US dollars) per hectare.

Table 8 shows the minimum, medium, maximum potential total annual cost (\$ US/ ha) to the Government of Costa Rica to compensate landowners for the four environmental services listed in the Forestry Law of 1996: carbon sequestration, protection of water, biodiversity protection and ecosystem protection (Castro, 2000). Landowners with primary forest are compensated more than landowners with secondary forests. Similar to Table 7, carbon sequestration has the highest monetary value. Table 8 shows that environmental services are compensated on a scale (minimum, medium and maximum), which allows for more flexibility.

Table 8- Minimum, medium, maximum potential total annual cost (\$ US/ ha) to the Government of Costa Rica to compensate landowners for the four environmental services listed in the Forestry Law of 1996 (taken from Castro, 2000)

Environmental Service	Primary Forest			Secondary Forest		
	(Min.	Med.	Max.)	(Min.	Med.	Max.)
Carbon Sequestration	19	38	57	14.63	29.26	43.89
Protection of water	2.5	5	7.5	1.25	2.5	3.75
Biodiversity protection	5	10	15	3.75	7.5	11.25
Ecosystem protection	2.5	5	7.5	1.25	2.5	3.75
Totals	29	58	87	20.88	41.76	62.64

There is critical work being done this year that will help to make quantifying ecological services easier, including establishing consistent forest cover maps, preparing a forest inventory and establishing a reference level and monitoring system. These will be crucial in furthering the process of determining economic values of ecosystem services in Costa Rica. With the help of these basics it will be much more possible to quantify the ecological services of green space on a countrywide scale.

### ***Results of Payment for Ecological Services Payments***

Referring back to Table 3, one can see that the reach of the PES program has been extensive. In the five years from 1997 to 2001, PES had 4,461 contracts: 84% were Forest Conservation Easements, 9.2% were Sustainable Forest Management, and 6.2% were Reforestation. The total amount of land that was covered in PES contracts over the five-year period was 283,384.2 acres.

The lessons learned through the PES program can be divided into categories; (1) participation agreements; (2) “equity” or social objectives; (3) trade-offs and synergies between multiple benefits; (4) measuring, reporting, and verification; and (5) sustainable finance in PES and REDD+ (FONAFIFO, 2012). It is vital to pay attention to these lessons in order to not replicate ineffective processes. All of these categories are important to the PES system and without addressing potential pitfalls it will be very difficult to enact effective policy.

The main goals of the PSA are to reduce deforestation and increase forest cover. The effect of the PSA on forest cover is small, but statistically significant: between 3 and 10 ha. In a nation wide analysis of the impact of PSA it was found that the PSA has resulted in greater gains in net forest cover, but has not affected deforestation rates (World Bank, 2014).

It was found that 70% of PSA forest protection contracts are on land with strong limitations that are not at all appropriate for agriculture. It was concluded that much of the land under PSA contracts might not have been converted to other uses even in the absence of payments (World Bank, 2014).

### ***Costa Rica Impacting Policies Around the Globe***

As Costa Rica is so far ahead in terms of developing effective climate policy, other countries can look to Costa Rica as an example as REDD/REDD+ policies are being developed. Costa Rica's PES program has been used as a model for many countries around the world. For example while compiling its research on the valuation of ecosystem services the Netherlands used Costa Rica as one of its 10 influential case studies (Slootweg, 2008).

Costa Rica has had the second longest continuous period of democratic stability through a presidential form of government (the US is the first). This strong governmental system has given rise to high quality public policies, which have received high marks in stability, flexibility, coherence, public regard, and policy index (Lehoucq, 2010). Costa Rica has driven the internalization of benefits from environmental services specified in new legislation, created markets to pay for them, and channeled the revenue into the hands of landowners who conserve or reforest their land as well as conservation organizations (Castro, 2000).

### ***Lessons for the United States:***

While these policies are working well in Costa Rica they may not be easy to replicate in other countries around the world. For instance there are key differences between the US and Costa Rica that will make replication difficult. In the US there are large amounts of funds and resources put towards the US armed forces, representing a large part of the US economy. In order for there to be a strong and effective PES system in the US there may need to be a shift in funds from military spending toward

environmental protection. This would likely require a much larger nation-wide paradigm shift from capitalistic and conqueror mentalities to socialist and stewardship mentalities than the US would be willing to make.

Costa Rica has grown in a socialist type structure where resources are shared and utilized by residents of both lower and higher social and economic statuses. The fact that Costa Rica has no army allows the funds that would be caught up in a large military structure to be invested in ecosystem protection instead. This choice demonstrates that Costa Ricans priorities and mentalities are very different from those found in the United States (US).

The US Environmental Protection Agency is currently utilizing regulatory initiatives (such as incorporating carbon pollution standards for the power industry and the first greenhouse gas regulations for heavy duty engines and vehicles) and voluntary programs where the Agency has partnered and created programs with numerous industries and public sector groups (EPA, 2013). The US is also involved in partnerships around climate change at local, tribal, state and international levels. These partnerships are able to address climate change in different ways (green power, methane reduction, water conservation through efficient appliances, etc.) (EPA, 2013).

While there is positive movement on climate-related initiatives in the US, much more could be done regarding comprehensive climate policy. For example, it is vitally important to have national or state level comprehensive land use planning in order to curb GHG emissions. Land use development can be planned to decrease GHG emissions by decreasing the distances that people have to drive. It is vitally important to shift regulations to require smarter development in order to avoid a situation of very high

emissions in the future (Canale, 2012). Urban sprawl is one of the main land use causes of GHG emissions in the US (Nolan, 2007).

Transportation is a significant contributor to GHG emissions in the US. Approximately eighty percent of the carbon dioxide emissions in the US come from the transportation sector (Canale, 2012). This signifies that transportation is both a huge problem and a huge opportunity. If there can be reductions made in the transportation sector, then as a country we have more of a chance to meet potential post-Kyoto protocol emissions standards, which are designed to counter the effects of climate change.

Costa Rica is a good guide for the US in terms of complying with and ratifying international agreements. Since the beginning of global conferences about the climate change problem, the US has not been an active participant. The US has failed to sign the Kyoto Protocol and promise to reduce emission levels, thus perpetuating the problem. The US should acknowledge its role on the global stage and step up to a leadership position in this battle against climate change.

The US needs to take responsibility for the role it has played and continues to play in the present climate change problem. The US should consider ratifying the next international agreement or protocol in order to create trust and community on the world stage. The US is one of the world's largest economies and the second largest greenhouse gas emitter after China; therefore it is crucial to have the US participation in climate change agreements (Bang, 2012). There is support for creating an internationally accepted "beyond Kyoto Protocol" cap and trade system. This system could stem from Kyoto's cap- and- trade mechanisms into a global market (Wicke, 2006). Again the US

should consider becoming an active participant in order to make such a system as effective as possible.

The inaction of the US has had serious and lasting implications on global dynamics in conversations on climate change. Large and growing emitters in the developing world, India and China, have used US reluctance to argue against any carbon constraints on their economies (Moslener, 2008). While the US has done shockingly little with international agreements there has been progress at the local, state and national levels within the US government. These efforts give hope that there will soon be improvements made to US climate change policies (Purvis, 2004).

One of the largest problems with the US not committing to any international agreements is that the US does not take responsibility for its actions. The US is one of the largest contributors to worldwide GHG emissions. Figure 9 below shows the global carbon emission footprint. The countries with the largest carbon emissions are the US and China. Countries that have large carbon emissions are India, Japan and Russia. Costa Rica (one of the pink dots in Figure 9) is one of the smaller carbon emission countries.

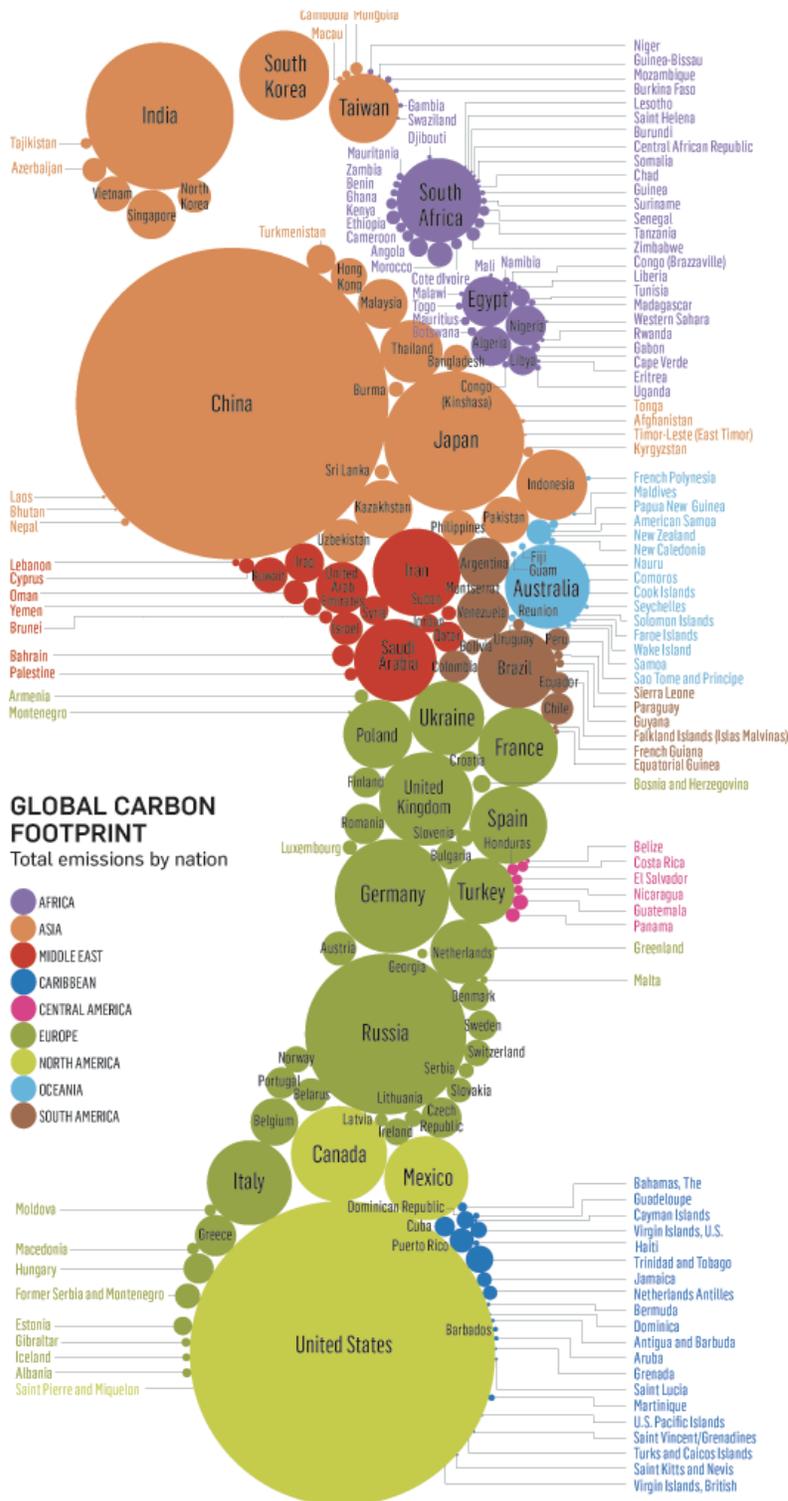


Figure 9- Global Carbon Footprint (Kay, 2010)

Comparing Costa Rica to the state of California in the US would be beneficial and informative. Future studies could consider how California has been able to become a leader in environmental issues without national support in order to help other states follow its example.

There are also a few areas where international agreements can be strengthened. For example any agreement made at a future international convention on climate change needs to take into account where the Kyoto protocol can be improved, such as including forest carbon management and including land use change as an important climate change factor (Pielke et al, 2002). Around the world, countries need to have the opportunity to be compensated for forest cover that already exists. At the moment, countries are not compensated for existing forest cover through international agreements. Costa Rica has made great strides in offering financial incentives for maintaining existing forest through its PSA program.

### ***Recommendations for Enhancing the Implementation of Costa Rica's Policies***

My recommendations for enhancing the implementation of Costa Rica's climate change policies include that there needs to be accounting for land use and its effect on climate change patterns. In this national government funded PES, there needs to be more targeting of payments to providers of important environmental services as well as the use of differentiated payments that will be able to benefit small land owners as well. Right now the PES is a voluntary program, which means that there is little to no control over where the PES is in effect in Costa Rica. There are areas within Costa Rica that have important environmental services that are not enrolled in the PES program because no

one in those areas has volunteered. These areas could be targeted for the program in order to protect the environmental services that they offer. Another recommendation is that there needs to be a large effort to collect data about the extent to which the PSA program is actually generating environmental services.

The PES system consists of putting a value on ecosystem services, creating new global funding sources, and identifying champions for the national policy and a managing institution to drive the program. It is important to adapt the system as lessons are learned and ensure that the people who live in and near the forests benefit from the policy. It is critical to convene international meetings, form cross-party forest groups in the governments of tropical forest nations, produce legislative tool kits and facilitate expert advice. It would also be good to create a development program and explore new financial mechanisms (Bennett, 2009). These ideas can help to implement and create truly effective policies in the face of climate change.

The PSA program has the opportunity to shift public opinion and raise awareness of the value of forests and rewarding good forest stewardship (World Bank, 2014). It is important to create public awareness in order to fully gather support from local community members, which can ultimately drive the success of the PSA program.

It is important to research what the effects are from the self-selection aspect of the PSA program. It is possible that the PSA could have even greater environmental benefits if it were possible to specify where PSA contracts were given. Targeting the PSA could be done instead of letting landowners whose land is less profitable make up the majority of PSA contracts. Future studies should focus on targeting and differential payment systems (Sánchez, 2007).

Deforestation is a major threat to the ecosystems and the biodiversity within Costa Rica. It is imperative to study and target deforestation threats in Costa Rica. These threats need to be addressed in order to have a greater impact on Costa Rica's deforestation rates and to maintain effective climate change policies.

### ***Conclusion***

The most effective policies from Costa Rica, for example the carbon neutral plan and the PPSA program can be utilized as templates by the US. The PPSA program can be used in conjunction with current protection plans. PPSA can combine smaller watershed size protection plans to create national plans and inventories of environmental services.

By following in Costa Rica's footsteps of integrating sustainable development regardless of shifting political forces, the US can make great strides in shifting to a more sustainable economy. The US has had many promising environmental movements, however, the majority of the good done by one administration (in the forms of protective acts or legislation) has been quickly erased by the arrival of the next administration. The US is politically divided on the subject of environmental protection, but it is imperative that party issues do not stand in the way of logical and necessary environmental policies.

The voluntary tax that is at the base of Costa Rica's carbon neutral initiative could also be applied to the US. This tax can be used to offset the amount of carbon dioxide that is produced in the US to move the US toward carbon neutrality. By charging people \$10 for 1 ton of carbon emissions, the US can use that money to buy emission reduction credits from Costa Rica.

The case of Costa Rica is not directly applicable to every situation around the world. The unique legal history and political climate in Costa Rica has made the PES system effective. There are a number of lessons that can be taken and used in other countries. Some important lessons are for countries to: (1) determine a payment level, (2) realize the danger of increasing land's value (which can lead to powerful groups displacing poor and indigenous groups that do not have secure tenure), (3) take local people's needs into account, (4) decide on main actors driving the system, (5) a starting point for developing PES, (6) use various methods of "payment", and (7) use PES to strengthen poverty reduction efforts (Bennett, 2009).

By using these lessons and guidelines the other countries have the opportunity to create an effective payments for ecosystem services program. Even though the PES system may not be directly applicable as a template for other countries, the lessons that are learned through the study of these PES programs can be applied to the US. These lessons can help the US and other countries in creating climate change policies.

The country of Costa Rica has pioneered effective climate change policies and actions. It is important to realize that the case of Costa Rica is not directly applicable to every situation around the world. The exceptional legal history and political climate in Costa Rica has made the PES system and Costa Rica's climate change policies effective. The successes and goals in Costa Rica's climate change policies can help to guide the international community, including the United States, towards a more sustainable future.

## Glossary- Abbreviations and Acronyms

CAF	Forest Credit Certificates (Certificado de Abono Forestal)
CBP	Forest Protection Certificate (Certificado para la Protección del Bosque)
CDM	Clean Development Mechanism of the Kyoto Protocol
CVF	Climate Vulnerable Forum
EU	European Union
ERPA	Emission Reductions Payment Agreement
FCCC	Framework Convention on Climate Change
FDF	Forestry Development Fund
FONAFIFO	National Forestry Financing Fund ( <i>Fondo Nacional de Financiamiento Forestal</i> )
FUNDECOR	Foundation for the Development of the Central Volcanic (Region in Costa Rica)
GHG	Green House Gases
Ha	Hectare
MINAET	Ministry of Environment, Energy, and Telecommunications of Costa Rica ( <i>Ministerio de Ambiente, Energía y Telecomunicaciones</i> )
NGO	Non-Governmental Organization
PES	Payment for Ecosystem Services
PSA	<i>Pagos por Servicios Ambientales</i> (Payments for Environmental Services)
PPSA	Costa Rica's Payments for Ecosystem Services Program
REDD	Reduced Emissions from Deforestation and forest Degradation
REDD+	Reduced Emissions from Deforestation and forest Degradation, conservation, sustainable forest management and enhancement of forest carbon stocks
SINAC	Costa Rica's National System of Conservation Areas ( <i>Sistema Nacional de Áreas de Conservación</i> )
T/C	Tons/Carbon
UNFCCC	United Nations Framework Convention on Climate Change
WAVES	Wealth Accounting and the Valuation of Ecosystem Services

## List of References

- Bang, G., Hovi, J., & Sprinz, D. F. (2012). US presidents and the failure to ratify multilateral environmental agreements. *Climate Policy (Earthscan)*, 12(6), 755-763.
- Barton, D., 2013. Payment for ecosystem services: Costa Rica's recipe. International institute for Environment and Development. First Accessed 3/12/14.  
<http://www.iied.org/payments-for-ecosystem-services-costa-rica-s-recipe>
- Bennett, K., Henninger, N. 2009. Payments for Ecosystem Services in Costa Rica and Forestry Law No. 7575- Key Lessons for Legislators. World Resources Institute.
- Bond, P., 2012. Emissions Trading, New Enclosures and Eco-Social Contestation. *Antipode*. Jun2012, Vol. 44 Issue 3, p 684-701. 18p.
- Business Dictionary, 2013. Emissions Reduction Purchase Agreement definition. First accessed 2/20/14. <http://www.businessdictionary.com/definition/Emissions-Reduction-Purchase-Agreement-ERPA.html>
- Canale, J. T., 2012. Putting the Pieces Together: How using cooperative federalism can help solve the climate change puzzle. *Boston College Environmental Affairs Law Review*. 39(2), 391-418.
- Castro, R., Tattenbach, F., Gamez, L., Olson, N. 2000. The Costa Rican Experience with Market Instruments to Mitigate Climate Change and Conserve Biodiversity. *Environmental Monitoring and Assessment*, March 2000, Volume 61, Issue 1, pp 75-92.
- Daily, G. C., Söderqvist, T., Aniyar, S., Arrow, K., Dasgupta, P., Ehrlich, P. R., ... & Walker, B. (2000). The value of nature and the nature of value. *Science (Washington)*, 289(5478), 395-396.
- Dirix, J., Peeters, W., Eyckmans, J., Jones, P., & Sterckx, S. (2013). Strengthening bottom-up and top-down climate governance. *Climate Policy (Earthscan)*, 13(3), 363-383.
- EPA Climate Change website. 2013. First accessed 3/18/14.  
<http://www.epa.gov/climatechange/>
- ERPA definition, 2013. First Accessed 11/28/13.  
<http://www.businessdictionary.com/definition/Emissions-Reduction-Purchase-Agreement-ERPA.html>
- FCPF and Costa Rica Sign Landmark REDD+ Agreement. Sept 10<sup>th</sup>, 2013. Climate Change Policy & Practice. **First accessed 9/14/13.** <http://climate-l.iisd.org/news/fcpf-and-costa-rica-sign-landmark-redd-agreement/>

- FONAFIFO. 2001. Reactivación de la Reforestación Comercial en Costa Rica. Proyecto REFORESTA. Propuesta de Asistencia Técnica y Financiera. MINAE-FONAFIFO. San José, CR.
- FONAFIFO, CONAFOR and Ministry of Environment. 2012. *Lessons Learned for REDD+ from PES and Conservation Incentive Programs. Examples from Costa Rica, Mexico, and Ecuador*. Pp. 164.
- Fraser, E. D., Dougill, A. J., Mabee, W. E., Reed, M., & McAlpine, P. (2006). Bottom up and top down: Analysis of participatory processes for sustainability indicator identification as a pathway to community empowerment and sustainable environmental management. *Journal of environmental management*, 78(2), 114- 127.
- Galland, Grantly; Harrould-Kolieb, Ellycia; Herr, Dorothee. The ocean and climate change policy. *Climate Policy* (Earthscan). 2012, Vol. 12 Issue 6, p 764-771.
- Greenfieldboyce, Nell, 2007. Study: 634 Million People at Risk from Rising Seas. NPR website. <http://www.npr.org/templates/story/story.php?storyId=9162438>
- Hidalgo, H. G., & Alfaro, E. J. (2012). Some physical and socio-economic aspects of climate change in Central America. *Progress In Physical Geography*, 36(3), 379-399.
- International Institute for Sustainable Development (IISD), 2004. National Strategies for Sustainable Development: Challenges, Approaches and Innovations in Strategic and Co-ordinated Action- Based on a 19-country Analysis. [http://www.iisd.org/pdf/2004/measure\\_nat\\_strategies\\_sd.pdf](http://www.iisd.org/pdf/2004/measure_nat_strategies_sd.pdf)
- Lehoucq, F. (2010). Political Competition, Constitutional Arrangements, and the Quality of Public Policies in Costa Rica. *Latin American Politics & Society*, 52(4), 53-77.
- Malavasi, E. O. & Kellenberg, J. Program of Payments for Ecosystem Services in Costa Rica. First accessed 2/15/14. [http://ecosystemmarketplace.com/documents/cms\\_documents/lr\\_ortiz\\_kellenberg\\_ext.pdf](http://ecosystemmarketplace.com/documents/cms_documents/lr_ortiz_kellenberg_ext.pdf).
- Mehling, Michael, 2012. Between Twilight and Renaissance: Changing Prospects for the Carbon Market. *Carbon & Climate Law Review*. 2012, Vol. 6 Issue 4, p 277-290. 14p.
- Moslener, U., & Sturm, B. (2008). A European Perspective on recent trends in US climate policy. *European Environment: The Journal of European Environmental Policy (Wiley)*, 18 (5), 257-275.
- Nolon, John, and Jessica Bacher. (2007) "Climate Change, Zoning and Transportation Planning: Urbanization as a Response to Carbon Loading." *Real Estate Law Journal* 36 (2007): 211.

- Ortiz, Diego Arguedas, 2014. Carbon-Neutral Costa Rica: A Climate Change Mirage?  
<http://www.ipsnews.net/2014/02/carbon-neutral-costa-rica-climate-change-mirage/>
- Pagiola, S. (2006). Payments for environmental services in Costa Rica. *Ecological economics*, 65(4), 712-724.
- Pearce, D. (2004). Environmental Market Creation: Saviour or Oversell? *Portuguese Economic Journal*. 3(2). 115-144.
- Pielke, R. A., Marland, G., Betts, R. A., Chase, T. N., Eastman, J. L., Niles, J. O., & Running, S. W. (2002). The influence of land-use change and landscape dynamics on the climate system: relevance to climate-change policy beyond the radiative effect of greenhouse gases. *Philosophical Transactions of the Royal Society of London. Series A: Mathematical, Physical and Engineering Sciences*, 360(1797), 1705-1719.
- Powell, A. 2008. Costa Rican minister outlines plan to achieve carbon neutrality through reforms. Harvard News Office.  
<http://news.harvard.edu/gazette/story/2008/05/costa-rican-minister-outlines-plan-to-achieve-carbon-neutrality-through-reforms/>
- Purvis, N. (2004). The Perspectives of the United States on Climate Change and the Kyoto Protocol. *International Review For Environmental Strategies* 5(1), 169-177.
- The REDD desk. 2014. A collaborative resource for REDD readiness. First Accessed 3/11/14.  
<http://theredddesk.org/countries/actors/national-system-conservation-areas-CostaRica> &  
<http://theredddesk.org/countries/costa-rica>
- Ringhofer, L., Singh, S. J., & Smetschka, B. (2013). Climate Change Mitigation in Latin America: A Mapping of Current Policies, Plans and Programs.
- Sabatier, P. A. (1986). Top-down and bottom-up approaches to implementation research: a critical analysis and suggested synthesis. *Journal of public policy*, 6(1), 21-48.
- SÁNCHEZ-AZOFEIFA, G. A., Pfaff, A., Robalino, J. A., & Boomhower, J. P. (2007). Costa Rica's payment for environmental services program: intention, implementation, and impact. *Conservation Biology*, 21(5), 1165-1173.
- Slootweg, R., Van Beukering, P. (2008). Valuation of Ecosystem Services and Strategic Environmental Assessment- Lessons from Influential Cases. Netherlands Commission for Environmental Assessment.
- Stack, Kevin M.; Vanderbergh, Michael P., 2011. THE ONE PERCENT PROBLEM. Columbia Law Review. Nov2011, Vol. 111 Issue 7, p 1385-1443. 59 p.
- Stanford Kay Infographic studios. 2010. Global Carbon Footprint. First Accessed 10/13/14.  
<http://www.stanfordkaystudio.com/information.html>

- Subak, S. (1999) The Case of Costa Rica's "Carbon Commodity". Natural Resources Defense Council. First Accessed 3/12/14. [http://www.forest-trends.org/documents/files/doc\\_688.pdf](http://www.forest-trends.org/documents/files/doc_688.pdf)
- Subak, S. (2000) Forest Protection and Reforestation in Costa Rica: Evaluation of a Clean Development Mechanism Prototype. *Environmental Management*. 26(3). 283-297.
- Tacconi, L. (2012). Redefining payments for environmental services. *Ecological Economics*, 73(1): 29-36.
- The International Ecotourism Society (TIES), 1990. First accessed 3/20/14. <https://www.ecotourism.org/what-is-ecotourism>
- Umaña, Alvaro. November 2007. The evolution of forest incentives and climate change policies in Costa Rica. OAS Panel of Experts Washington, D.C.
- UNEP- United Nations Environmental Programme, 2009. Giant Cube in Copenhagen helps Visualize one Tonne of CO2. <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=606&ArticleID=6397&l=en>
- UN-REDD Programme website, 2009. First accessed 2/25/14. <http://www.un-redd.org/FAQs/tabid/586/Default.aspx>
- WAVES-Wealth Accounting and the Valuation of Ecosystem Services- Costa Rica. <https://www.wavespartnership.org/costa-rica> First accessed 2/28/14.
- Wicke, L., & Duerr-Pucher, G. (2006) Beyond Kyoto 2012: No Prevention of Dangerous Climate Change Without an Internationally Acceptable "Beyond Kyoto" Global Cap-and-Trade Scheme. *International Review For Environmental Strategies* 6(1), 63-91.
- World Bank, 2014. Payments for Environmental Services in Costa Rica- Chapter 9- Impact of the PSA Program on Land Use
- Worldheadquarters. Costa Rica- Airline/Bus/Taxi Transportation. <http://www.worldheadquarters.com/cr/transportation/> First accessed 4/2/14.