Mexican Climate Change Policy Perspectives: the NDC and REDD+ strategy

A thesis submitted to the University of East Anglia for the degree of Doctor of Philosophy

By

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Abstract

The success in preventing complex climate change in the years to come relies on crucial commitments and practical actions. Worldwide participation at all levels within a framework of international environmental agreements to tackle climate change is indeed the ultimate aim. Nations of the world declare their commitments in the Nationally Determined Contribution (NDC), but regrettably, many of those are rated insufficient. Moreover, what they really will achieve in practice remains uncertain. All countries and sectors are supposed to be part of a mix of mitigation that would deliver a high probability of limiting global warming below 2°C and respect a cumulative CO_2 budget of less than 400GtCO_2 (Schmidt and Archer, 2009). Therefore, policies and practices adopted by each country need to lead the way towards less greenhouse gases (GHG) emissions. The objective of this thesis is to analyse to what extent the Mexican mitigation policy is working under such framework to tackle climate change. This analysis explores the mitigation plan within the NDC associated with the REDD+ strategy, in order to assess its likely success in supporting climate change mitigation. The assessment pays particular attention to the obstacles imposed by the political context in Mexico in the period 2010-2018. The analytic tools that are adopted for the study, particularly qualitative research, provide empirical evidence. Both, a combination of semi-structured interviews to derive empirical results relating to actual mitigation forestry schemes in Mexico and insights from Earth System Science were deployed. The analysis focuses in particular on the concept of sustainability measured by planetary limits for anthropogenic global warming. Then, a critical analysis is developed to examine features of the Mexican NDC, REDD+ strategy, and the national political context to assess its scope and capacity for delivering consistent results aimed at reducing CO_2 emissions and therefore preventing the associated increment in the global mean temperature.

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Acknowledgements

I express my most sincere admiration and gratitude to my supervisor Professor Kerry Turner. Without all his support and guidance through all this time, the conclusion of this work would not have been possible.

Mom, I thank you for being yourself and always stay by my side, even now that you became a star in the sky.

My beloved husband and daughter, you are my universe and I am grateful for having you in my life.

Father and brother, your support through all my life has been a fundamental part for my development, thank you so much for everything.

Life is a precious thing; I honour the unknowable light that makes every beautiful moment possible.

List of Abbreviations

CAT- Climate Action Tracker

CBD- Convention on Biological Diversity

CCMSS- Consejo Civil Mexicano para la Silvicultura Sostenible

CONAFOR- Comisión Nacional Forestal

CRU- Climate Research Unit

ENAREDD+- Estrategia Nacional para Reducción de Emisiones por Degradación y Deforestación.

FAO- Food and Agriculture Organisation

FCPF- Forest Carbon Partnership Facility

GEF- Global Environment Facility

GHG- Greenhouse gases

INDC- Intended Nationally Determined Contribution

INE- Instituto Nacional de Ecología

INECC- Instituto Nacional de Ecología y Cambio Climático

IPCC- Intergovernmental Panel on Climate Change

IUCN- International Union for Conservation of Nature

LGB- Ley General de Biodiversidad

NOAA- National Oceanic and Atmospheric Administration

OECD- Organisation for Economic-Co-operation and Development

PECC- Programa Especial de Cambio Climático

REDD+- Reducing Emissions from Deforestation and Forest Degradation

SAGARPA- Secretaría de Agricultura, Ganadería y Desarrollo Rural

SEGOB- Secretaría de Gobernación

SEMARNAT- Secretaría de Medio Ambiente y Recursos Naturales

UNDP- United Nations Development Programme

UNEP- United Nations Environment Programme

UNFCCC- United Nations Framework on Climate Change

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Introduction

Climate change mitigation policies are an approach for implementing strategies to prevent and reduce greenhouse gases (GHGs) emissions. Through them governments develop and monitor actions aimed at providing traceable outcomes. They currently focus on key socio-economic sectors, including energy supply systems, industry, forestry, agriculture and transport. Current climate change mitigation strategies contain a diverse mix of actions including among others: research and development of new technologies; less carbon intensive and renewable energies, energy efficiency in domestic and industrial equipment, and programs for protecting forests and oceans. This thesis focuses on forest protection in particular.

These policies emerge from the knowledge that climate change is a global threat that needs global action. As such, climate change has been addressed by an international political instrument, the United Nations Framework Convention on Climate Change (UNFCCC), which main objective is “to stabilise atmospheric greenhouse gases concentration at a level that would prevent dangerous anthropogenic interference with the climate system”. The Intergovernmental Panel on Climate Change (IPCC), another international body that informs the UNFCCC on the scientific aspects of climate change, has estimated that global warming should stay below 2°C and carbon dioxide emissions plus other GHGs must be reduced by 50%-80% by 2050 compared to 1990 levels. To achieve this, developed countries would need to reduce between 80% and 95% of their emissions by 2050 and some developing countries would need to restrain and adapt their socio-economic development within boundaries set by climatic limits.

Since it entered into force in 1994, the UNFCCC has held the Conference of the Parties (COP) each year. These meetings have been the forums for discussing climate change issues, shaping policy and building an international legally binding treaty. An agreement on the latter was reached during the COP meeting held in Paris in 2015, although its suitability and practicability is still under debate. At the same time, the focus is as well on the Nationally Determined Contributions (NDCs) conducted in each country in order to meet their GHGs mitigation commitment. On its side, the assessment of the mitigation scope and capacity from the NDCs can provide information on the impact of commitments on emissions reduction; whether commitments and actions are a fair share of the global effort to limit global warming; and assist in the monitoring of steps taken towards the decarbonisation needed across sectors and countries. In other words, the contribution of policies can be evaluated as sustainable only if they contribute to the successful achievement of the mitigation target. This means that, in order to be sustainable, policies, commitments and actions need to be submitted to and conditioned by the physical reality of global warming and climate change. In other words, a precautionary principle approach should be adopted in order to minimise long term consequences. Policies should always facilitate to some extent mitigation actions and provide support to reducing destructive human impacts.

Although there is still a lot of research to do to fully understand the physical reality of planet Earth, there is already enough information to know that there are planetary boundaries which may need to be observed as constraints on current societies' way of life. What is also required is accurate monitoring of

government actions, specifically of what their NDC declare, what they really carry out and their policies' impacts. All sectors are important and all need to contribute with their share, but special attention is given here to the forestry sector. Climate change is emerging as an extremely important environmental problem, because of its global impacts on water provision, ecosystems, biodiversity, human health and more. Therefore, the official stance of Mexico is to carry out actions that contribute to mitigate climate change. The role and importance of forests to climate change mitigation has been constantly reaffirmed and presented by FAO, other international research institutions and specialists. Among the crucial actions are conservation and sustainable management of forests. Within this line, the REDD+ strategy and its integration to national mitigation plans and commitments have been topics of persistent research. Mexico included REDD+ as an important part of its National Development Plan 2013-2018 and it is also included within its NDC. However, the effectiveness of the REDD+ strategy implementation has been criticised by some researchers, NGOs and people that are part of rural communities which have been involved with the strategy. For this reason, this thesis aims to explore such context. So, the central research question concerns the role that forestry policy in Mexico plays in climate change mitigation and its adequacy in terms of sustainability and climate change target achievement considering the Mexican political framework.

The focus of this thesis is on the analysis of what the climate change mitigation policy in Mexico declares in its NDC for the forestry sector, and on the evaluation of the extent to which that policy is consistent with the

sustainable climate change mitigation aim. The thesis is divided into five chapters, conclusions and further research final comments.

Chapter one concerns the science of global warming and climate change to later understand the conceptualisation of four main budgets and targets for limiting GHGs emissions and the related increment in the global mean temperature. Following this, the UNFCCC process, an overview of climate change mitigation under the UNFCCC and the basis for NDCs are addressed in chapter two, as well as the climate change mitigation REDD+ strategy for the forestry sector. Methodology is explained in chapter three, where the selection of the case study is described as well. Chapter four contains the description of the Mexican mitigation policy and its political context. Chapter five contains the case study which includes the experiences that were gathered and documented from the fieldwork conducted in the Yucatan Peninsula where the implementation of the REDD+ strategy can be found. The last section in this chapter highlights the obstacles in Mexican politics which may hinder the success of the climate change mitigation action and aims. Lastly, in chapter six conclusions and future research directions are formulated and discussed.

Chapter one

The physical reality

There is clear scientific research that proves we are on a path of increased atmospheric CO_2 and other GHGs concentrations. The related increase in the global mean temperature will result in a significant level of climate change. The UNFCCC (with its main objective "to stabilise atmospheric concentrations at a level that would prevent dangerous anthropogenic interference with the climate system"), along with the IPCC, have established that global warming should stay well below 2°C and carbon dioxide emissions plus other GHGs must be reduced by 50%-80% by 2050 compared to 1990 levels.

The NDCs approach produced at the UNFCCC's international negotiations, will serve as a tool for each country for meeting their GHGs mitigation commitment. It is intended to facilitate the implementation of *ad hoc* mitigation strategies. Furthermore, the assessment of the mitigation scope and capacity from the NDCs can provide information on the impact of commitments on reduction of emissions and whether commitments and actions are a fair share of the global effort to limit global warming. Further, the information can help to keep track on the steps taken towards the decarbonisation needed across all sectors. For all mitigation efforts to deliver consistent results, good understanding of climate change science and the selection of the reference target are the first things to get right.

1.1 Climate change

Climate change is a direct consequence of global warming. Earth has a natural greenhouse effect, that historically, at least for the past 600,000 years (according to the permafrost ice core measurements), has had a stable range of CO_2 atmospheric concentrations of between 180ppm and 300ppm (NASA, 2013). CO_2 among other gases are responsible for the warming effect in the atmosphere. In their absence the low atmosphere that we live in would be colder than we know it, and on the contrary, with their increase it would be

hotter. Today, we are dealing with the latter scenario. In 1958 Charles Keeling (1928-2005) began measurements of CO_2 atmospheric concentrations on a daily basis showing its saturation behaviour. Such measures continue up until today providing a record of its increasing tendency, jumping from 280ppm back in the 1950's decade to 400ppm in 2015.

The rate of the associated warming connected to these CO_2 concentrations is increasing too, currently recording 1 Celsius degree over pre-industrial levels without any signs of slowing down (Karl et al., 2015). There are three compilations of global mean temperatures which are based on the readings from land weather stations, ships and buoys in the ocean that keep a record of over 150 years. These measures are provided by NASA, the National Oceanic and Atmospheric Administration (NOAA), and the third one is the collaboration between Britain's Met Office, the Hadley Centre and the Climate Research Unit (CRU). Such measures lead to a high agreement among scientists which say that they are consistent with other indicators of warming, such as rising sea levels and melting glaciers. Sea level rise is caused by global warming, specifically due to the added water from melting land ice and the expansion of water as it warms. According to NASA's satellite sea level observations taken since 1993, there has been an increment of 66.91mm until 2015 with a rate of change of 3.24mm per year. On the other hand, the evidence of melting glaciers is also dramatic. According to data from NASA's GRACE satellite, just from Alaskan glaciers, 46Gt of ice have been lost every year from 2003 to 2010.

Furthermore, even sceptic scientists are now believers. This was the case of physicist Richard Muller who conducted a study to disprove global warming and end up by confirming what other climate scientists had previously found in 2011. The Berkeley Earth Surface Temperature study estimated that over the past 50 years the land surface warmed by 0.911 °C (just 2% less than NOAA's estimate), leading Muller to make a statement in 2012 for the New York Times which says: "Call me a converted skeptic. Three years ago, I identified problems in previous climate studies that, in my mind, threw doubt on the very existence of global warming. Last year, following an intensive

research effort involving a dozen scientists, I concluded that global warming was real and that the prior estimates of the rate of warming were correct."

In synthesis, as of 2015 there is a global scientific consensus where it has been accepted that global warming is a fact which imposes a serious threat to the planet and humanity, and that it is a certainty that anthropogenic emissions are increasing atmospheric concentrations of greenhouse gases. Unfortunately, there is still debate over the specifics of a global legally binding treaty which would contain a serious target to limit CO_2 emissions and prevent dangerous global warming and its effects on the global climate.

1.2 Environmental sustainability

For years there has been widespread support for a neoliberal economy and its sustained growth principle for covering all human necessities. However, the capitalistic market economy cannot expand indefinitely, and without regulation, does not guarantee welfare equality or recognise planetary limits.

For instance, the capitalistic crisis in 2008, the Long Depression in 1873-1879 and the Great Depression in the 1930 decade are good examples that indicate that achieving a steady and infinite economy growth process is a near impossible objective. Secondly, economic progress it can be argued should yield welfare/wellbeing improvements in society, but it doesn't, at least not equally, not for everybody and not without high social and environmental costs. Aristotle said that the "economy is the administration of those useful and necessary resources for life, civil and household" (Guthrie, 1994). Capitalism is far from that definition. Capitalism is closer to that what Greeks described as "commercial chrematistics" that according to Aristotle is devoted to the accumulation of money (Guthrie, 1994). Thus, commercial chrematistics has as a fundamental objective, the relentless search for pecuniary gains and its reinvestment for the accumulation of capital through markets, prices, and private property. Consequently, if we have more unrestrained financial, commercial and productive activity, we have more inequality (Stiglitz, 2013). But, the concept of limitless economic growth seems to understand Earth as a plain and endless land (Hinkelammert, 2010). Therefore, strong critiques have appeared. At the beginning, from a

social-economic perspective (one of the most relevant and known is the work of Carl Marx), and later from the environmental perspective. Both worldviews conclude that the economic system overexploits humans and nature in its favour. From the environmental side, an iconic work that many say is the beginning of the movement against the system is Silent Spring by Rachel Carson, published in 1962. In this book, Rachel Carson puts a case against the chemical industry, specifically, the use of DDT and the damage it causes to wildlife, domestic pets and humans during a research she conducted for 6 years. A decade later, another revolutionary work came into the environmental scene with a broader scope of analysis. Without a doubt, "The limits to growth" (1972) focused attention on the debate about the environmental impact of expanding economic activity and interconnections at the global scale.

The neo-Malthusian Limits to Growth analysis highlighted the global and finite condition of the planet. Denis Meadows and his colleagues concluded that things had to change, otherwise world population growth, industrialisation, environmental pollution, food production and resources depletion would encounter its limits during the XXI century (Meadows et al., 1972). The exponential growth of those five variables constitutes the critique to sustained growth of the capitalistic economy. Regarding this exponential growth concept and the limits to it, Stephen Hawking gives an example: if the amount of the population keeps duplicating every 40 years at the same rate (1.9%) as it has been in the last two centuries, by the year 2600 we will be standing shoulder to shoulder. To better understand the notion that there must be limits to uncontrolled growth, James Lovelock provides another example, if a bacterium would divide itself and repeat such division every 20 minutes, in two days all those bacteria would be as heavy as Earth (Lovelock, 2007). In the same line, the New Economics Foundation released "The impossible hamster", a video that tells the example of a hamster growing beyond the natural limits reaching 9 billion tonnes of weight and capable of eating in a day the global corn production of a year. The point that they all want to make is that "there are reasons in nature why things don't grow indefinitely".

Regardless of these warnings and even an updated version of the *Limits to Growth* in 2004, the idea of "sustainable development" has been conceptualised to get together economic growth and planetary safe conditions. It has been three decades now that the concept emerged in the Brundtland Report but it arguably has done too little to safeguard those complex interactions among the biosphere, geosphere and atmosphere that make life possible, including the capitalistic economy. In fact, the system has gone beyond any respect for that. According to the Global Footprint Network, humankind currently uses the equivalent to 1.7 planets, in other words, Earth is being overexploited. Consequently, it can be said that "sustainable development" is a toxic pair, because it was conceived within the conventional economic model, and according to some the pair is an antinomy itself (Latouche, 2010).

The history of "sustainable development" starts in 1972, when the world met in the United Nations Conference on the Human Environment held in Stockholm, Sweden as recognition of the negative impacts of human exploitation of nature. An outcome of this meeting was the creation of the United Nations Environment Programme (UNEP), which currently is "the leading global authority that sets the global environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system and serves as an authoritative advocate for the global environment". From that moment on, it began the political process to spread the notion of sustainable development to the world. However, true changes would be more difficult to achieve in the years to come. Such complications began even in the definition itself. The Brundtland Report (1987) also known as "Our common future", included six different meanings of "sustainable development" and just two years later John Pezzey, former consultant to the Environmental Policy and Research Division of the World Bank, reviewed 27 (Latouche, 2006). Most of those definitions focus on the relevance of the economic sphere (Latouche, 2006) and therefore, reinforce the antinomy by emphasising that "to be sustainable, human development must also include economic growth" (Clausen, 1981).

There are radical economic growth advocates that even deny that there is an ecological collapse or urgency at all. To these people, the research published in *The Limits to Growth* is the mother of all apocalyptic forecasts and over time, those forecasts have proven to be wrong, because “there have been no real shortages or productive breakdowns, instead the resources generated by human ingenuity remain far ahead of human consumption” (Lomborg, 2013). To Bjorn Lomborg for example, a Danish visiting professor at the Copenhagen Business School, President of the Copenhagen Consensus Centre and author of The Skeptical Environmentalist, climate change is a trivial problem. For him, there are bigger ones such as hunger, poverty, health, among others, that still need to be attended around the world, and while the Paris Agreement is not going to do much to tackle climate change, it is extremely costly, thus it is a waste of time and money to focus on it. According to Lomborg, the world should prioritize global problems and climate change is not high on the agenda. His argument for discarding climate change as a priority is that the relevance of the subject today is based on the invented fear by *The Limits to Growth*. “The genius of *The Limits to Growth* was to fuse environmental worries with fears of running out of stuff, we were then doomed, so the only hope was to stop economic growth, though such message was spectacularly wrong”, Lomborg says. Moreover, he thinks there will always be efficient and inexpensive options, so economic growth doesn’t have a limit. He says, for example, that mercury has been replaced from batteries, dental fillings and thermometers, so mercury’s price went down 90%. However, it wasn’t because there were efficient and inexpensive options, it was due to extremely harmful effects on human health and the environment to the extent that The World Health Organisation (WHO) and the United Nations Environmental Programme (UNEP) have issued guidelines for the health sector around the world to eradicate mercury use (Rustagi and Singh, 2010). In the case of the dental fillings for example, the substitute has been resin composite. However, there has been research on the toxicity of dental resin composite that replaced mercury. *In vitro* and *in vivo* studies “have clearly identified that these components of restorative composite resins are toxic” (Gupta et al., 2012), on the other hand, it has been also proved such resins “have higher failure

rates, more recurrent caries, and increased frequency of replacement" (Bohaty et al., 2013).

Something similar happens with Lomborg's example on oil and natural gas. His critique to *The Limits to Growth* is that its projections predict depletion of both fuels in the 1990 decade and then a fuel catastrophe, that turned out to be false because of the enormous amounts of shale gas that have become available. Indeed, there have been discoveries of shale gas reservoirs that can substitute oil and natural gas. However, there are two points of consequence. The first one is that Lomborg indicates there isn't a fuel catastrophe due to shale gas, but shale gas has come to the scene because oil and natural gas availability is quickly decreasing and getting to the peak of maximum possible extraction, moreover, "most informed analysts agree that this will happen during the next two decades and an increasing number believe that it is happening now" (Heinberg, 2010; IEA, 2017). On the other hand, there are serious environmental concerns about shale gas, such as the environmental impact due to leaks and spills associated with surface operations, methane emissions during production and effects on climate change mitigation compliance (Hirst, Khor and Buckle, 2013; Fuller, 2016) among others.

He also points out that *The Limits to Growth* is wrong because population growth has been slowing down since the end of the 1960's decade; food supply has not collapsed; hunger has dropped by more than half; and we are not choking on pollution. Moreover, the obsession promoted by *The Limits to Growth* with "doom and gloom" distracts the attention from real threats such as poverty, which together with all other problems can be solved with economic growth that has created "massive improvements in health, longevity and quality of life… so the four decades since *The Limits to Growth* have shown that we need more of it, not less" (Lomborg, 2013).

Nevertheless, what economic growth promises is an illusion. Economic growth intrinsically denies the problems it creates, and the solutions needed to solve them. For example, economic growth promises people a job which is the means to access to money, which is the means to access to all things to

live: house, food and services such as electricity, gas, water, transportation, communications, healthcare and education. However, while the economy embraces technology as one of its pillars, technology substitutes human labour in many fronts, depriving people from the means to access to what they need to live. Moreover, the productive capacity enabled by the technological revolution is now so big, that we can't find an effective demand for it, people without a job now have no money and do have plenty of time, but the question is whether such time is for enjoying or for just making rows of unemployed and poor people (Rifkin, 2003). Furthermore, there are some forecasts that estimate a loss of up to 47% of jobs over the next 25 years just in the US, that will be eliminated by technology and globalisation, and The World Bank estimates that we are already heading to a global job crisis where there will be needed around 600 million new jobs by the year 2030 just to keep up with current levels of population growth (Iyengar, 2014). Regarding poverty, according to the World Bank, even when there have been changes in the numbers, (in 2013 of the world population 10.1% lived with less than 1.90 US dollars a day compared to 12.4% registered in 2012) such changes are temporary, highly threatened by economic shocks, food insecurity, climate change, but even more critical, such changes are still highly inequitable. Pollution on the other hand, is really chocking people. According to a study conducted in 2010 by researchers from the University of Montana and the National Institute of Paediatrics in Mexico, sponsored by The American Society for Investigative Pathology, young people living in Mexico City begin to show adverse effects in their hearts related to air pollution. The investigation included pathology tests to heart tissue of young people between 13 and 23 years old that had recently died in an accident. The researchers found that their heart tissue presented inflammation related to the elevated presence of particles that are strongly associated to heart disease and sepsis (Medical Express, 2010). Other studies have also studied health risks for large samples of population living in cities with air pollution far above the WHO standards (Kelly and Fussell, 2015; Stahl, 2015; InterHealth Worldwide, 2017). On population growth, according to figures from the United Nations Department of Economic and Social Affairs, world

population was in 1990 5.3 billion people, nowadays in 2017 population is 7.6 billion people, and estimates for 2030 are 8.6 billion people (UN, 2017).

Faith in long-run economic growth was presented in 1956 by Robert Solow. In his article, he attempts to explain long-run economic growth by means of accumulation of capital, labour, population growth and increases in productivity related to technological progress (Gardonová, 2016). Solow (1956) argues that any possible limitations that land and resources may impose to the economy can be overcome by technological progress and substitution of resources. This is the prevailing rationale among economic growth supporters. For example, Switzerland is a country lacking many natural resources, but this condition has not been a reason for abandon economic growth and reach a very high human development index that were achieved through massive industrialisation. The conclusion of this case analysis from the economic-growth point of view is that “the limitations posed by natural resources are not very significant, and the reason for this is that in the economy there exist two processes through which an economy maximizes its use of scarce resources- substitution and technological progress” according to Kristína Gardonová, economist and researcher at the Slovak Academy of Sciences (2016). Moreover, “as far as technological progress is moving forward at the same or higher rate that natural resources are used up or depleted, the limitations posed by natural resources fixed amount on Earth will not have a significant effect on economic growth”, she says. While global trade is a good thing for distributing products and services, it is a constant that this kind of analysis fail to mention critical aspects related to social and environmental safeguards that are intrinsic to what it takes to obtain those resources moving around the world. According to the Observatory of Economic Complexity (OEC), Switzerland imports around 50% of products-resources it consumes with a monetary value of 262 billion dollars, coming from more than 100 countries, in which many of them, capitalistic extraction techniques cause high levels of social and environmental degradation (Bellamy-Foster, 1993; Magdoff and Bellamy-Foster, 2011; Ha-Joon Chang, 2012; Juniper, 2014; Bell, 2015).

This same argument was also reinforced by William Nordhaus in 1992, when he said that any concern in the past due to resource exhaustion has been withdrawn by technological changes such as new seeds, chemical fertilizers, machinery to reach deeper oil reservoirs, small investments in pollution abatement, among others, that prove the victory of technology over natural constraints to economic growth (Nordhaus, 1992).

Additionally, while main concerns from critics to growth is excessive consumption and depletion of all Earth resources, radical economic growth supporters such as Wilfred Beckerman, say that “there is clear evidence that in the end the best and probably the only way to attain a decent environment in most countries is to become rich” (Nordhaus, 1992). However, such radical postures are pedantic and show it has been argued that those economists don’t read Science (Common, 1995). The problem, critics of conventional economics would say, lies in the imposed idea that Economics is a hard science too, together with Physics, Chemistry and Medicine. Cunningly, mainstream economics found its way to get a distinction among exact sciences and turned away from the fact that it is a social one. In fact, there is a global recognition of this with the Prize in Economic Sciences in Memory of Alfred Nobel. But, there are at least two clear problems with this. Economics has proved not to be exact, as it illustrates the failure of Myron Scholes and Robert Merton (among others) on derivatives to set a safe and lucrative trading strategy in 1997, that a year later ended in 4.6 billion dollars lost in the market; and while there is not an equivalent Nobel Prize for Psychology, Anthropology and Sociology, being one for Economics seems to imply that Economics operates like the physical world and thus, “changes the way we think about the Economy” … making us believe it’s in the process of “discovering timeless truths” (Luyendijk, 2015).

However, even within the mainstream economics paradigm views are changing. In his 1992 critique to the Limits to Growth, William Nordhaus explains that “the lethal nature of economic growth in Limits I and II can be reproduced in simple growth models…and the entire argument can be reversed with a simple change in the specification of the model…introducing technological change into the production structure and assume that the

Cobb-Douglas production function accurately represents the technological possibilities for substitution" (Nordhaus, 1992). Although he points out that there are empirical questions that cannot be established only by theorizing with models whether economic or environmental ones, he remains sceptical of any slight sign of productivity slowdown due to natural resources exhaustion, especially with the "irrefutable" evidence of markets and changes in the prices of scarce resources from where he concludes that, at that moment when he wrote this work, "a generalised increase in the relative scarcity of resources" did not seemed to had occurred. He finally says that "an efficiently managed economy need not fear shipwreck on the reefs of resource exhaustion or environmental collapse" (Nordhaus, 1992). But, years later, Nordhaus has become closer to that message from the Limits to Growth. In 2016, Nordhaus published a paper in which he states that achieving the target of 2°C agreed in the Paris climate deal in 2015 is rhetoric and infeasible with reasonably accessible technologies and even with unrealistic ambitious strategies, because of "the inertia of the climate system and rapid projected economic growth in the near term" (Nordhaus, 2016). Analysts have concluded that the combined plans of all signatory countries will only limit global warming to 2.7°C above pre-industrial levels, due to the little progress in adopting strong policy measures that according to Nordhaus may be called "The Rhetoric of Nations", which without a tough international carbon tax, sustained growth will lead to increased emissions as well as the social cost of carbon (damages related to climate change) that since 2013 has increased 50% according to his model DICE (King, 2017). Furthermore, Nordhaus has discussed three singular contributions from the book by Gernot Wagner and Martin Weitzman, Climate Shock: the economic consequences of a hotter planet and proposes "A new solution: The climate Club" (2015). In their book, Wagner and Weitzman talk about the risks of global warming and the policies to deal with them, and point out that: 1) nations may "free ride" on the decisions of others; 2) the uncertainties on climate change and its consequences; 3) and threats of geoengineering to reverse anthropogenic climate change.

In the first case, Nordhaus agrees with Wagner and Weitzman that the fundamental reason for the lack of progress in the political arena are the incentives for a nation to receive a benefit from the common efforts of others while such nation doesn't contribute to the efforts. He says that free-riding is particularly malicious for global issues such as climate change because both, the benefits and negative effects are indivisible dispersed all over the world. So, countries join international agreements but being such, are essentially voluntary. That opens the opportunity to act rationally in the nations own self-interest so will incentivise free-riding on the emissions reductions of others without sacrificing their development. The second point refers to "tail events", which are those that are unlikely to occur because they are outside everyday observations. However, Wagner and Weitzman highlight that most of the current climate change analyses don't bring enough attention to tail events which may be underestimated, so dealing with these possible events should be a central task of policy. Thirdly, we know that there must be concrete reductions of emissions to tackle climate change. Though, some argue in favour of geoengineering to offset anthropogenic global warming. For Wagner and Weitzman geoengineering means management of solar radiation inducing changes on Earth to prevent it from absorbing too much sunlight. The three of them conclude that this approach is dangerous, and markets instead are the solution through "a high enough price on carbon to reflect its true cost to society" (Nordhaus, 2015; Wagner and Weitzman, 2015). This approach hasn't only been seen from the economists' point of view. The idea has been proposed in the past by climate scientist James Hansen in the first place (2008; 2012; 2016) and could really bring some benefits as part of a whole strategy including comprehensive energy efficiency implementation as well.

Research on geoengineering has been capturing some attention and has been considered by some as a viable option "to avoid a significantly changed and warmer climate, as well as the other impacts of rising levels of CO_2" (Granger and Ricke, 2010).

Geoengineering advocates argue that more common options considered such as carbon capture and storage (CCS) are slow as they may take

decades to centuries and are expensive. In contrast, they say that geoengineering in the form of solar radiation management (SRM), can produce results very rapidly, from days to months and it's cheap. It may look like a viable option, but taking a detailed look it raises many questions. The National Academy of Sciences committee for example, concludes that "modification strategies are limited primarily by considerations of risk, not by direct costs" (Nordhaus, 2016). Among the risks are that SRM does nothing to reduce ocean acidification due to increased atmospheric CO_2 and there is a high likelihood of changes in precipitation patterns that are even noted by SRM proponents like Granger and Ricke (2010).

However, by implementing geoengineering and given the case that it would deliver the expected results, it could open the way for business as usual and let rapid economic growth proceed, with all its inherent threats. Detractors to the Limits to Growth such as Robert Solow, Allen Kneese and Roland Riker, complained that The Limits to Growth model didn't let all the input elements grow exponentially, specifically the evolution of technology that would have proven to be the solution. Well, nowadays, technology is being put forward to be the answer to the global warming problem with SRM for example. Yet, even if their claims were correct, we now face the risks of technological fixes that could make things even worse than the original problem by mismatching nature and letting continue business as usual in economic growth.

On the other hand, 40 years later, the Limits to Growth forecasts have still not been proved to be completely misguided, and "if we continue to track in line with the book's scenario, expect the early stages of global collapse to start appearing soon" (Turner and Alexander, 2014). In a study conducted by Dr. Graham Turner, he found that the world is tracking very close to the business as usual scenario showed in the Limits to Growth in 1972, and data collected over the past 40 years doesn't match up with other scenarios (Turner and Alexander, 2014). However, as mentioned before, continued economic growth is impossible and is constrained in a world that is already being overexploited through a process of continued degradation and destruction. Therefore, we should investigate the necessity of creating a new theory that seriously considers the biophysical limits of the planet (Daly,

2010). The analysis of the suitability of environmental policies then can be placed within the debate between the development paradigm and the critique from the biophysical limits to growth.

The 21st century is being marked by the interrelation between the natural environment and the economic system, specifically, by the fatal consequences of the progressive degradation and destruction of Earth perpetrated by the global and complex social-economic network led by the capitalistic paradigm. For this reason, there have been efforts to study such interrelation and the environmental impacts of human societies. The available group of sustainable development definitions include the environmental sphere, although they have in common the ambiguous way they refer to it (Table 1). Robert Solow, Nobel Prize in Economy, proposed that to provide clarification, it is necessary to be precise on what is intended to preserve and thus deliver more specification to the generic statement in the Brundtland Report. Additionally, since development will inevitably cause non-renewable resources depletion, the notion of sustainability must go beyond just natural resources preservation and a vague conservation commitment (Lopez, 2006).

Environmental sustainability is a pillar of a broader concept, sustainable development, which involves two more pillars, social sustainability and economic sustainability. The notion of sustainability comprises ideas from politics, economics, philosophy, sociology, and hard sciences. Its aim is to study the natural systems functioning, and what needs to be kept in balance considering the relation with human civilisations. It is based on a simple principle: everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment.

Table 1. Sustainable development definitions.

Source	Definition
The Brundtland Report (UN,1987)	1. Development that meets the needs of the present without compromising the ability of future generations to meet their own needs
World Conservation Strategy (IUCN, 1980)	1. The modification of the biosphere to satisfy human necessities and management of the biosphere to obtain the greatest benefit for present and future generations. 2. The improvement of human quality of life while maintaining the ecosystems carrying capacity.
Caring for the Earth (IUCN,1991)	1. The improvement of human quality of life within the carrying capacity that sustain ecosystems.
International Institute for Sustainable Development (IISD,2002)	1. To undertake business strategies and activities that solve current necessities and at the same time protect and improve human and natural resources that will be required in the future.

Source: Own elaboration with information from: UN,1978; IUCN, 1980; IUCN, 1991; IISD,2002.

These three pillars were identified in 2005 at the World Summit on Social Development that took place in New York, which led to the Millennium Declaration of the Millennium Development Goals (Figure 1). These goals include themes that are directly related to environmental sustainability such as: clean water and sanitation, affordable and clean energy, sustainable cities and communities, responsible consumption and production, climate action, life below water and life on land. The three pillars of sustainability (Figure 2) aim, in theory, to create and maintain the conditions under which humans and nature can exist in productive harmony, to support present and future generations. Nevertheless, it can be argued that throughout the years this notion within the economic system hides contradictory proposals that do not necessarily secure the environmental wellbeing.

Figure 1. Sustainable Development Goals.

Source: UN.org

Figure 2. The three pillars of sustainability.

Source: URSA.com. http://www.ursa.com/en-us/drivingsustainability/pages/global-need-for-sustainable-development.aspx

1.2.1 Bio-capacity, biophysical limits and tipping points.

If there was once a time when it was questioned and in doubt that human societies within the current economic system are increasingly damaging the Earth that time is long past. There has been some evidence of such damage since the middle of the 20th century. At the beginning, it was easier for the detractors to ignore the evidence, they argued that there wasn't enough or credible evidence support. Nowadays, the evidence base has grown and contains more convincing data.

The story probably begins with the Gaia theory. Back in the beginning of the 1970-decade, James Lovelock thought that “Earth was a planet with apparently the strange property of keeping itself always a fit and comfortable place for living things to inhabit… and that somehow this property was not an accident of its position in the Solar System but was a consequence of life on its surface” (Lovelock, 2009). This hypothesis adopted the name of Gaia that in Greek mythology is the goddess that personifies Earth, mother of all life. By 1979, James Lovelock was releasing his book Gaia: a new look at life on Earth, in which he wanted to “get to know Gaia without understanding what she is” (Lovelock, 2009). In this book, he introduces important elements that in those years he misunderstood at a certain point but that in the years to come would be vital to the Earth Sciences. In the 2009 reissued version he points out what he got wrong, such as his understanding of the capacity of Earth to regulate its conditions, it was not only the biosphere but the entire entity through which complex global networks regulate themselves. On the other hand, he correctly states that “we are part of a greater whole; our destiny is not dependent merely on what we do for ourselves but also on what we do for Gaia, if we endanger her, she will dispense with us in the interests of a higher value- life itself” (Lovelock, 2009). According to Lovelock, most of the criticism to the Gaia hypothesis, came from scientists who read this first book and didn’t get the view that he was introducing by recognizing Earth as a being, moreover, they thought that its “association with myth and storytelling made it bad science” (Lovelock, 2009). Years passed, and the holistic view of Earth developed accompanied by increasing scientific research, obtaining the recognition and upgraded to theory. Today, most scientists accept the Gaia concept, but they prefer to call it Earth System Science instead.

In his work, Lovelock speaks strongly of catastrophic events linked to the future climate because he is “a scientist influenced by evidence coming from the Earth and viewed through Gaia theory” (Lovelock, 2009b). Such evidence makes him think that the IPCC may be underestimating the severity of climate change. For example, he explains that a paper by Rahmstorf et al. published in *Science* magazine in 2007 illustrates average and individual

measurements of sea level from 1970 until 2007 that show an increment 1.6 times faster than was predicted, and a similar case regarding global mean temperature (Lovelock, 2009b). Another example is the one associated to the Arctic Ocean covered in summertime by floating ice, which the evidence suggests that if melting continues at the same rate recorded until now, the Arctic Ocean will be almost ice-free within 15 years and not in more than 30 years as the IPCC predicts (Lovelock, 2009b). One additional example that supports his posture is the data published concerning satellite observations of ocean areas that showed a progressive decline of algae (Polovina et al., 2008) which will act as a positive feedback on global heating.

Furthermore, according to Lovelock, almost every single system known that affect climate on Earth is already on positive feedback and “any addition of heat from any source will be amplified, not resisted, as would be expected on a healthy planet” (Lovelock, 2006). Some of such positive feedbacks are summarized in table 2.

Table 2. Positive feedbacks of systems affecting global climate.

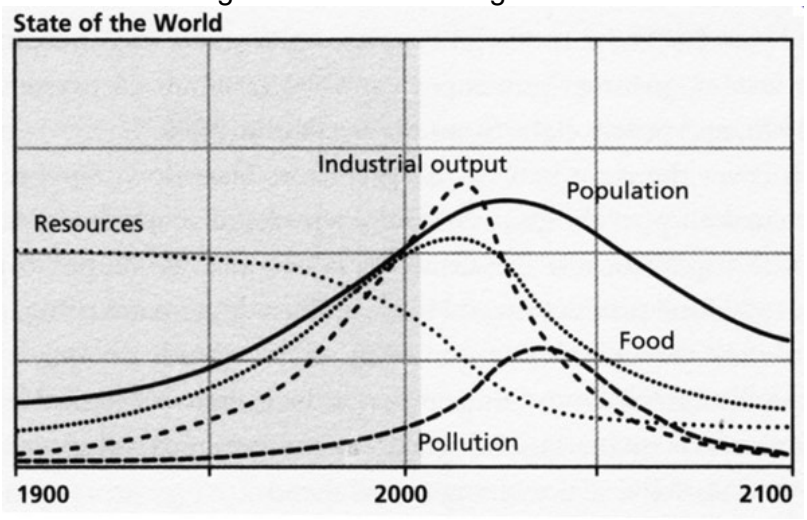
Component	Description
Albedo	The albedo is the reflectivity of an object or a surface. The snow covering the ground reflects almost all sunlight back into space. However, as snow disappears, this reflecting capacity is lost, then the surface now absorbs sunlight and therefore gets warmer.
Oceans	When the oceans warm increases the amount of nutrient-poor water, which is harmful for algae. This reduces the rate of pump down of carbon dioxide and the generation of white reflecting marine stratus clouds. Ice-water: ice reflects incoming sunlight but sea water absorbs it. If sea ice melts, the resulting water absorbs more radiation and gets warmer, causing more ice to be melt and so on.
Land	A higher temperature tends to destabilize tropical forests and diminish their presence, the land that replaces them lacks cooling mechanisms and is hotter.
Forests	Boreal forests in Siberia and Canada are dark and heat absorbing, so as the world gets warmer these forests extend their cover area and absorb more heat.
Greenhouse gases	Methane and carbon dioxide are released from forests and algal ecosystems as they die, contributing to more warming, as well as ice crystals containing methane as they melt. When temperature rises, water evaporates, water vapour is a strong greenhouse gas which causes more warming.

Source: Own elaboration with information from: Lovelock, 2006; Powell, 2011.

Other researchers concur with Lovelock. A group from the University of Reading, “reported in 2004 that if global temperatures rise by more than 2.7°C the Greenland glacier will no longer be stable, and it will continue melting until most of it has gone”; scientists from the Hadley Centre “conclude that a rise in global temperature of 4°C is enough to destabilize the tropical rain forests and cause them, like the Greenland ice, to melt away and be replaced by scrub or desert” (Lovelock, 2006). From historic data, we know that the carbon dioxide and methane atmospheric concentrations we have been experiencing during the past century until now are like those naturally present 55 million years ago. At that time, the temperature rose about 8°C in northern areas, 5°C in the tropics and the consequences of such increases lasted 200,000 years (Lovelock, 2006).

Another important and known early warning is the already mentioned *The Limits to Growth*. Donella Meadows, Jorgen Randers and Dennis Meadows conducted a project using "system dynamics theory and computer modelling to analyse the long-term causes and consequences of growth in the world's population and material economy" to examine and answer whether policies were leading to a sustainable future or to collapse (Meadows et al., 2004). The project was commissioned by the Club of Rome, an international group of scientists, businessmen and statesmen. The final report stated that "global ecological constraints related to resource use and emissions would have significant influence on global developments in the twenty-first century" (Meadows et al., 2004). Their work focused on the limits to growth seen as the physical limits of the planet, in other words, the availability of natural resources and the Earth's capacity to absorb emissions related to the industrial activity. At that time, they didn't know about some biophysical limits that came to light as the research continued during the next years until now. However, the results of the realistic scenarios ran in their model World3 found that such limits forced an end to growth during the 21st century. In their model, they analysed 5 elements of current societies: food production, global pollution, resources exploitation, industrial output and global population. Figure 3 shows the graph published in the 1972 book.

Figure 3. The limits to growth.



Source: Meadows et al. 1972.

What this graph shows is that population and industrial output growth would continue during the first decades of the 21st century. Afterwards, growth will inevitably stop. In all their projections, global population, resources exploitation, food production, industrial output and pollution will decline sometime between the years 2020-2050 (Meadows, 2010). Furthermore, Meadows (2010) states that what we currently consider problems are mere symptoms because the true problem is continued physical growth within a finite world. Growth leads to collapse when growth exceeds the planet's capacity; this is where we may be standing now. In 1972, the authors thought there was still time to rearrange policy options to avoid the danger they foresaw in the projections, by 1992 when they conducted a 20-year update and published their findings in *Beyond the Limits*, the conclusion was that there wasn't any time left, 20 years of history had reinforced their conclusions and that humanity had already overshot the limits of Earth's support capacity (Meadows et al., 2004). In 2004, once again the authors published another book, this time it contained the 30-year update. Although the warning is pretty much the same from the past book, they argue that there are some other important reasons (Table 3) that incentivized them to release it.

Table 3. Reasons for a 30-year update of *The Limits to Growth.*

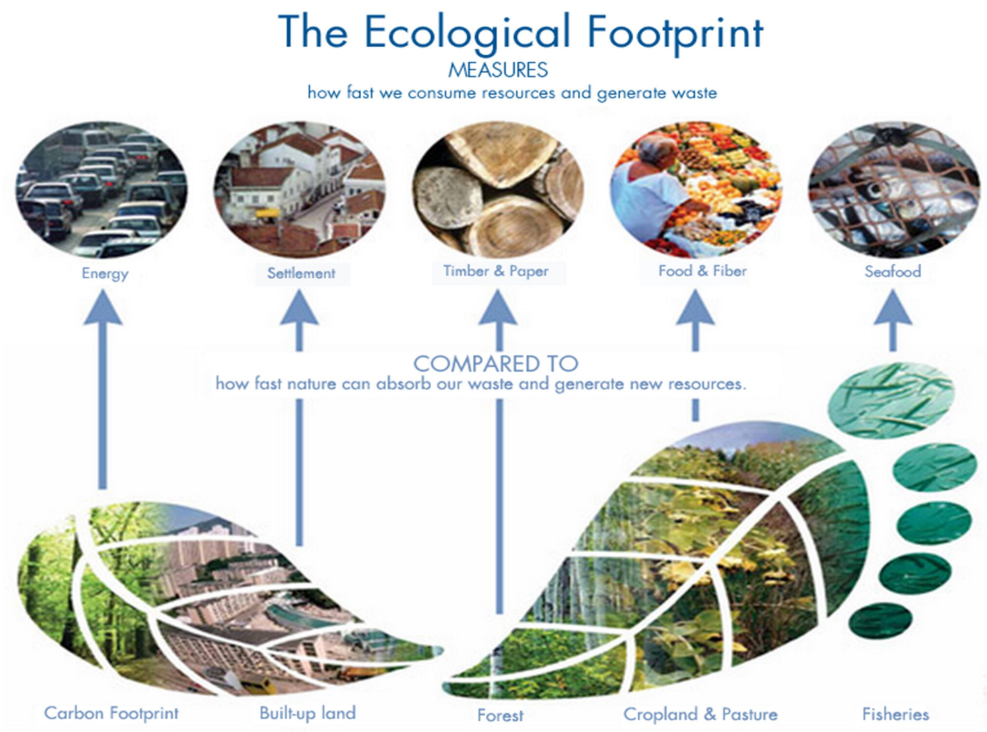
1. The authors' main goal was to restate their 1972 argument in a way that is more understandable and better supported by all the data and examples that emerged during the previous decades.
2. They wanted to stress that humanity is already in overshoot and that the resulting damage can be reduce through wise policy.
3. To offer data and analysis that contradict prevailing political pronouncements that humanity is on the correct path with current policy.
4. To inspire the world's citizens to think about the long-term consequences of their actions and choices.
5. To show that progress has been made since 1972 in understanding the long-term causes and consequences of growth.

Source: Own elaboration with information from: Meadows et al., 2004.

The signs of change that James Lovelock, Donella Meadows, Jorgen Randers and Dennis Meadows explored in their work are key elements of the relationship between the exploitation of planet Earth and her capacity to sustain such exploitation. Such capacity is frequently called bio-capacity, better understood and disseminated by the ecological footprint. The

ecological footprint was a study conducted for the Earth Council in 1997 by Mathis Wackernagel and his colleagues. They describe it as “the capacity of ecosystems to regenerate what people demand from those surfaces…the biocapacity of a surface represents its ability to renew what people demand... (therefore it is) the ecosystems’ capacity to produce biological materials used by people and to absorb waste material generated by humans, under current management schemes and extraction technologies” (Figure 4).

Figure 4. The Ecological Footprint.

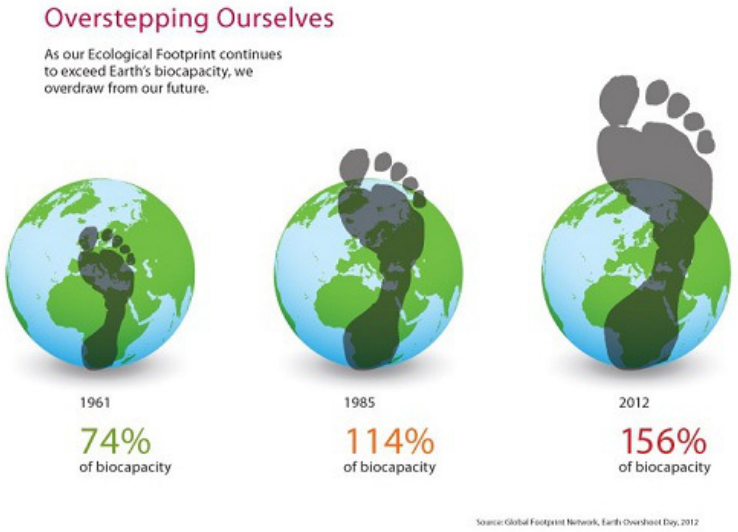


Source: Global Footprint Network (http://www.footprintnetwork.org/).

Their work on these calculations continues providing data and tools in their web page http://www.footprintnetwork.org/, and has been also helpful to build other related reports such as the ones released by the World Wildlife Fund (WWF) called *Living Planet Report* in which it is provided information on the

ecological footprint of most of the nations of the world. According to the Global Footprint Network, human societies around the world have been exceeding Earth's bio-capacity since 1985 (Figure 5) and keeps increasing. The consequences of this excess are very dangerous and in many cases, will take centuries and even millennia to correct (Meadows et al., 2004).

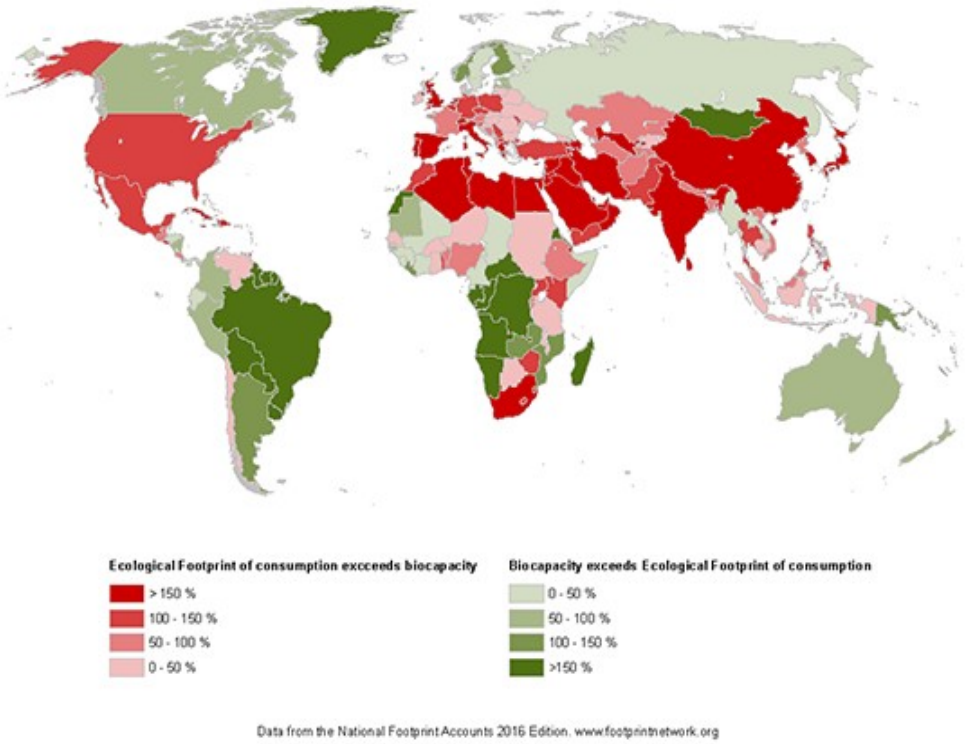
Figure 5. Ecological Footprint exceeding Earth's biocapacity.



Source: Global Footprint Network (http://www.footprintnetwork.org/).

"Ecological overshoot is possible only for a limited time before ecosystems begin to degrade and possibly collapse" (Global Footprint Network, 2010). Figure 6 shows in different shades of red, those countries that exceed their bio-capacity and those that their consumption doesn't exceed their bio-capacity in different shades of green. Darker shades of red show those countries that exceed by more than 100% their bio-capacity.

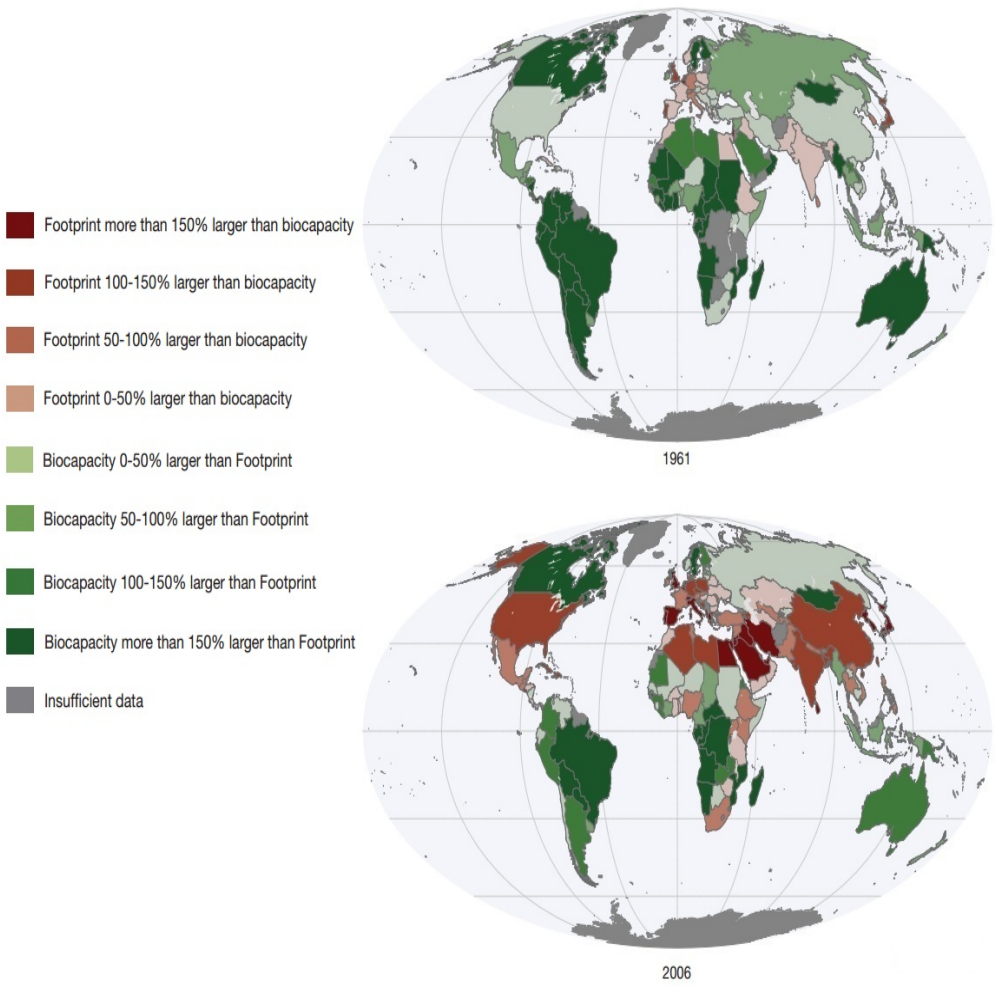
Figure 6. The Ecological Footprint and Biocapacity of Nations.



Source: Global Footprint Network (http://www.footprintnetwork.org/).

Among them are the United States of America, China, India, Japan, Spain, Portugal, Italy, the United Kingdom, South Africa, Mexico, as well as some other African, European and Asian countries. Nowadays, globalization allows the exchange of products all over the world. This might be beneficial for some economies and markets, but it raises risks from an environmental point of view, because many countries rely on the bio-capacity of other countries to meet their domestic demands (GFN, 2010). According to the Ecological Wealth of Nations repot (GFN, 2010) in 1961, most of the countries could sustain their own consumption without exceeding their bio-capacity. By 2006 the situation was different and disturbing, less than 20% of the global population was living in countries able to sustain their needs within their national biocapacity (Figure 7).

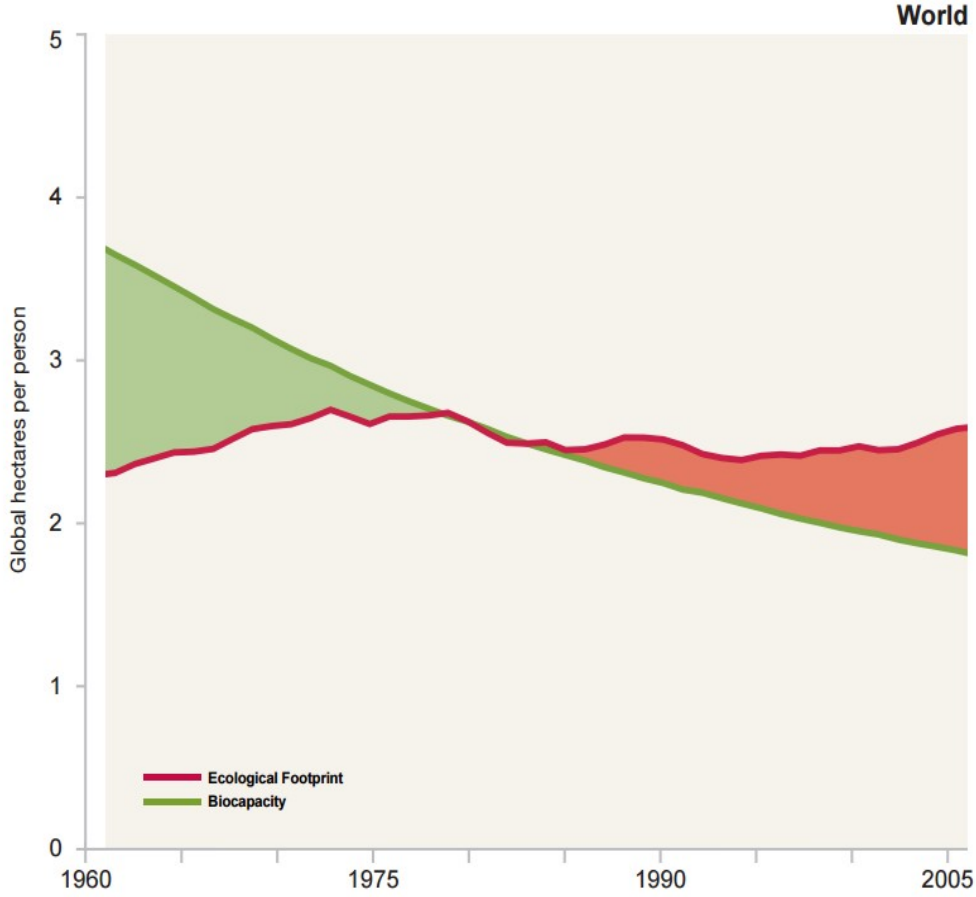
Figure 7. Footprint of consumption compared to biocapacity 1961-2006.



Source: Adapted from The Ecological Wealth of Nations (GFN, 2010).

Figure 8 shows global ecological footprint and biocapacity in global hectares per person from 1960 to 2005. As we can see in the graph, the amount of bio-productive space needed to meet human demands began to surpass Earth's biocapacity around 1980. Since then, Earth's biocapacity has been declining and being pushed to overexploitation.

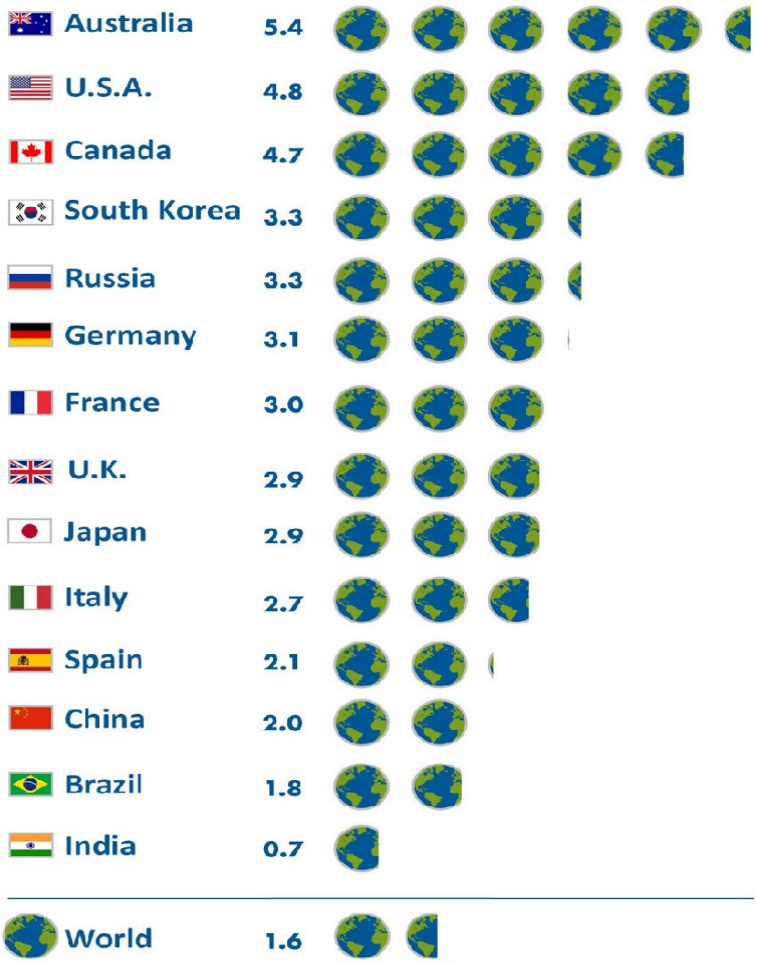
Figure 8. Ecological footprint and biocapacity in global hectares 1960-2005.



Source: Adapted from The Ecological Wealth of Nations (GFN, 2010).

In 2012, the global average ecological footprint was 2.84 global hectares per person with an average biocapacity of 1.73 hectares. Unfortunately, the pressure on Earth has not changed. In 2016, the Global Footprint Network released the National Footprint Accounts 2016 which provide an insight on how much is currently being needed to sustain diverse ways of life. Based on that information Figure 9 show examples of how many Earths would we need if all humans lived like a determined country.

Figure 9. How many Earths would we need if all humans lived like.



Source: Adapted from National Footprint Accounts 2016 (GFN, 2016).

We can see that if all humans would live like Australian citizens do, we would need a bit more than 5 planets like Earth, and so on with the other examples. The total average of the world is 1.6 planets, which means that we are exceeding Earth's capacity by more than a half extra planet. The concept of bio-productive space through the Ecological Footprint has become a relevant tool for understanding and operationalizing what can be modified in, for example, personal lifestyles. The GFN developed on its web site the Ecological Footprint Calculator which helps to find out the areas of resource consumption and what can be done to reduce such impact on Earth.

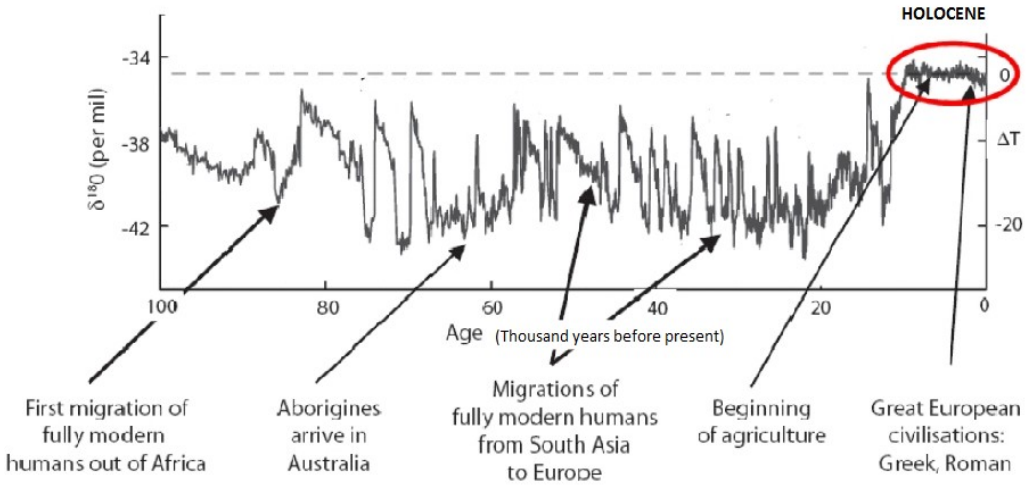
The Ecological Footprint came to add a significant perspective on the natural environment-human society's relationship. However, it considers the bio-productive space, in some way, superficially. This is because, behind the capacity of Earth and its space to be productive, there are complex sub-systems and networks that cannot be seen through this framework. There is another analytical framework that allows us to get a more in-depth perspective of key systems performance, which appeared in 2009.

A group of climate researchers leaded by Johan Rockström, published their paper Planetary Boundaries: Exploring the Safe Operating Space for Humanity. Their work argues that anthropogenic pressures have reached a point where changes on the Earth system can't be ignored anymore. The analytical framework contains estimates of planetary boundaries to analyse global sustainability. The crossing of one or more of these boundaries could potentially result in abrupt and catastrophic environmental change at a planetary scale. They concur with past conclusions made by James Lovelock and The Limits to Growth team, fundamentally that exponential growth has been adding an enormous and dangerous pressure on Earth and that such pressures could destabilize biophysical systems to a point of irreversible damage.

Rockström et al., 2009, introduce and explain the concept of planetary boundaries, identify "key Earth System processes and attempt to quantify for each process the boundary level that should not be transgressed if we are to avoid unacceptable global environmental change". What they mean by "unacceptable global environmental change", are the circumstances induced by humans that trigger a transition from the Holocene to the so-called Anthropocene. The Anthropocene has been recently adopted as the term to identify a new historical era on Earth that refers to the overriding and profound influence of human beings on the functioning and well-being of the planet.

One of the most important facts in which the planetary boundaries framework stands is that during the Holocene (around 11,700 years ago until our present), Earth remained under stable conditions that serve as a reference point for “key biogeochemical and atmospheric parameters fluctuating within a relatively narrow range” (Rockström et al., 2009) (Figure 10). Another relevant fact is the thresholds or tipping points, which are defined as “non-linear transitions in the functioning of coupled human environmental systems” that can happen on a global or local scale (Rockström et al., 2009).

Figure 10. The Holocene era.



Source: Adapted from Rockström et al., 2009.

One more fact that is vital to this framework is, as mentioned before, Earth System processes. Table 4 summarises the main features of the three key facts just mentioned.

The research group identify 9 Earth system processes: climate change, ocean acidification, stratospheric ozone, global P and N cycles, atmospheric aerosol loading, freshwater use, land use change, biodiversity loss, and chemical pollution. Figure 11 show the 9 processes, where we can see red

zones that indicate uncertainty and high risk, yellow zones that indicate uncertainty and increasing risk, green that indicate below boundary and still safe conditions, and grey that indicates boundary not yet quantified.

Table 4. Features of the key facts in which the planetary boundaries framework stands on.

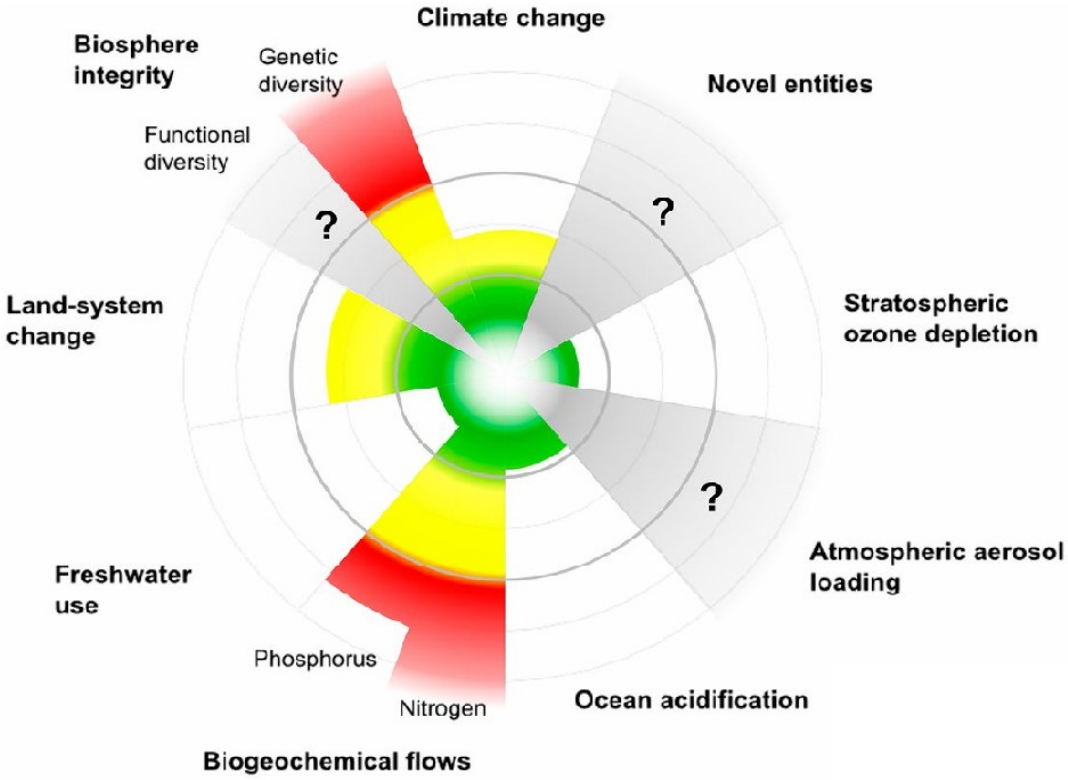
Historical data	Tipping points	Earth system processes
1.Earth remained within a stable domain during the Holocene era (around 11,700). 2.There weren't any drastic interferences with the Earth's functioning at a global scale. 3.The Holocene era conditions may be maintained for thousands of years into the future if it was not for human interference since the industrial revolution.	1. The point at which a small perturbation can cause a large response and qualitative change in the future state of a system. 2. Such changes may be abrupt and irreversible. 3. Are difficult to predict due to the complexity of the environmental systems nature, therefore, the precautionary principle must be always present. 4. The analysis of environmental tipping points should be translated and integrated to the policy making process to adopt the challenges and respond accordingly.	1. Science has provided warnings regarding the risks of crossing thresholds, there is evidence for at least two of the systems, climate change and stratospheric ozone. 2. Other systems can show tipping points, for example, scientists have identified changes between landscape states, and biogeochemists have identified roles of positive feedbacks in driving oceanic anoxic events.

Source: Own elaboration with information from Rockström et al., 2009; Ecologic Institute and SERI, 2010; Lenton, 2013.

Two of the nine boundaries have crossed the line into the red zone of uncertainty and high risk, the first one is genetic diversity that is part of the biosphere integrity, the second is the P and N cycles, part of the biogeochemical flows boundary. Another two boundaries have crossed the line into the yellow zone of uncertainty and increasing risk; these are climate change and land system change. Three boundaries are still within the green zone, freshwater use and stratospheric ozone depletion although the third one, ocean acidification, has almost reached the line into the yellow zone.

Finally, there are three boundaries that remain unquantified: functional biodiversity, novel entities and atmospheric aerosol loading. Table 5 describes some relevant characteristics of the planetary boundaries.

Figure 11. Planetary boundaries.



Source: http://www.stockholmresilience.org/research/planetary-boundaries/planetary-boundaries/about-the-research/the-nine-planetary-boundaries.html

In 2015, “Planetary boundaries: guiding human development on a changing planet” revised and updated the planetary boundaries framework based on new scientific research developed since the 2009 publication (Steffen et al., 2015). In this new version, the authors highlight that two of the boundaries, climate change and biosphere integrity, have the power on its own, to cause on Earth a new and dangerous state.

Table 5. Planetary boundaries.

Stratospheric ozone depletion The ozone layer located in the stratosphere filters out ultraviolet radiation from the sun, if decreased, more UV radiation will reach the biosphere damaging humans, terrestrial and marine biodiversity.	**Biodiversity integrity** Refers to biodiversity loss and extinctions. According to the Millennium Ecosystem Assessment (2005) anthropogenic changes to ecosystems were faster during the past 50 years than at any time in human history which increases the hazard of abrupt and irreversible changes.	**Novel entities** Includes chemical pollution and the release of novel entities, such as heavy metal compounds and radioactive materials which can have irreversible effects by affecting biodiversity, atmospheric processes and the climate system. Currently, humans are still unable to quantify a single chemical pollution boundary, however, the risk of crossing such thresholds is enough understood for its inclusion within the planetary boundaries.
Climate change Scientific evidence suggests that the current CO_2 atmospheric concentrations (more than 400 ppm) have already passed the planetary boundary and rapidly approaching to several system thresholds or tipping points such as the loss of summer polar sea-ice which is almost certainly irreversible, and which can unleash rapid positive feedback, as it is the same case with the destruction of world's rainforests where climate-carbon cycle feedback accelerates global warming.	**Ocean acidification** Oceans capture and dissolve around a quarter of the anthropogenic CO_2 emitted into the atmosphere. In the ocean, CO_2 forms carbonic acid, which alters the ocean's chemistry making it more acid and reducing the amount of carbonate ions which is fundamental for many species to form their shells, Moreover, the acidification of the ocean makes bad conditions for corals, shellfish and plankton to survive. Ocean's acidity has increased by 30% compared to pre-industrial times. The extension of the damage is global due to their extension on the planet.	**Freshwater use** The climate and land use boundaries are closely linked to the freshwater one. Additionally, humans have altered the functioning and distribution of freshwater systems. Water is becoming increasingly scarce.
Land system change All types of land such as grasslands, forests, wetlands have been converted to agricultural land. In addition, such changes are driving forces of biodiversity loss, changes on freshwater flows and the biogeochemical cycles of carbon, nitrogen and phosphorus.	**Biogeochemical flows** Industrial and agricultural processes have change drastically the biogeochemical cycles of nitrogen and phosphorus. Human activities transform atmospheric more nitrogen to reactive forms than all related Earth's processes together, polluting the biosphere.	**Atmospheric aerosol loading** The interaction between aerosols and water vapour is critical in the hydrological cycle affecting cloud formation and atmospheric circulation patterns at a global scale. Aerosols also affect the amount of solar radiation reflected or absorbed back to space.

Source: Own elaboration with information from Steffen et al., 2015.

Additionally, this revision reinforces the necessity of having a safe operating space for human societies in which they can remain. For that, the authors propose once more the planetary boundaries framework that, if it is respected, could reduce the threat that humans are imposing to the planet.

The boundaries are placed in a range of uncertainty, but where current scientific knowledge tells that there is high probability to take the planet's systems beyond thresholds and resilience capacity. The boundary is located before reaching the tipping point as well as the limit of the capability of the systems to persist under pressure (resilience capacity). As seen before, biogeochemical flows of N and P as well as biosphere integrity (genetic diversity) are beyond such limits and are now in a zone of high risk to cross anytime their tipping points and resilience capacity.

According to the precautionary principle, it would be unwise (not to say extremely irresponsible) to push the Earth system substantially away from the stability condition kept during the Holocene era. Earth has been putting into action her resilience capacity until now; however, there are already signs that she's been pushed into her limits. According to Rockström, we may have now crossed a tipping point in the loss of portions of the Antarctic ice sheet. Furthermore, there is not still enough knowledge on how the boundaries interact and how dangerous this may be. Of course, we should be worried about the signs, but the planetary boundaries framework sets a guide to correct the catastrophic path our societies are walking now. The obvious question is whether it will be enough to reach and pull politics towards the actions needed.

1.3 Planetary boundaries to anthropogenic climate change.

We see a tipping point occurring right before our eyes, the Arctic is the first tipping point and it's occurring exactly the way we said it would.
James Hansen

There are signs of mismanagement in all Earth systems, all the spotted planetary boundaries are at risk and science has achieved and gathered evidence on the damage and dangers this poses to the planet and human civilization well-being. However, the focus of this dissertation is on the climate change boundary only. The reason for this is the subject of research: climate change mitigation policy, taking as an example the REDD+ strategy as a tool to reduce greenhouse gas emissions within the NDC and with this,

contribute to tackle climate change. Therefore, the comprehension of this system and its boundary is vital to analyse whether such strategy and its outcomes are useful to attain the reductions needed.

This next section integrates some of the most relevant features that have emerged during recent decades and contribute to the knowledge of this system and boundary. We can begin the history of the planetary boundary to anthropogenic climate change in 1824, when Joseph Fourier documented that atmospheric gases absorb heat from the incoming sunlight to Earth and then increase the temperature on the surface of the planet. In 1896, Svante Arrhenius made calculations on the amount of atmospheric carbon dioxide and the related increase in global temperatures, estimating that if doubled, such amount would rise the temperature in a range of 5 to 6°C. Then, John Tyndall, studied and measured how much heat each atmospheric gas absorbs, discovering what would be later known as the “greenhouse gas effect”, explaining that “if the amounts of different gases in the atmosphere were to change” this would allow the atmosphere to absorb more radiation and therefore, allow the climate to change (Powell, 2011). Later, in 1938, Guy S. Callendar published an article where he concludes that Earth was getting hotter, by analysing data from 200 meteorological stations. A few years later, Roger Revelle and other scientists based at the Scripps Institute of Oceanography, using the radiocarbon dating technique, detected fossil carbon in the atmosphere which could not get there but through burning fossil fuels only. Additionally, they discovered that oceans are not capable of absorbing more than about 10% of atmospheric carbon dioxide, and therefore, cannot be thought as an option to withdraw anthropogenic carbon dioxide that have been realised and increasing since the Industrial Revolution. Thus a body of critical scientific information has been assembled to establish the connection between human activities and an increase in carbon dioxide concentrations in the atmosphere; and that this gas and other gases were capable of increasing temperatures; and that this could eventually change Earth’s climate and that the oceans could not act as a sink for an increasing amount of carbon dioxide. Measuring atmospheric carbon

dioxide concentrations therefore became an imperative. In the 1950's decade, Charles D. Keeling began measuring atmospheric carbon dioxide concentrations at two monitoring stations, one located in Hawaii and the other in Antarctica to ingeniously avoid variations related to factories or highways near to other possible points to take the samples. Keeling then obtained the data that confirmed past outcomes, two years of measurements exposed an increase in atmospheric carbon dioxide concentration, and contrary to past assumptions such measurements revealed that it wouldn't take hundreds or even thousands of years for carbon dioxide concentrations to increase. It could be as short as annually. By 1965, there was enough data to unveil a warning through the President's Science Advisory Committee of the United States of America, which said that "by the year 2000 there will be about 25% more CO_2 in our atmosphere" than at that moment, and that such increase "will modify the heat balance of the atmosphere to such an extent that marked changes in climate could occur" (Powell, 2011). One of the early computer models, answered in 1967 the question related to how much temperature could be reached if atmospheric carbon dioxide concentrations doubled, or what is the same, it answered what is the climate sensitivity. An improved model did the same exercise in 1975, estimating climate sensitivity at 3.5°C. However, the most important conclusion was the confirmation that an additional amount of carbon dioxide in the atmosphere because of burning fossil fuels would certainly cause an increase in the temperature. In addition, amplifying feedbacks would cause, with even a small amount of carbon dioxide, huge increases in global temperature. We need to remember that amplifying feedbacks trigger tipping points and that beyond them, climate dynamics can cause fierce changes that can be out of any control. Feedbacks determine the magnitude of climate change, they are dominant on time scales from decades to hundreds of thousands of years, and some of them are already seen, such as "significant reduction in ice sheets, release of greenhouse gases from melting permafrost and Arctic continental shelves, as well as the movement of climatic zones with resulting changes in vegetation distributions" (Hansen, 2009). The instability of the Greenland ice shelf, for example, shows that "we can't let it go on another then years like this",

otherwise, the continued increase on emissions will eventually imply such changes that will produce a different planet (McKibben, 2010).

Back to the decade of 1970's, James Hansen, another crucial researcher in the field, was conducting an experiment to measure the properties of Venus' clouds that was on board the Pioneer Venus mission. Hansen resigned from the project before it even got to Venus, passing it over to a colleague. The reason was the background data that had been coming to light, showing that the atmosphere composition of Earth was changing rapidly. The concentration of carbon dioxide was in the spotlight, as well as the source, most likely to be humans burning fossil fuels. Then, the next question to answer was concerning the implications this would have on the planet's climate (Hansen, 2009). By 1988, Hansen was 99% confident that Earth's atmosphere was suffering critical changes due to an anthropogenic climate forcing and therefore, she had entered a period of long-term warming.

A climate forcing is an imposed perturbation or disturbance of the planet's energy balance that tends to alter global temperature (forcing drive climate change), examples of this would be a brighter sun that would make Earth warmer or a human-made change to the atmospheric composition (Hansen, 2009). These forcing elements affect the energy balance and temperature of Earth and are measured in watts per square meter. Hansen explains: if the sun becomes 1 percent brighter, it is a forcing of about 2 watts per square meter, because the planet absorbs 240 watts of sunlight averaged over day and night. Nowadays, the largest climate forcing in course is anthropogenic greenhouse gases which cause less energy radiated from Earth than she absorbs, causing an energy imbalance that causes warming. Today it can be calculated, with less than 15% uncertainty, the impact of anthropogenic CO_2 to Earth's energy balance. The climate forcing induced due to CO_2 emissions since 1750 to 2000 is 1.5 watts, plus others such as methane, nitrous oxide, chlorofluorocarbons that make a total of 3 watts. Science has discovered examples in Earth's history that show the climate's sensitivity to a change of climate forcing and, if current climate forcing add more than 1 watt per square meter, the temperature on Earth will go beyond the amount registered

in the past million years. During the Pliocene, three million years ago, there was a global warming of 2°C that caused sea levels to rise 25 meters higher than today, and a climate forcing of 6.5 watts per square meter, registered 20,000 years ago, maintained Canada and parts of the United States below a thick ice sheet (Hansen, 2009). However, anthropogenic climate forcings are triggering a climatic change response faster than those induced naturally, which in contrast took 20,000 to 100,000 years compared to current changes induced in just a few decades. Unfortunately, paleoclimate does not give data on the Earth's response to fast, relentless and large scale forcings (Hansen, 2009). Nonetheless, we do have reasons to be worried. We know then, that historic naturally induced changes have had dramatic consequences on Earth's climate, that there are amplifying feedbacks that trigger tipping points and to make things even worse, oceans, ice sheets and world energy systems act as sources of inertia that also affect global warming (Table 6).

Table 6. Sources of inertia that affect global warming.

Oceans	Ice sheets	World energy systems
Ocean on average is 3,900 meters deep (being the deepest area in the Marianas Trench about 11,000 meters deep). Therefore, it takes centuries to completely warm because of anthropogenic warming. For this reason, even if CO2 concentrations were stabilised today, the ocean will continue to warm. Surface temperature reaches its long-term response to a forcing in just a few decades, and it takes even centuries to get a full response. However, the ocean currently has already reached more than a half of its full response to anthropogenic greenhouse gases.	When the planet and oceans get warmer, ice shelves begin to melt, and ice sheets are softened up. Under business as usual, there is a high certainty that ice sheets will collapse, and sea level will rise at least several meters. Thousands of years ago, Earth came out of the last ice age recorded and as the planet became warmer, sea level rose at an average rate of one meter every 20 to 25 years that continued for centuries.	Fossil fuelled energy controls human world today. Coal, gas and oil are the main sources of energy and a transition out of their use will certainly be very slowly, what would mean more greenhouse gas emissions and climate change in the meantime.

Source: Own elaboration with information from Hansen, 2009.

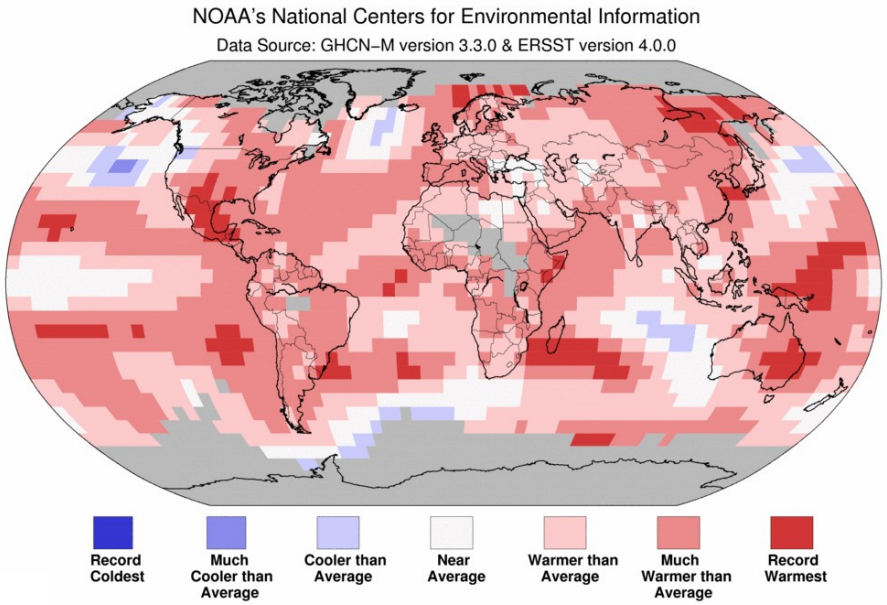
Years later after Hansen's statement in 1988 occurred, scientists were discussing what would be then the limit that shouldn't be crossed to prevent runaway warming and climate change.

To answer this, in 2008 Hansen and other colleagues published an article where they explain why CO_2 atmospheric concentrations shouldn't go over 350ppm. This number has already been exceeded by much, by burning fossil fuels, humans are currently increasing atmospheric CO_2 by 2ppm per year, in other words, this man-made climate forcing is ten thousand times more powerful than the natural forcing and up until July 2017, CO_2 atmospheric concentration was at 407ppm (NOAA, 2017). This means that we have not just to stop but to go back (Hansen, 2008). There are 5 issues, in addition to paleoclimate data, which support that the aim should be 350ppm at the most: the area of Arctic sea ice as well as mountain glaciers have been disappearing faster than it was predicted by models (Antarctica's Larsen A ice shelf collapsed in 1995, Larsen B ice shelf collapsed in 2002, and an almost 6,000 km^2 iceberg from Larsen C ice shelf has recently detached on 12 July 2017 (Lang, 2017)); subtropical regions have extended their areas by 4 degrees of latitude; coral reefs are suffering various pressures, including ocean acidification and surface water warming (Lynas, 2008).

Consequently, what some scientists have proposed is to focus on preventing getting beyond 2°C of warming by focusing on an amount of cumulative CO_2 emissions that could still be emitted before reaching such point (Monastersky, 2009, Gignac and Mathews, 2015). However, according to Malte Meinshausen, climate researcher at the Potsdam Institute for Climate Impact Research and Professor at the University of Melbourne, the remaining emissions budget is very small, and if emissions are to be decreased in a smooth way, options are practically gone because we are rapidly on our way to getting 2°C of warming (based on trends of emissions of the past years and under current policies). Figure 12 shows an image from NOAA's National Centres for Environmental Information that clearly illustrates the status on global average warming trends. During the period between January and March 2017, global land and ocean surface temperature was 0.97 above the 20^{th} century average of 12.3°C, which is the second highest period in the record taken since 1880 (the first highest period was recorded in 2016). For this same period but in 2017, global land surface temperature was also the second highest at 1.75°C above the 20^{th} century average of 3.7°C. January,

February and March 2017 were characterized by warmer to much warmer than average conditions on most of the Earth's land and the average global sea recorded 0.68°C above the 20th century average of 15.9°C and characterized by warmer to much warmer than average conditions in most of Earth's oceans (Table 7).

Figure 12. Land and Ocean temperature percentiles Jan-Mar 2017.



Source: NOAA: https://www.ncdc.noaa.gov/sotc/global/201703

Table 7. Global average temperature anomaly from January to March 2017.

JANUARY–MARCH	ANOMALY		RANK (OUT OF 138 YEARS)		RECORDS		
	°C	°F			YEAR(S)	°C	°F
Global							
Land	+1.75 ± 0.16	+3.15 ± 0.29	Warmest	2nd	2016	+2.06	+3.71
			Coolest	137th	1893	-1.30	-2.34
Ocean	+0.68 ± 0.15	+1.22 ± 0.27	Warmest	2nd	2016	+0.82	+1.48
			Coolest	137th	1911	-0.48	-0.86
Land and Ocean	+0.97 ± 0.16	+1.75 ± 0.29	Warmest	2nd	2016	+1.15	+2.07
			Coolest	137th	1911	-0.54	-0.97

Source: Adapted from NOAA/National Centres for Environmental Information. https://www.ncdc.noaa.gov/sotc/global/201703

Continuing with the cumulative carbon budget, Myles Allen, Professor of Geosystem Science at the University of Oxford, together with Professor Mainshausen and other colleagues, ran simulations in combined climate-carbon cycle models which showed that if CO_2 emissions could be limited to 1 trillion tonnes, there would be a chance to prevent a warming of beyond 2°C. Their finding is that global temperature change is linearly associated to cumulative emissions and then, the idea is having a global carbon budget which can inform climate mitigation policy to prevent going further with such warming (Gignac and Mathews, 2015) by allocating a very specific number on the emissions that could still be emitted before reaching the trillionth tonne. We are currently on 612,901,700,000 and counting, and therefore, the estimate is that the remaining emissions budget will be reached by the year 2037 under current circumstances. Although this strategy seems to be our best opportunity given our current situation, it is unfortunately still far from what is needed. The associated warming to the trillionth tonne (2°C) "is actually a prescription for long-term disaster" according to James Hansen, because this will take the planet to an ice-free Arctic, sea level rise in more than ten meters and eventually modify Earth altering her into a different planet (Parry, 2011). Summarizing, we know now that talking of limiting global warming in terms of ppm of CO_2 takes us to 350ppm at the most; in terms of cumulative carbon emissions the number is less than a trillionth tonne, although this number only means to prevent going beyond 2°C of warming, and in terms of temperature, the limit is below 1°C (Table 8).

Table 8. Boundaries to anthropogenic climate change.

Atmospheric concentration (ppm)	Current	Temp.	Current	Cumulative emissions budget	Current
350ppm	407ppm	Less than 1°C	1.48°C*	Less than 1 trillionth tonne**	612,901,700,000 (and counting)

Source: Own elaboration with information from: Hansen, 2009; *Global average temperature reached in Jan-Mar 2016 https://www.scientificamerican.com/article/earth-flirts-with-a-1-5-degree-celsius-global-warming-threshold1/; http://www.trillionthtonne.org/ **for preventing going beyond 2°C of warming.

Although there have been proposals on the matter, such as the one by the Deep Decarbonization Pathways Project (but only considering the energy sector for the period between the period 2015-2050), there has no estimate of the share that would apply for each sector to get to such goals to stay within the boundaries to anthropogenic climate change. Therefore, there isn't a specific number for the forestry sector. However, what we surely know is that, citing James Hansen again, we have not just to stop but to go back. So, no effort will be too much, but they can be too little. The need for strong strategies and policies that effectively reduce, stop and reverse greenhouse gas emissions are now vital and any attempt to get to these figures will require strong policy leadership and international cooperation. On this matter, four different ways to approach such a target have been proposed: 1) to set a stabilisation of atmospheric concentrations at 350ppm of CO_2, 2) keeping the global mean temperature below 2°C of warming, 3) reducing emissions by 50%-80% by the year 2050, and 4) a total emissions budget (cumulative warming commitment) of 565GtCO_2 which leaves 80% probability of staying below 2°C. These options are part of the UNFCCC negotiations in the first place and secondly, are related to individual country actions to implement their own policies to accomplish their pledges to tackle global warming, even if a sufficient legally binding treaty has not come into force yet.

1.4 Carbon budgets and targets for limiting climate change

All UNFCCC's parties have committed to reducing emissions to avoid "dangerous interference with the climate system". However, policy-makers are trying to find the way to do it and translating that into policies. When selecting a target to base those policies on, some argue for keeping the global temperature below 2°C above preindustrial levels, while others argue for a stabilization of atmospheric CO_2 concentrations at 350ppm, there are others who advocate for reducing emissions by 80% by the year 2050 and lastly there are others who strongly support a cumulative emissions budget. The aim is the same: all of these approaches try to determine what level of CO_2 is needed to avoid a dangerous increase in the global mean temperature (Schmidt and Archer, 2009).

The selection of a target is a necessity for structuring climate mitigation policies and such selection is of extreme importance for two main reasons. The first one is the space for ambiguity each option could leave. For example, using the below 2°C target doesn't specify how much reductions of GHGs emissions are needed by sector and/or country. While using the cumulative warming commitment makes easier to calculate a number of total emissions allowed for keeping 80% chance of staying below 2°C. The second reason relates to the practicality of tracking emissions reductions progress. Using the same example, once the share for each sector and/or country is calculated within the cumulative warming commitment, it would be easier to keep track of the policies' efficiency for reducing emissions. Taking these two reasons into account, emissions budgets are closer than stabilization targets to the effective policies required for regulation of anthropogenic GHGs emissions.

1.4.1 Stabilisation of the atmospheric CO_2 concentration at 350ppm

When discussions began to explore policy options to reduce CO_2 emissions, nations adopted 550ppm as top target to pursue, but soon researchers concluded that CO_2 concentrations should not exceed 450ppm. Later, James Hansen and his colleagues (2008) concluded that even 450ppm was too high. So according to their studies we need not only to stop but to go back to 350ppm. As of 2017, global concentrations have reached 408 ppm already (NASA, 2017), but some scientists claimed it should take relative little time (around 100 or 200 years) to reverse the course once all emissions were cut off. At least that was their belief before the study from the National Oceanic and Atmospheric Administration (NOAA) in Boulder, Colorado lead by Susan Solomon. The study concluded what would happen if CO_2 emissions ceased after concentrations peaked at different ppm concentration values (Solomon et al., 2009). The result was that CO_2 levels decreased very slowly, and they remained above preindustrial levels for 1,000 years. Moreover, global mean temperature stayed up as well and started declining once it peaked by the year 3,000. The explanation for this slow recovery seen in the simulated conditions is due to two factors: the first one is because natural sinks are only

able to take up a fraction of the CO_2 atmospheric, ensuring a warming effect long after emissions are cut off. The second factor is the thermal inertia of the oceans, as the vast amount of water in them delays the rate of warming in the surface due to the lagging effect. Then, once they have completely warmed, it will take more time for Earth to cool down even if emissions have already ceased. The results of this simulations were reinforced by another study conducted by Lowe et al. (2009) at the Met Office, which coupled a general circulation model to a carbon cycle one finding that temperatures stayed elevated after the emissions were cut off (Monastersky, 2009).

Such exercises allow us to see that using the ppm reference target for building policy could be unsuitable for two main reasons. For instance, global atmospheric GHGs concentrations have already passed by a lot what science has identified as a safe limit: 350ppm; and according to the studies mentioned above, it will take a long time now to go back to that safe limit. This leads to the second point: we need to stop emissions right now, so any policy based on the ppm target would have to prohibit all emissions and begin GHGs elimination from the atmosphere as soon as possible. So, using this target leaves no room for any more emissions. That is what we are searching for, but unfortunately the global socio-economic inertia imposes a huge problem to suddenly do it.

1.4.2 Keeping global mean temperature below 2°C of warming

According to top climate scientist James Hansen, the target of keeping global mean temperature below 2°C proposed at UNFCCC negotiations will not prevent the devastating effects of global warming. His research on the subject suggests that the climate is more sensitive to GHGs emissions than had been suspected and therefore, with 2°C more the planet would probably be warmer than it had been in millions of years, so such target “is actually a prescription for long term disaster” (Hansen, 2008). In this same line, as of December 2015, 158 pledges had been submitted to the United Nations accounting for 94% of global CO_2 emissions that according to the Climate Action Tracker they would result in around 2.7°C of warming in 2100 and this is conditional to all governments meeting their pledges. However, the

situation could be even worse, because with their current policies we are heading to a 3.6°C of warming according to Prof. Kornelis Blok (Climate Action Tracker, 2015).

So, given that the sensitivity of the planet to GHGs is higher than thought this would mean that there is less room to allow a higher amount of emissions, less time to act and that the pledges submitted until now are not as ambitious as needed.

Although the 2°C target may have some use in the perception of the climate-related risks and consequences (Leggewie and Messner, 2012) (the related effects expected to 2°C more degrees are an increased risk of sea level rise, shifting rainfall patterns, extreme weather patterns such as floods, droughts and heat waves, among others), it does make it difficult to frame mitigation policies. According to Mike Hulme (2012) this would be due to four characteristics: universality, ambiguity, doubtful achievability, and questionable legitimacy. The universality characteristic refers to the assumption that achieving climate change mitigation is the only one goal, leaving aside other implicit spheres of the problem. Ambiguity refers to the focus on the output element, meaning by this the temperature increase, and leaving aside the input elements which would have to be the most important things to observe, such as GHGs emissions for example. For doubtful achievability, Hulme states that there isn't enough understanding yet of the complexity of planet Earth and much less with 2°C more of warming in which human societies would have to re-think their lives. Finally, the author doubts the legitimacy of this target, since neither of both, scientists nor politicians fully accept the responsibility for the adoption of this target. Summarizing, this target can make it easier to raise attention around the precautionary principle, on the devastating effects on Earth of allowing an increment on the global mean temperature. However, this is not enough for developing climate change mitigation policies. The most important reasons for this, agreeing with Hulme, are his ambiguity and doubtful achievability points. When building policy for stopping more global warming and climate change from happening, we need to focus on the sources of the problem. We need to take measures to regulate current emissions and prevent future ones. And here we return to

what James Hansen highlights regarding Earth's climate sensitivity (the relationship between GHG concentrations and temperature change). When looking for a stabilization concentration we must know in the first place the long-term response of the planet in terms of the climate sensitivity, so we can calculate how much warming we will have for a given concentration (Schmidt and Archer, 2009). Then, a given level of cumulative carbon emissions can be associated solely with a given global temperature change. The policy implications of this are huge, and the conditions with 2°C of warming may be even more devastating than predicted. But, such conditions will be a certainty when we actually experience them and too late to prevent them.

1.4.3 Reducing emissions by 80% from 1990 levels by the year 2050

An example of this approach is the European Commission's roadmap plan to transform the EU into a low carbon economy by the year 2050. This plan aims to cut total GHGs emissions by 80% by 2050 as a minimum and up to 95% below 1990 levels. A relevant part of this plan is that it considers such reductions coming from domestic efforts rather than relying on abroad carbon credits plus a strong focus on development and implementation of clean technologies. This plan also highlights the importance of having all sectors contributing significantly, given that the power generation sector is the one with the biggest potential for cutting emissions. To achieve this, it will be necessary to work on the transition to renewable energy sources, implementation of energy efficiency measures and significant investments in low-carbon technologies.

However, a study conducted by Weaver et al. (2007) examined the long-term climate implications of diverse GHGs emissions reduction targets by the year 2050. Their conclusions were that all of those with less than 60% global reduction by 2050 break the 2°C limit of warming within this century. Furthermore, even with a stabilisation at 90% below current levels such threshold is eventually broken. The authors suggest then, that if the 2°C warming level is to be avoided, among other actions, large amounts of carbon capture and storage will be needed. According to their research, even

if emissions are eventually stabilised at 90% less than 2006 levels globally, equivalent to 1.1GtC/year, the 2°C threshold is broken before the year 2500.

1.4.4 Cumulative emissions

When talking about the urgency of avoiding an everyday increasing risk of catastrophic global warming, the crucial point is how much of GHGs go into the atmosphere. According to Professor Myles Allen, policy targets based on limiting cumulative emissions of carbon are likely to be more scientifically robust than those based on emissions rates or concentration targets (Allen et al., 2009).

The cumulative carbon emissions are the sum of the total CO_2 emitted during a given period of time and global warming responds linearly to them. Therefore, it is an effective way of quantifying how global temperatures respond to anthropogenic emissions and moreover, a cumulative carbon budget is a good representation of an amount of emissions for a given target (Matthews, Zickfeld, Knutti, Allen Eds, 2015). Translating this to policy, having a cap or budget on total emissions gets a clearer idea of a number of reduction on emissions below a baseline year, rather than trying to reach a concentration target (350ppm) that has actually been exceeded. Ideally, emissions should be back to 350ppm or even to pre-industrial levels. Unfortunately, current emissions will not just stop and reverse so, what mitigation policy is seeking is to begin progressive cuts. In this sense, it is more helpful that once a budget is stablished, you spend it and after that there is no more left to spend. Meinshausen et al. (2009) and Allen et al. (2009) conducted studies on the relationship between carbon emissions and the climatic response to them to try to evaluate how much additional CO_2 might be the total budget that could still be emitted. Both studies agree that what really matters is the total amount of carbon emitted, which they call the cumulative warming commitment (CWC). This determines the peak temperature change expected as a function of such emissions (Schmidt and Archer, 2009). The conclusions of these studies calculate that another 480GtC would put us over 2°C with more than 50% likelihood, given that

anthropogenic emissions up to 2008 have reached 520GtC already. In conclusion, the cumulative carbon budget should stay below the trillion tons.

A few years later, another study estimated cumulative carbon budgets ($GtCO_2$), remaining emissions quotas from 2015 and 2020 ($GtCO_2$), and equivalent emission-years associated with a 66% or 50% probability of global mean warming below 2°C, 3°C and 4°C relative to the period 1850-1900 (Friedlingstein et al., 2014). According to this research, the cumulative budget since 1870 for having 66% probability of staying below 2°C is 3,200$GtCO_2$, leaving a remaining quota since 2015 of 1,200$GtCO_2$ equals to around 30 more years of emissions, and from 2020 onwards the remaining quota is 1,000$GtCO_2$ equals to around 22 more years of emissions. For a 50% probability of staying below 2°C the remaining quota is 1,500$GtCO_2$ equals to around 37 more years of emissions from 2015, and from 2020 the remaining quota is 1,300$GtCO_2$ equals to around 28 more years of emissions. The cumulative budget since 1870 for having 66% probability of staying below 3°C is 4,900$GtCO_2$ leaving a remaining quota since 2015 of 2,900 $GtCO_2$ equals to around 72 more years of emissions and from 2020 the remaining quota is 2,700 $GtCO_2$ equals to around 58 more years of emissions. For a 50% probability of staying below 3°C the remaining quota is 3,300 $GtCO_2$ equals to around 82 more years of emissions from 2015, and from 2020 the remaining quota is 3,100 $GtCO_2$ equals to around 67 more years of emissions.

Summarizing, the studies based on this approach have shown that the temperature increase is closely related to the total amount of CO_2 emissions released and accumulated over a period of time. In other words, any future level of global warming is associated with a quota on cumulative global CO_2 emissions (Raupach et al., 2014). So, new policies must limit the overall amount of emissions accumulated over the years rather than just considering a specific point in time. The global carbon project (2014) in its World's Carbon Budget Report for 2013 reveals that CO_2 levels increased at a faster rate than the average over the past 10 years, and it also showed that anthropogenic CO_2 emissions since preindustrial times are well over half way towards the threshold for staying below 2°C of warming.

Chapter two

The political reality

You cannot get through a single day without having an impact on the world around you. What you do makes a difference, and you must decide what kind of difference you want to make.
Jane Goodall

2.1 Climate change mitigation

All strategies and actions aimed to reduce GHGs emissions as well as to remove them from the atmosphere are mitigation of climate change. The IPCC defines it as the implementation of policies to reduce GHG emissions and enhance sinks. Some of the main areas in which projects work to implement climate change mitigation are research and implementation of renewable energy and energy efficiency, technology transfer, low-carbon systems, land use-land use change and forestry, agriculture, among others. To enable this, the development of international instruments for discussing, negotiating and creating strategies has been of a key role.

The foundations of such international instruments are found back in 1991, when climate change began to gain more international attention and a pilot programme in the World Bank emerged for assisting in “the protection of the global environment and to promote environmental sustainable development”. The partners who supported this new instrument were the United Nations Development Programme (UNDP), the United Nations Environment Program (UNEP), and the World Bank. This is how the Global Environment Facility (GEF) emerged as a pillar for introducing climate change to the political arena. The GEF is now an international partnership including 183 countries, civil society organisations, private sector and international institutions that address global environmental issues. The GEF collaborates with global partner institutions such as the Food and Agriculture Organisation of the United Nations (FAO), Conservation International (CI), the Inter-American Development Bank (IDB), and the International Union for Conservation of Nature (IUCN), among others. Additionally, it serves as a financial mechanism for global conventions such as the Convention on Biological

Diversity (CBD), the United Nations Framework Convention on Climate Change (UNFCCC), the UN Convention to Combat Desertification (UNCCD), the Stockholm Convention on Persistent Organic Pollutants (POPs) and the Minamata Convention on Mercury. The GEF moved out from the World Bank in 1994 at the Rio Earth Summit, so it became a permanent and separate institution since then. After the GEF was established and climate change was recognised as a global threat the United Nations consolidated an international body to more specifically address it. The UNFCCC was shaped as an international treaty in 1992 and that would be the beginning of the international political process to deal with this issue.

2.1.1 The UNFCCC process and the Paris Agreement

In 1988, climate scientist James Hansen spoke at a meeting with the U.S Senate Committee where he said that he was 99 percent certain that there was a connection between human activities, the increasing concentration of atmospheric GHGs and increasing global mean temperature. His first paper published on the subject “Climate impact of increasing atmospheric carbon dioxide” (1981), predicted that burning fossil fuels would increase global temperatures by 2.5°C by the end of the 21st century. Seating before the committee, Hansen declared that Earth was warmer in 1988 than at any time in the history of instrumental measurements, and that there was only 1 percent chance of an accidental warming of such magnitude. Before Hansen’s testimony, climate change science was considered somehow uncertain but that was about to change because the scientific evidence was now compelling. In this same year, the IPCC was set up and its main objective has been since then to gather scientific research on the matter. Back then, such evidence led countries around the world to join in an international treaty. The UNFCCC is a Rio Convention, one of the three adopted at the Rio Earth Summit held in 1992. The other two Conventions are the UN Convention on Biological Diversity and the Convention to Combat Desertification. This was the founding of the UNFCCC that entered into force in 1994. It is intended to frame international cooperation to combat climate change and its ultimate aim is “preventing dangerous interference with the

climate system". UNFCCC's negotiations started since then and up until November 2016, 22 editions of the Conference of the Parties (COP) have taken place.

One of the most representative steps in this political climate change process is the Paris Agreement, the outcome from COP21 that "seeks to accelerate and intensify the actions and investment needed for a sustainable low carbon future…keeping a global temperature rise this century well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C". It entered into force on 4 November 2016 and all governments that have ratified it, including China, the US, the EU and India, from now on carry obligations (although these are not legally binding) to hold global warming below 2°C above pre-industrial levels. These commitments will apply from 2025 to 2030 and are best known as the Nationally Determined Contributions (NDCs). However, the commitments on curbing emissions under the agreement appear to be not good enough. According to The Emissions Gap Report 2016 from UNEP, such pledges would see global mean temperature reaching 3°C of warming. UNEP's report found that emissions could reach 54 to 56 Gt of carbon dioxide equivalent a year by 2030 (it has been estimated that 42 Gt a year would be likely to be the level at which global warming exceeds 2°C) (UNEP, 2016).

Because this, among other issues, the UNFCCC's negotiating process has been criticized throughout the years by scientists, researchers in related fields, civil society groups and non-governmental organisations (NGOs), arguing that such has failed in delivering strong and efficient ways to tackle climate change. Furthermore, to some of the world's top climate scientists the UNFCCC process is lost, the Paris Agreement a flaw and is another attempt to hide the influence of the corporative mafia on climate change mitigation policies. The evidence for them is that the Agreement is not as strong as needed and after 22 years of negotiations we are still on our way to reaching 2°C of global warming and probably even more than that. Bjorn Lomborg, President of the Copenhagen Consensus Center, has estimated that the Paris Agreement will cost a fortune but does little to reduce global warming. In a letter sent to *The Independent* (Bawden, 2016) some scientists state that

the Paris Agreement offers a false hope and say that the need for the use of geoengineering is increasing faster, although it has been considered a dangerous solution to the problem. Geoengineering has been described as an “array of technologies that aim, through large-scale and deliberate modifications of the Earth’s energy balance, to reduce temperatures and counteract anthropogenic climate change” but the chances of success are small, and the risks are great (Broze, 2016). The use of geoengineering doesn’t guarantee that the problem is solved (stop GHGs emissions) and on the contrary, puts the odds on a strategy that is not even well understood and may have a catastrophic impact on the Earth’s functioning.

On the other hand, people representing industry or government bodies that are lobbying against climate change actions, when are asked about the issue, they are unable to respond accordingly. For example, Gina McCarthy, the head of the US Environmental Protection Agency stated before the house committee on Science, Space and Technology that the Paris Agreement was an incredible achievement but when the committee members asked her to explain how much will this treaty reduce global temperatures, she could not say a thing. Big pronouncements and vague specifics has been a good strategy for politicians and other demagogic supporters of poor measures to tackle climate change and another example is the Obama’s administration Clean Power Plan. Bjorn Lomborg used the same climate prediction model from United Nations to analyze its impact on climate change mitigation and he found that it will accomplish almost nothing. Even if fully implemented by the end of the century it will achieve a temperature reduction of 0.023°F. If we add to this number, the rest of the Paris Agreement pledges and consider them to be sustained throughout the century, global temperatures would be reduced in 2100 by 0.3°F only. The Paris Agreement as it is, just gets us 1% of the total amount needed to stay below of the 2°C target. Other promised achievements rely on the big assumptions that stronger actions will be taken.

Additionally, UNFCCC’s negotiations have encountered big difficulties on achieving a strong set of efficient and legally binding policies. By far, the two most important would be the common but differentiated responsibilities discussion and the interference of the fossil fuels and industry lobby. In the

first case, the trouble relies on the implications of climate change being a global issue and how to deal with it in a fair manner: GHGs emissions mix and travel in the atmosphere no matter the place where they originated, and no matter where a mitigation action is taken the benefits impact the entire atmosphere. Therefore, countries don't want to work for free while others do less than they do or don't do anything at all to mitigate climate change. Another dimension of this equity dilemma, are historical emissions from developed countries which are the current cumulative atmospheric concentration and its related global warming (1°C over pre-industrial levels already), versus current emissions from economic growth of developing countries. While some countries have achieved their social and economic development (which has the current climate change cost), there are others that are still walking their development path (that will have in the future a climatic cost). In the UNFCCC's negotiating process this issue goes back to the Berlin Mandate (COP1 in 1995), where the annex 1, mainly OECD countries were set up to take a commitment to mitigate climate change, while non-annex 1 were not set up to take a commitment. Afterwards, in 1997 the Kyoto Protocol set quantitative targets for annex 1 countries but there wasn't any for emerging economies. Ten years later, at COP13 in 2007, the Bali Action Plan set up action for non-annex 1 countries and COP15 in 2009 (the Copenhagen Accord) as well as COP16 in 2010 (the Cancun Agreements) began to blur the distinction between annex 1 and non-annex 1 countries that was finally achieved in 2011 at COP17 with the Durban Platform for Enhanced Action containing a new legal framework to include all countries for implementation in 2020.

The UNFCCC's outcome set up in Paris at COP21 in 2015 contains within that framework a bottom up approach, the NDCs that are meant to take advantage of national strengths from each country and deliver climate change mitigation results instead of waiting for an international almighty strategy. Achieving this approach took 21 years of negotiations. Whether the Paris agreement and this new approach with the implementation of the NDCs will succeed, no one knows, but the only thing certain is that we are running out of time.

On the other hand, the interference of the fossil fuels and industry lobby has been identified as a leading stakeholder putting pressure for weakening the negotiations. During COP20 Lima in 2014, more than 53,000 signatures from activists were presented to the UNFCCC Secretariat calling for fossil fuel corporations and their lobbyists to be banned from the UNFCCC talks. This is not an impossible task, as there are examples that prove how the UNFCCC could restrict their interference as it is the case of the World Health Organisation which banned the tobacco industry from tobacco control talks and policymaking.

Regrettably, the UNFCCC prove the contrary, and during COP21 Paris in 2015, NGOs stated that some of the COP sponsors, namely Business and Industry Non-Governmental Organizations (BINGOs) opposed the negotiations aims but still bankroll 20% of the Conference's budget and moreover, they possess the ability to infiltrate to the highest level of the policy-making process. Then, even when the UNFCCC is in the middle of a conflict of interests calling for action to tackle climate change while allows private sector sponsorship and intervene climate talks, Christiana Figueres UNFCCC's Executive Secretary at that time said that the accusations against the private sector which demonize oil and gas companies should stop.

The persistent lack of political will turns out to be extremely dangerous under current circumstances. Global warming continues, climate change related impacts are more evident and just from the world's coal seams and tar sands left there is enough to burn and emit as much as an extra trillion tons of carbon to the atmosphere. As mentioned before, a trillion tons is as well the extreme upper limit of cumulative emissions that would put the world over 2°C of warming. The world has emitted over 600 billion tons already and based on the trillionthtonne.org calculations considering the past 20 years of emissions trends and business as usual emissions, we will be expecting to reach the trillion by the year 2038. That would mean that those fossil fuels reserves cannot be touched and every additional ton we dare to emit from now on gets us to a more dangerous long-term impact and practically irreversible catastrophic climate change.

2.1.2 Mitigation policy

Global warming and the associated climate change would continue even if we stopped all GHGs emissions today, so our planet is committed to some level of climate change. To what extent this will linger is determined by some important factors such as the trends of GHGs emissions, to how the climate system responds to them and the actions taken or not taken by our societies to control this situation. Due to such level of unavoidable climate change there is the need of responding to tackle the problem as fast as possible as well as in the mid and long term. There are two main things to do: mitigation (reducing emissions and stabilizing levels of GHGs in the atmosphere) and adaptation.

Mitigation policy involves the implementation of strategies and tools to reducing emissions of GHGs into the atmosphere, either by reducing the sources (emissions from burning fossil fuels) or enhancing the sinks that trap and store them (forests, oceans, soil). On an international level, the UNFCCC has been the forum for discussing and producing mitigation policies. The first UNFCCC's instrument, the Kyoto Protocol, was adopted in 1997 in Kyoto, Japan, and it entered into force in 2005. Its implementation rules were adopted at COP7 in Morocco and are referred to as the "Marrakesh Accords". The Protocol's first commitment period started in 2008 and ended in 2012. Afterwards, in that same year, the "Doha Amendment" to the Protocol was adopted. Such Amendment includes a second commitment period from January 2013 to December 2020. In this new commitment, parties agreed to reduce GHG emissions by at least 18% below 1990 levels from 2013 to 2020, representing an increase in the commitment from the first commitment period which stated a reduction of 5% against 1990 levels. The Kyoto Protocol includes as well, three market-based mechanisms to help meeting countries' mitigation targets. These are the International Emissions Trading Scheme (IETS), the Clean Development Mechanism (CDM), and the Joint Implementation (JI). Additionally, all Parties' emissions must be monitored and reported by submitting an annual emission inventory. Another well-known strategy from the UNFCCC's negotiating process is Reducing Emissions from Deforestation and Forest Degradation (plus conservation,

sustainable management of forests and enhancement of forest carbon stocks) REDD+.

The success of these tools in achieving a mitigation impact is debatable. Some CDM, JI and REDD+ projects may have had benefits in areas such as local development, but their impact on mitigation could be less tangible. Moreover, the most important demonstration of the unrecognised inefficiency of the Kyoto Protocol and REDD+ is the search for a new approach on climate change mitigation policies such as the NDCs plan for 2020 onwards.

However, no matter what the coming approaches are, there is still a big issue to deal with that has been hindering UNFCCC's negotiations all along and may have a negative impact in the implementation of the NDCs as well. The debate regarding the common but differentiated responsibilities is in force. The recognition of how much atmospheric space of cumulative emissions has been used up already, the related global warming and climate change from them, and their source found in the economic development of a few countries is still disturbing the minds of policy-makers from developing countries. According to Ding Zhongli, geophysicist and vice-president of the Chinese Academy of Science, if we want to limit cumulative carbon emissions to a trillion tons, industrialized countries have exhausted their budgets long ago. His calculations estimate that the United States passed its limit in 1936, the United Kingdom in 1945 and Germany in 1963; moreover, emerging economies such as China and India won't reach their limits until 2047 and beyond (Pearce, 2013). This unsolved issue will certainly pose a big risk for the success of the new NDCs bottom up approach and very likely will be looping and returning every time to the same fair distribution and equity debate.

2.1.3 Nationally Determined Contribution (NDC)

By February 2017 CO_2 cumulative emissions were already over 600 GtC. The IPCC stated in its 2013 report that to have a chance of limiting global warming to less than 2°C counting since 1861-1880, anthropogenic cumulative CO_2 emissions will have to stay below 840-1,000 GtC. If

emissions continue at that same rate (2% each year between 2000-2010) the 391 GtC carbon budget that remains will be reached by 2037. Therefore, there is great urgency for true commitments from all countries to tackle climate change. More recently, another international instrument for that has come into play, the NDCs.

Within the path to tackle climate change, the common but differentiated responsibilities and respective capabilities (CBDR-RC) has been mostly related to mitigation and the operationalisation of it was materialised in the Kyoto Protocol in which only developed countries are compelled to reduce their GHG emissions. The instrument is based on the idea of a universal accord from the top towards national governments, but this approach has not been successful. Then, the Durban Platform for Enhanced Action (2011) was aimed to develop another legal instrument under the UNFCCC for all parties, to be adopted in 2015 at the Paris Conference (COP21) and meant to be implemented from 2020 onwards. This happened on the 12th of December 2015 and it is known as the "Paris Agreement". After the UNFCCC negotiations under the Ad Hoc Group on the Durban Platform for Enhanced Action, the COP invited all Parties to begin their preparations for their INDCs. These plans outline what governments promise to do to cut emissions and adapt to climate change across diverse sectors, for example decarbonising the power sector by moving to renewables and improving energy efficiency or sustainable land management. The INDCs portray what each country decides to be their ambitions for reducing emissions and their main feature is that they take into account the specific circumstances and capabilities of each nation. The INDCs symbolize a continue process, therefore they do not give a complete view of future emission reductions. Nevertheless, studies on projected emissions from current INDCs demonstrate an expected warming of 2.7 to 3°C by 2100 (Mbeva and Pauw, 2016). The UNEP gap report 2015 estimates that 21st century warming will reach 3°C and the Climate Action Tracker estimates it will reach 2.7°C, both reach similar conclusions and multiple studies project climate change impacts to become seriously bad and even worse for higher levels of warming.

The INDC for many countries are a part of the potential for mitigation because they have been developed from current processes. Within them each country can contextualise their self-differentiated capabilities because they are a bottom-up instrument. Nevertheless, they could be not fair or not as ambitious as needed due to this each individual freedom and due to the lack of official criteria established by the UNFCCC. As far as of July 2016 there is little literature that analyses the fairness of the INDCs. The most important studies until now are the UNFCCC synthesis report 2015, the UNEP Emissions Gap Report 2015, the Equity Review of INDCs 2015 conducted by civil society organisations, and the Climate Action Tracker 2015 (Mbeva and Pauw, 2016). Their key features are presented in table 9. Each country has the freedom to define what is fair, but the big problem and implications for the climatic mitigation objectives relies on the fact that there is not an accepted and traceable definition of what is fair. Therefore, what a country accepts as fair for the national interests may not be acceptable for the international ones. According to the study by Mbeva and Paw (2016) there are four indicators from which countries contextualised fairness in their INDCs. To the objectives of this study the emissions indicator is the most relevant to explore whether the share of REDD+ as part of the INDC in Mexico would be providing significance to the mitigation pledges. Unfortunately, many countries prefer not to mention or refer to their historical responsibility of emissions contribution. This information is important because many countries have already reached their emissions peak and should have a stronger participation through their mitigation efforts. It does not mean that countries which have not reached their budget yet do not have an obligation to begin strong efforts, but the other ones have exhausted their rights to emit and are consuming from the budget of others if we see this in the strict and cold way of global carbon emissions budget.

An INDC becomes a Nationally Determined Contribution (NDC) when a country ratifies the Paris Agreement. Afterwards, countries will be expected to submit an updated NDC that shows progress on their commitments every 5 years. Up to February 2017, 127 parties to the UNFCCC have submitted their first NDC.

Table 9. INDC's analysis

Organisation	INDCs/Countries analysed	Characteristics of the analysis
CAT	159 INDCs	Finds that pledges result in a global temperature rise of 3.6°C by 2100 compared to preindustrial levels.
UNFCCC	119 INDCs	Includes a general analysis of how countries explained the fairness and ambitions of their INDCs.
UNEP	146 Countries	The analysis focuses on mitigation and on closing the gap between current emission pathways and the aim of keeping global warming under 2°C compared to preindustrial levels.
Civil Society Organisation	37 Countries	How countries' mitigation contributions were fulfilling their fair share in tackling climate change based on the historical responsibility for emissions and the capacity to acting using national income.

Source: Own elaboration with information from Mbeva and Pauw, 2016.

Currently, countries are in the stage of determining their capacities to engage stakeholders and carry out the NDC implementation plans that include visualising national processes to make necessary institutional arrangements. Then, by 2020 countries will be submitting a second NDC that would be a new one if the first runs to 2025 or an updated if the first runs to 2030 (Figure 13).

Figure 13. Timeline of the Paris Agreement and NDCs implementation.

2015	2016	2020	2025	2030
Paris Agreement and submission of INDCs.	Ratification of the Paris Agreement by 175 parties and it enters into force.	COP26 2nd new or updated NDC depending on if it runs up to 2025 or 2030.	COP31 3rd NDC	COP36 4th NDC

Source: Own elaboration with information from CDKN (https://www.cdkn.org/ndc-guide/book/planning-for-ndc-implementation-a-quick-start-guide/introduction/)

All countries face common challenges in implementing the new climate change policy, no matter whether they are developed or not. Some of such problems are: bringing awareness of the importance of this issue among stakeholders; the integration of climate change into national policy planning; making strong links between subnational and national governments; analysing, developing and implementing climate change policy successfully; good coordination relating NDCs implementation.

Additionally, it has been suggested that climate change action can be integrated into development plans and in this way both agendas can make synergies. However, it may represent a risk for successful implementation of climate change action in the case of countries where there have been proved difficulties in reaching development goals. Whether such countries will overcome those difficulties or not, will depend on their political, economic and social processes. Regarding the general view, the initiative Climate and Development Knowledge Network (CDKN) has developed a reference guide to help stakeholders in visualising a pathway to NDC implementation (Table 10). In a more specific view, NDCs can comprehend a variety of mitigation actions. The information collected from NDCs that have been submitted already by UNFCCC parties, show forms of reducing greenhouse gases, such as outcome-based goals while other parties selected a qualitative way, meaning action-based goals.

Table 10. General pathway for NDC implementation.

Input	Reference guide	Output
Current national plans and activities INDC submission	**Step 1**: Submit first NDC **Step 2**: Developing the NDC implementation plan. **Step 3**: Delivering NDC implementation plan.	Communicate future NDCs

Source: CDKN (https://www.cdkn.org/ndc-guide/wp-content/uploads/2016/12/Quick-Start-Guide-final-pdf.pdf).

Another aspect to consider is the scope; such goals can cover just one or two sectors or can consider the whole economy. One more characteristic is the baseline selected; it could be an absolute reduction target, a reduction compared to a past year, or a reduction considering projected business as usual emissions. Additionally, there are actions that can be conditioned to the support from other countries, which is mostly the case of least developed countries where most of their actions depend on international financing. The guide describes activities by each of 5 modules providing an implementation framework. Table 11 presents the most important activities given for each module according to CDKN's reference guide. Mitigation actions are probably more important than adaptation measures because well planned and implemented they will tackle the root of the problem and prevent it from getting bigger. If we do not stop global warming, it could get the moment that no adaptation measure would be enough. For this reason, it is of vital importance to go deep into the mitigation structure, analyse policy for each sector of the economy and work to make efficient implementation actions.

Table 11. Activities by each of the 5 modules considered for NDC implementation.

Governance	Mitigation	Adaptation	MRV	Finance
Strengthening governance involves: 1. Review current institutional arrangements. 2. Establish an NDC implementation coordination team. 3. Ensure integration of related government agencies. 4. Establish the capacity across the government structure to enable NDC implementation. 5. External stakeholders' engagement. 6. Develop legal frameworks.	Progress in reducing greenhouse gas emissions can include the following actions: 1. A revision of current mitigation policy. 2. Make institutional arrangements for mitigation policy. 3. Make an analysis of the potential to identify mitigation options. 4. Identify priorities. 5. Design mitigation policies. 6. Financing mitigation actions. 7. Implementation of mitigation policies. 8. Design and implement an MRV system.	Prepare for the impacts of climate change: 1. A review of current adaptation measures. 2. Incorporate new or enhance current measures to make a link to NDC. 3. Adaptation plans. 4. Financing adaptation plans. 5. Implementation of programmes and policies. 6. MRV of progress of adaptation actions.	Design and implement a process to track and report the impacts of mitigation actions. 1. Analyse current monitoring, reporting and verification measures. 2. Establish adequate institutional arrangements to coordinate MRV actions. 3. Assessment of needs, prioritise data gaps. 4. Design the monitoring, reporting and verification system for tracking mitigation, adaptation and finance. 5. Build capacity for MRV and improve it overtime.	Activities to strengthen financing: 1. Review current financing scheme. 2. Institutional arrangements to coordinate financing. 3. Estimate an overall cost for the NDC. 4. Identify funding gaps. 5. Assess financing options. 6. Develop an investment plan. 7. Secure access to international climate funds. 8. Develop financing propositions. 9. Increase private sector engagement. 10. Design and implement an MRV system.

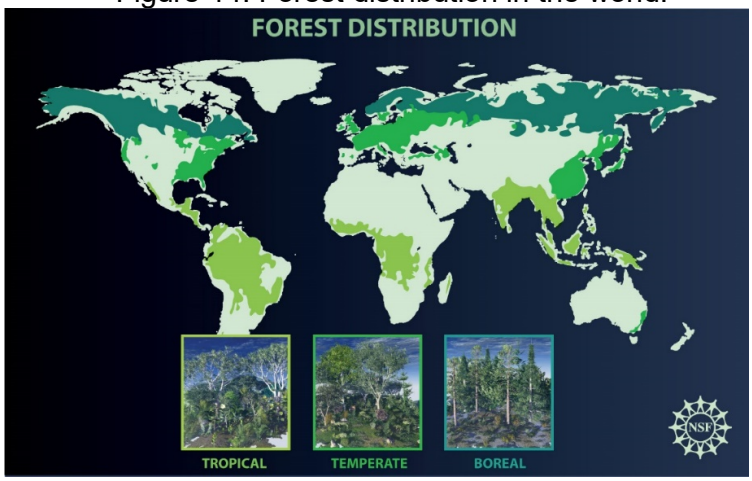
Source: Own elaboration with information from CDKN (https://www.cdkn.org/ndc-guide/wp-content/uploads/2016/12/Quick-Start-Guide-final-pdf.pdf).

2.2 The forestry sector contribution to climate change

Forests cover around 30% of Earth's land surface (Figure 14). In 1990, there was 4,128 million hectares and by 2015 this number decreased to 3,999 hectares (FAO, 2015). The world forests can store around 45% of terrestrial carbon (Bonan, 2008; MEA, 2005) and total carbon content of forests has

been estimated at 638 billion tons (Gt) (FAO, 2009; UN-DESA, 2009). According to Professor Steve Running, forest ecologist and expert in numerical terradynamic simulation at the University of Montana, forests are the biggest natural sink and at the same time the biggest natural source of carbon.

Figure 14. Forest distribution in the world.



Source: National Science Foundation.
https://www.nsf.gov/news/mmg/mmg_disp.jsp?med_id=66421&from=

However, tropical forests are of greater concern in comparison to boreal and temperate ones. The loss of forest cover is mainly located in the tropics, and these represent around 50% of the total forested area (FAO, 2015). In the period between 1990 and 2015 there was a loss of 129 million hectares which is about the size of South Africa (FAO, 2015) and just in the 1990-decade, deforestation mainly tropical, released 5.8 $GtCO_2$/yr (IPCC, 2007). According to the Forest Assessment Report 2015, from the top ten countries with forest cover, five correspond to tropical forests (Table 12) and those with greatest annual net loss of forest area between 2010 and 2015, they all are tropical forests (Table 13).

Table 12. Top ten forested countries in 2015.

Country	Forest area (thousand ha)
Russian Federation	814,931
Brazil	493,538
Canada	347,069
United States of America	310,095
China	208,321
Democratic Republic of the Congo	152,578
Australia	124,751
Indonesia	91,010
Peru	73,973
India	70,682

Source: Own elaboration with information from Forest Assessment Report, FAO 2015.

These figures have drawn attention and reinforced the discussions about the role of forests. Their contribution to determine climate through exchanges of energy, water and carbon dioxide is extremely important (Bonan, 2008). Moreover, they possess many other characteristics that make them a fundamental component of the planetary system.

Table 13. Top ten countries with greatest annual net loss.

Country	Area (thousand ha)
Brazil	984
Indonesia	684
Myanmar	546
Nigeria	410
United Republic of Tanzania	372
Paraguay	325
Zimbabwe	312
Democratic Republic of the Congo	311
Argentina	297
Bolivia	289

Source: Own elaboration with information from Forest Assessment Report, FAO 2015.

During the past World Forestry Congress held in Durban in 2015 the role of forests was highlighted. The emphasis was on their fundamental role to provide food security, energy, shelter as well as environmental processes such as the stabilization of soils, regulation of water flows and climate (FAO, 2016). Forests are reservoirs of approximately 90% of the world's terrestrial biodiversity; support the livelihoods of 1.2 billion people living in extreme poverty (World Bank, 2004; IPCC, 2007) and supply many ecosystem

functions such as water flow regulation, nutrient cycling, rainfall generation; flood control and soil protection. Yet, in many countries cutting down trees is for various reasons seen as more economically advantageous than keeping them standing, even if this means to lose all those vital benefits. The highest rates of deforestation are registered in developing countries and it is a process that is frequently a combination of diverse motivations interacting in different ways depending on the country. However, logging, land use change for agriculture and cattle ranching are the most representative (IPCC, 2007), proximate drivers which at the same time may be enhanced by government policies that support agriculture and logging practices to meet the market demand as well as weak governance and institutions in the forestry sector are important too (Davis, 2007; Middleton, 2008). Another essential part of the problem is poverty, rapid population growth rates and unequal distribution of land (Middleton, 2008) which are prevailing characteristics in many developing–tropical forested countries.

The role of the forestry sector is a complex issue but regarding climate change and mitigation the state of the art is as follows. In the past 40 years, around 50% of CO_2 anthropogenic emissions accumulated between 1750 and 2011 have occurred, and annual emissions have continued to increase during the period between 2000 and 2010 (IPCC, 2015). According to the IPCC's Fifth Assessment Report (AR5), deforestation has contributed to those numbers in the period between 1750 and 2011 with more than 600 $GtCO_2$. That is about one-sixth of global carbon emissions.

Nevertheless, forests can absorb as well one tenth of carbon emissions projected for the first fifty years of this century. Therefore, their capacity to capture carbon from the atmosphere makes them an essential piece to mitigate climate change, as they sustain a dynamic flux of big amounts of carbon. Therefore, reducing deforestation is the forest mitigation option with largest, most immediate carbon storage impact (IPCC WGIII, 2007). However, development of forests mitigation potential depends on a crucial convergence of elements, to mention some, institutional capacity and investment capital, technology research, development and transfer, as well

as appropriate policies, incentives and international cooperation that unfortunately are absent to some extent and represent an obstacle to implement forestry mitigation activities (IPCC, 2007). The history of the efforts to bring policy and mitigation structured action regarding forestry goes back to the late 1970's.

In the 1979 World Climate Conference (WCC) a concern for the consequences that changes on climate might have on human life was expressed, but it was not until 1988 that the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO) established an international scientific body of around 2500 scientists to provide scientific, technical and socio-economic information to understand human induced climate change and its impacts. The Intergovernmental Panel on Climate Change (IPCC) has released five assessment reports (1990, 1995, 2001, 2007 and 2015) which show growing evidence of human impact on climate. During the 1992 Earth Summit in Rio de Janeiro, the United Nations Framework Convention on Climate Change (UNFCCC) was signed. The Convention that came into force in 1994 recognises global warming and therefore, began working with an agenda for acting to diminish climate change, pursuing the objective of reducing greenhouse gas emissions, particularly those of carbon dioxide to their 1990 levels by 2000. The UNFCCC agreed on the stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system', to that end two groups of countries were identified, the Annex I or developed countries that were encouraged to cut their greenhouse gas emissions, and non-Annex I countries that had no obligations, but voluntary actions were encouraged as well. Then, the Conference of the Parties (COP), the supreme body of the Convention which has been meeting since 1995, concluded that the 1992 UNFCCC commitments were insufficient and that there was a need to establish compulsory targets (Sudhakara-Reddy and Assenza, 2009). A Protocol to address climate change was agreed in November 1997 in Kyoto, Japan but it took further negotiations to keep working on details regarding monitoring, reporting and compliance issues, which finally were agreed at the COP7 held

in Marrakech 2001. Details were discussed about the role of carbon and land use, land use change and forestry (LULUCF), but due to technical uncertainties its addition in the Protocol was in doubt. The Kyoto Protocol was ratified in 2005 with a first period of commitments between 2008 and 2012, in which LULUCF activities are included under the Kyoto Protocol's Clean Development Mechanism (CDM) but limited to reforestation and afforestation activities, excluding avoided deforestation. This approach has failed to enhance mitigation from forests, as up to date very few projects have qualified under this instrument.

Recognising the contribution of deforestation to global greenhouse gas emissions, the trends in tropical forests loss and the urgency to put in practice more bold actions, a strategy emerged in 2005 at COP11 held in Montreal, when Papua New Guinea and Costa Rica proposed a mechanism for Reducing Emissions from Deforestation in developing countries (GCP, 2008). Hence, a two-year period was established to allow parties and non-governmental organisations from all over the world, to explore and submit options for the proposal. Recommendations for Reducing Emissions from Deforestation and Degradation (REDD) began to flow to the Subsidiary Body on Scientific and Technical Advice (SBSTA), and later on, in 2007 at COP13 held in Bali, the Bali Action Plan stated that a comprehensive strategy to mitigate climate change should include 'policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries (UNFCCC, 2007), as well as the creation of a new global agreement to establish more ambitious targets for reductions in carbon emissions (23% 2013-2017, 40% 2020, 95% 2050 from 1990 levels). An agreement on these issues was intended to be reached by December 2009 at COP15 in Copenhagen to follow the first commitment period of the Kyoto Protocol ending in 2012, unfortunately with no clear success.

Meanwhile, at COP13 countries adopted the decision of encouraging parties to begin efforts to address deforestation and give support to those

developing- tropical forested countries to be able to reduce emissions from deforestation and degradation. From its part, the UNFCCC and the World Bank set up two separate platforms, the UN-REDD and the Forest Carbon Partnership Facility (FCPF). The UN-REDD consists of a framework set in collaboration with FAO, UNDP and UNEP. On the other hand, the FCPF is a global partnership that today has 47 REDD participating countries, amongst them Mexico which is the case study of this dissertation.

2.3 The REDD+ strategy

Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks (REDD+) is aimed to be a climate change mitigation strategy that incorporates as well, related activities to communities' development. Article 5 from the UNFCCC's Paris Agreement says that "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" and in paragraph (2) states that …Parties are encouraged to take action to implement and support…positive incentives for activities relating to reducing emissions from deforestation and forest degradation, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries…(d) and to deliver an overall mitigation in global emissions".

To that end, there have been projects implemented in several countries in which REDD+ comes to join the existing national environmental policy. Thus, the implementation and suitability of REDD+ to each of the local realities has been of a concern and the subject of study. Some authors focus on the adoption of the strategy to either social, economic or policy structures of the country (Angelsen ed, 2009; Corbera and Schroeder, 2010; Phelps, Webb and Agrawal, 2010). While other focus on looking for clues regarding the methods to measure, verify and report (MRV) performance and outcomes (Wertz Kanounnikoff and McNeill, 2012; Estrada and Shijo, 2012; Asner G, Mascaro J, Anderson C et al (2013). This information altogether would

provide a light on the strategy's effectiveness to deliver consistent reductions in emissions. Consequently, the search for such information is crucial to determine whether REDD+ strategy is working to fulfil its purpose.

REDD+ has been a complex process and the strategy is not completely done. Since the Kyoto Protocol it was stated that positive changes in GHG emissions from human induced land use, land use change and forestry (LULUCF) obtained from afforestation, reforestation and deforestation occurred since 1990, can be used to meet the reductions commitments of the Parties. The methodologies under the Kyoto Protocol's CDM mechanism provided options for agriculture-forestry, bio-fuels, timber production and these needed legal frameworks and policies to guarantee that national schemes would deliver permanent emissions reductions, avoid social and environmental dangers created by REDD+ and provide co-benefits. Therefore, changes in domestic structures were expected to happen to meet the requirements of the UNFCCC's UN-REDD and the World Bank's Forest Carbon Partnership Facility.

2.3.1 UN-REDD

The United Nations Collaborative Programme on REDD was launched in 2008 and builds on the technical expertise of the United Nations Food and Agriculture Organisation (FAO), the United Nations Development Programme (UNDP), and the United Nations Environment Programme (UNEP). Its aim is to support national processes to implement REDD+. The programmes' main goal is to reduce forest emissions and enhance carbon stocks in forests while contributes to the sustainable development of the countries. The programme has now more than 60 partner countries across Africa, Asia-Pacific and Latin America. The support given through this programme includes design and implementation of national REDD+ programmes, complementary support to national actions oriented to REDD+, and technical capacity building support. The UN-REDD+ governance includes: an executive board, an assembly, national steering committees and a multi-party trust fund office (Table 14).

Table 14. UN-REDD governance structure.

Governance component	Characteristics
Executive board	Its aim is to oversee the programme and take decisions on the allocation of the fund's resources.
Assembly	It is a multi-stakeholder forum and its aim is to encourage dialogue and knowledge exchange among all parties involved.
National steering committees	They facilitate country's ownership of the REDD+ programme and include representatives of indigenous communities and civil society. Each of them oversee the programme and addresses delays and changes ensuring the delivery of results as expected by the Executive Board.
Multi-party trust fund	Provides the administration of the funds for the programme.

Source: Own elaboration with information from UN-REDD.

The aim of this governance arrangements is that the UN-REDD+ programme allow the effective participation of all stakeholders involved, such as donors, partner countries, indigenous communities, civil society organisations while the decision-making process stays clear and accountable. The path that the UN-REDD programme follows is ruled by its 2016-2020 strategic framework consisting of some assumptions for its theory of change (Table 15).

Table 15. UN-REDD strategic framework.

IF	THEN
There are political commitments for REDD+ that support national sustainable development strategies. The implementation of REDD+ policies are supported by political will and finance. There is a multi-stakeholder consultative process.	The GHG emissions from forests will be reduced and carbon stocks from forests will be enhanced.

Source: Own elaboration with information from UN-REDD Programme.

Additionally, the programme has set three outcomes to realize its goal: the contributions to climate change mitigation from REDD+ have been designed; national contributions to climate change mitigation are measured, reported

and verified as well as institutional arrangements been set; and the contributions are implemented and safeguarded with policies (Table 16). However, there have been identified four pieces that are crucial for REDD+ to achieve the desired results. REDD+ success will depend on each of the national circumstances. Such cross-cutting themes are: forest governance, tenure security, gender equality and stakeholder engagement (Table 17). That is the overall shape of UN-REDD that needs to prove right when contrasted to the realities when implemented on each of the national circumstances. On the funding side at least, things already seem going backwards. When UN-REDD shaped its strategic framework in 2015, few funders raised their hands. On its web site, it is stated that only the government of Switzerland joined the programmes' group of donors in 2016, which already included the government of Norway, the European Commission, Denmark, Japan, Luxembourg and Spain. UN-REDD, was expecting a contribution of 200 to 300 million dollars for its 2016-2020 strategic framework, but only received 15 million dollars.

Table 16. UN-REDD outcomes.

REDD contributions are designed	REDD contributions are measured	REDD contributions are safeguarded
• Development of technical and economic national REDD+ plans involving stakeholders. • Development of an approach to address the safeguards agreed in the Cancun Agreements. • Enhance social and environmental benefits and demonstration of the scope of such benefits.	• Development of a National Monitoring Forest System (NMFS) which allows collecting information to fulfil the Measure, Report and Verification (MRV) requirements. • Estimates of Forest Reference Emissions Levels (FREL) submitted to the UNFCCC in accordance with requirements.	• Implementation of REDD+ policies that generate emissions reductions. • Institutional arrangements that allow access to finance. • Operationalisation of the Cancun safeguards and demonstration of their implementation.

Source: Own elaboration with information from UN-REDD web page (http://www.un-redd.org/work-programme).

Table 17. UN-REDD Cross-cutting themes.

Forest governance	Tenure security	Gender equality	Stakeholder engagement
Involves local and global people from diverse sectors and covers the decisions, processes and policy arrangements to carry out REDD+. Governance involve factors that will determine how successful this strategy may be. This theme also refers to hoe REDD+ priorities and opportunities are negotiated as well as how decision-making powers are organised. The UN-REDD programme supports countries to establish governance schemes and build knowledge and capacities on priority areas such as: national REDD+ funds, mainstreaming anti-corruption, gender and legal preparedness, tenure and rights.	Tenure security enables two main aspects related to the implementation of REDD+: motivation to manage forests in a sustainable way and clarify accountability. A common problem among developing countries is reconciling customary rights and statutory law. One of the most important issues is to address land tenure to enable REDD+ and among the crucial issues are: stakeholder participation, the use of the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the context of National Food Security (VGGT) as a guiding framework, emphasise the rights of indigenous and local communities, gender sensitive approaches.	It is recognised that an important part of sustainable development as well as for REDD+ is gender equality and women's empowerment. Therefore, UN-REDD provides technical support for: 1. Gender-responsive assessments and gender specific analyses; 2. Awareness raising and capacity building on gender; 3. Gender-responsive participation; 4. Gender-responsive planning and monitoring; 5. Knowledge management on gender.	Stakeholder engagement is a priority for REDD+, UN-REDD has identified critical elements: 1. Effective participation of stakeholders, in particular indigenous peoples and local communities; 2. Real stakeholder engagement has been a priority since the beginning of REDD+' conceptualisation; 3. The implementation of REDD+ depends on a structure to ratify reforms which includes government, indigenous peoples and local communities; 4. A human rights based approach under applicable international law.

Source: Own elaboration with information from UN-REDD web page (http://www.unredd.net/knowledge/redd-plus-technical-issues).

Moreover, the programme could be already on its way to dissolution. After 9 years since its creation, around a grand total of 280 million dollars collected and without mechanisms to tackle huge corruption networks, industrial tree plantations, illegal logging, and other reasons, deforestation is still on its course.

2.3.2 Forest Carbon Partnership Facility (FCPF)

Together with UN-REDD, the FCPF intends to focus 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 (REDD+). Originally conceptualised by the World Bank and the Nature Conservancy, it is a partnership that includes governments, businesses, civil society and indigenous communities. The FCPF assists 45 developing countries (17 in Africa, 18 in Latin America and the Caribbean and 10 in Asia) (Table 18). Its funding comes from 15 developed countries, one funder from the private sector and one NGO in a two separate but complementary funding mechanisms, the Readiness Fund and Carbon Fund (Table 19). The Readiness fund, currently around 375 million dollars, allows for each of the participating countries to prepare necessary policies, particularly adopting a national strategy that should include reference emission levels, a methodology for measuring evolution, reporting and verification systems, and REDD+ management arrangements counting with proper safeguards.

Table 18. FCPF REDD+ Participants.

Africa	Latin America and the Caribbean	Asia
Burkina Faso	Argentina	Bhutan
Cameroon	Bolivia	Cambodia
Central African Republic	Chile	Indonesia
Congo, Republic of	Colombia	Lao Peoples' Democratic Republic
Congo, Democratic Republic	Costa Rica	Nepal
Côte d'Ivoire	Dominican Republic	Pakistan
Ethiopia	El Salvador	Papua New Guinea
Gabon	Fiji	Thailand
Ghana	Guatemala	Vanuatu
Kenia	Guyana	Vietnam
Liberia	Honduras	
Madagascar	**Mexico**	
Nigeria	Mozambique	
Sudan	Nicaragua	
Tanzania	Panama	
Uganda	Paraguay	
Togo	Peru	
	Suriname	

Source. Own elaboration with information from the World Bank group- FCPF.

Table 19. FCPF funding sources.

Readiness Fund	Carbon Fund
European Commission Australia Canada Denmark Finland France Germany Italy Japan Netherlands Norway Spain Switzerland United Kingdom United States of America	European Commission Australia Canada France Germany Norway Switzerland United Kingdom United States of America BP Technology Ventures Inc. The Nature Conservancy
365 million dollars	**692 million dollars**

Source: Own elaboration with information from the World Bank Group- FCPF.

On the other hand, the Carbon Fund provides payments for emissions reductions that have been verified from a REDD+ programme and from countries where there has been a good progress towards REDD+ readiness. The criteria to evaluate such are: 1. Focus on results (emissions reductions that also include social and environmental benefits); 2. Scale implementation (at a local or national level); 3. It must be consistent with the UNFCCC standards; 4. Generate experience for the FCPF and participants; 5. Transparency, so the monetary incentives reach the people and places it is intended to; 6. Conduct clear stakeholder consultations. On a general perspective, the FCPF works around four strategic objectives: 1. Assisting countries in their efforts to adopt REDD+ strategy by assisting them with financial and technical issues; 2. Pilot a payment system for REDD+; 3. To explore forms to sustain or enhance the livelihoods of local communities and; 4. To spread the information gained from the Facility development and implementation of the Readiness Preparation Proposals. To deliver these objectives, the FCPF has the following governance structure: The World Bank assumes the functions of trustee and secretariat. The Readiness Fund and REDD+ readiness support services are delivered by the World Bank, the

Inter-American Development Bank and the United Nations Development Programme.

A centre piece of the REDD+ process are the arrangements for REDD+. This process is best known as the Readiness Preparation Proposals (RPP). The RPPs are framework texts where issues such as the implementation plan, budgets and schedule to achieve REDD+ are considered. Once it is prepared, it must be shared with all relevant stakeholders and then be submitted to the FCPF where it is reviewed before the grant is given. Up to 2017, 25 countries have submitted their RPP, are carrying out a REDD+ project and or other readiness initiatives, and have received a grant either from UN-REDD, the FCPF or both, their status is detailed in table 20. Up until today, REDD+ has taken a different form and moves at a slower pace than it was conceived and launched back in 2007 at COP13 in Bali. It is still very far from achieving its ultimate objective, meaningful large-scale carbon emissions reductions. From a general perspective, it was a quite simple idea, stop emissions from deforestation for climate change mitigation. It was in fact, stated as a fast, cost-effective and first in hand way to reduce emissions. The past years have proven wrong these ideas. Moreover, there are national realities that have rose to the surface and let know that it is not just about the trees and emissions.

Table 20. Some REDD+ countries' status according to the REDD desk GCP.

REDD+ Country	REDD+ Projects	Other readiness initiatives	Forest Cover	Deforestation Rate	UN REDD	FC PF
Bolivia	0	0	High	High	No	No
Cameroon	5	17	High	High	Yes	Yes
Colombia	10	23	High	Low	Yes	Yes
Ecuador	3	14	Low	High	Yes	No
Guyana	0	23	High	Low	Yes	Yes
Indonesia	30	45	High	High	Yes	Yes
Kenya	4	39	Low	Low	No	Yes
Laos	7	16	High	Low	No	Yes
Malaysia	0	5	High	Low	Yes	No
Mexico	**11**	**36**	**Low**	**Low**	**Yes**	**Yes**
Nepal	2	8	Low	Low	Yes	Yes
Peru	19	18	High	Low	Yes	Yes
Vietnam	4	28	High	Low	Yes	Yes

Source: Own elaboration with information from The REDD Desk 2015.

2.3.3 For and against REDD+

Relevant advocates for REDD+ guard the idea that it has been little practice for REDD+ and that it is the main reason why it is too soon to say that the strategy is incapable of fulfilling its objective (Angelsen et al., 2017). Yes, the whole process from its conceptualisation through its negotiation, transformation, adoption within national climate change mitigation policy have taken almost 10 years, troubling pilot and official projects possibly affecting their performance and ability to provide more evidence in favour. Nevertheless, how much time does REDD+ need to obtain such evidence? We must not forget that in terms of climate change we are running out of time and we are in fact already walking a very dangerous path (Myles et al., 2009; Steffen, et al. 2015; thetrillionthtonne.org). Moreover, what REDD+ has indeed exposed are very complex social, economic and environmental issues within each of the national examples and within the global arena such as land grabs (Ahmed, 2014, Work C, 2017; Climate News Network, 2017); carbon markets not reducing emissions (Kollmuss, et al., 2015; Carnes, et al., 2016); and corruption (Mowat, 2017) among others. For example, going deeper on markets, an argument is that REDD+ was once a market-based strategy that was intended to obtain its finance from the global carbon market, which was a reason of critique, but now only a little part of the whole 330 REDD+ initiatives around the world depend on the voluntary carbon market (Evans, 2017), so from their point of view, there is no reason to blame REDD+ failures on the negative characteristics of the capitalistic market (Angelsen et al., 2017). But when opponents refer to this aspect, they not only see the financing side. There is another controverted related issue, the trade of environmental functions as if they were commodities in a supermarket. It has been proposed and carried out in the past, trees themselves and their role within the global carbon cycle seen as a commercial item. Although this has been criticised, even now there is still an insistence to do so. During the climate talks that took place in Bonn on May 13 2017, Ellysar Baroudy head of the Forests and Landscapes team in the Climate Change Group at the World Bank, Coordinator of the Forest Carbon Partnership Facility and the BioCarbon Fund, gave a presentation where she explains that there are

emerging private sector partners, among them the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA-ICAO) and the intention of international aviation to offset emissions. Carbon offsetting is in theory a practice of a reduction of carbon emissions which results in the production of a carbon credit. These credits come from a project where actual reductions are supposedly taking place, for example avoiding deforestation or building a wind farm. Now, even if such reductions are effective, they are used to say that the company, who owns the credits, is making such reductions while is not making any. It is like having an overweight person claiming that the diet of others counts as his own diet while keeps eating without measure. Recalling the information from the first chapter, we need all sectors making strong contributions to emissions reductions, and not only saying that they are. Another version that uses carbon credits and trade is the cap and trade scheme. The cap consists in putting a limit on greenhouse gas emissions, if the company exceeds the cap gets a penalty. The trade part consists in a market where companies buy and sell allowances that represent an amount of emissions. But another lesson obtained from the past years, is that this entire market world always means the chance of economic profit which turns people and companies into greedy monsters that do not care for the climate change problem. Some examples of this are the carbon credits scams (Gorst-Williams, 2017; Hetherington, 2017; RBS, 2017; ABC Money, 2017; Watts, 2016). In 2012, the London Carbon Credit Company was selling carbon credits with no value, and for example, persuaded a person to invest 7,900 GBP in the voluntary emissions reduction credits, the certificates were taken to an expert financial advisor who could not find any information regarding the credits (Penman, 2012). The reporter updated the story in 2016, adding the end of the story with jail for all of those involved (Penman, 2016). There are some general sides from which to analyse REDD+, table 21 provides examples regarding some arguments for and against.

The world's countries adopted a new international climate agreement under the UNFCCC in Paris at COP21 in December 2015. Prior to such agreement, countries outlined their Nationally Determined Contributions (NDC's) which

are their statements on the climate actions they intend to take from 2020 on. Such outlines try to focus on achieving 3 main objectives. 1. To stop the increase in the global mean temperature well below 2°C; 2. Undertake efforts for limiting global mean temperature to 1.5°C; 3. To achieving net zero emissions from 2050 on.

Table 21. Arguments for and against REDD+

For	Against
Regarding time	
Still little time of practice to say it doesn't work.	Time is critical. No more time for practicing.
Regarding economic resources	
Results based aid instead of a market based instrument funded by a global carbon market.	Market-based intervention to solve environmental issues still predominant.
Regarding cross-cutting issues	
Business as usual continue to be very powerful and REDD+ has not been implemented at a scale needed to fully counterbalance those interests.	Illegal logging Market-based conservation/trading nature Offsetting emissions from other sectors Corruption
Regarding lessons	
If not implemented, miss the opportunity to learn important lessons based on empirical evidence.	Empirical evidence on problems in each national circumstance for REDD+ implementation. Is not just about the forests.

Source: Own elaboration.

2.4 REDD+ in the NDCs

The INDC's were elaborated by each country, this means that NDC's correspond to each of the national circumstances and context of their own priorities and capabilities. Additionally, the process for preparing the NDCs should have been transparent to provide accountability and trust. The Nationally Determined Contributions stop being 'Intended' when countries formally join the Paris Agreement and then they compromise to submit an updated NDC every five years in which they must report the progress towards their stated objectives.

Such contributions will need to incorporate actions related to land use, forestry and agriculture, recognising that this sector is a key part of climate change mitigation. Assuming this, countries agree to conserve and enhance greenhouse gases' reservoirs. Moreover, forests conservation is part of two more accords. The first one is the document "Transforming our world: the 2030 Agenda for Sustainable Development" which was agreed in the Summit on Sustainable Development held in 2015 and which integrates 17 Sustainable Development Goals (SDGs). The second is the Durban Declaration of the World Forestry Congress 2015, in which the significant role of forests in achieving both, climate change mitigation and SDGs, was highlighted (FAO, 2016).

The focus of this research is in REDD+ and the NDC's. The road of REDD+ to be part of the NDCs began in 2013 at COP19 in Warsaw, when negotiators had an almost complete 'REDD Rulebook', a guide for countries that choose to reduce emissions from the forestry sector. This book contains separate decisions related to monitoring national forests, addressing drivers of deforestation and forest degradation, and measuring, reporting and verifying. Afterwards, to add more practical ways to ensure this, it was arranged 'The Bonn Challenge' that aims to help realizing existing commitments including the CBD Aichi Target 15, the UNFCCC REDD+ Goal, and the Rio+20 land degradation neutrality goal. The main goal of the Challenge is to reach 150 million hectares of the world's degraded land into restoration by 2020 and 350 million hectares by 2030. According to The Bonn Challenge, there are still 57 million hectares left to reach the first commitment. Another similar way is the 'New York Declaration on Forests', which in September 2014 outlined 10 goals to protect forests and stop natural forest loss by 2030.

In the Paris Agreement negotiating text, REDD+ was considered and there were 6 options which are outlined in table 22.

Table 22. Options for negotiating in the Paris Agreement at COP 21 where REDD+ is considered.

Option	Characteristics
1	May use market mechanisms for meeting commitments but must follow several rules, such as the contribution to the sustainable development of the host country; transparent accounting of reductions; ensure consistency with own contributions.
2	Investors (parties or companies) can claim mitigation outcomes achieved in other parties, subject to specific rules and requirements.
3	May use market mechanisms for meeting commitments but must prove that: reductions of GHG are real, additional, permanent and verifiable; avoid double counting.
4	An economic mechanism that facilitates the accomplishment of NDCs goals, such as the Kyoto's Protocol Clean Development Mechanism (CDM) and Emissions Trading Scheme (ETS).
5	International cooperation to achieve mitigation commitments and deliver real and permanent mitigation outcomes.
6	No provisions on market based mechanisms; recognition of the need to get emissions reductions in the aviation and maritime sector for which global policy frameworks to achieve such targets are considered.

Source: Own elaboration with information from: http://www.ecosystemmarketplace.com/articles/redd-new-climate-text-will-indc/.

Once COP21 was finished and the Paris Agreement produced, the references to REDD+ in the official text included indigenous peoples, removals and sinks, ecosystems and biodiversity, food production and security, based results payments for REDD+. Table 23 summarises main features of the text. As seen, The Paris Agreement includes a call to put more emphasis on forests management, focused on climate change mitigation. The Agreement also refers to past REDD+ decisions, putting altogether the history of past negotiations up to the conception of the NDCs. However, it doesn't elaborate on a more specific set of steps to walk towards mitigation and adaptation. There are only general provisions for governing mitigation and adaptation; there are no special considerations for accounting reductions from land use (ClimateFocus, 2015). As said before, the new process implemented by the Paris Agreement is a bottom-up approach. It allows each country to develop their national strategy accordingly to their own circumstances and include in their internal debate, the priorities regarding mitigation and forests. Most of tropical forests countries have included mitigation and forests into their NDCs and this could be an opportunity to plan and coordinate their efforts to address their challenges.

Table 23. References to REDD+ in the Paris Agreement text.

Section and key word	Text
Decisions preamble-indigenous peoples	Parties shall consider and respect their obligations on human rights. Promote regional and international cooperation including all sectors, stakeholders and governance levels.
Decisions mitigation-removals and sinks	Parties shall include when communicating their NDC quantifiable information on baselines, time frames of implementation, coverage, methodology, for estimating and accounting GHG emissions and removals. The Ad Hoc Working Group on the Paris Agreement will elaborate guidance for accounting the NDCs. The Subsidiary Body for Scientific and Technological Advice will develop guidance to ensure that double counting is avoided.
Decisions finance- results based payments-REDD+	Recognition of the importance of financial resources, including results-based payments for incentivising the objectives of REDD+.
Non-Party stakeholders-indigenous peoples	Strengthen the knowledge, practices and efforts of local communities and indigenous peoples.
Paris Agreement Preamble-Food security	Priority to safeguarding food security and food production systems to climate change impacts.
Paris Agreement Preamble-Sinks and reservoirs	Conservation and enhancement of GHG sinks and reservoirs.
Paris Agreement Preamble-Ecosystems and biodiversity	Ensure the integrity of all ecosystems, recognised by some cultures as Mother Earth.
Paris Agreement Article 4-Sinks and removals	To achieve a balance between emissions and removals that allow to reach the long-term temperature goal, based on equity and in the context of sustainable development.
Paris Agreement Article 5-Sinks, results based payments and REDD+	Conserve and enhance sinks and reservoirs of GHG. Implement policy and incentives for activities under the REDD+ strategy.
Paris Agreement Article 7,9-Ecosystems	Implementation of policies, plans that include the assessment of climate change impacts and vulnerability and building resilience of socioeconomic and ecological systems.

Source: Own elaboration with information from: References to Land use and REDD+ in the adopted Paris Agreement. Adoption of the Paris Agreement, Proposal by the President. UNFCCC Conference of the Parties (COP). December 12, 2015. FCCC/CP/2015/L.9/Rev.1

However, why would this path make the difference? Previously to The Paris Agreement, all REDD+ countries registered a history of poor forest governance, troubles with illegal logging, corruption, land tenure, and more, with no apparent light of solutions. The key question is: How will the Paris Agreement and the NDCs help to solve these internal problems?

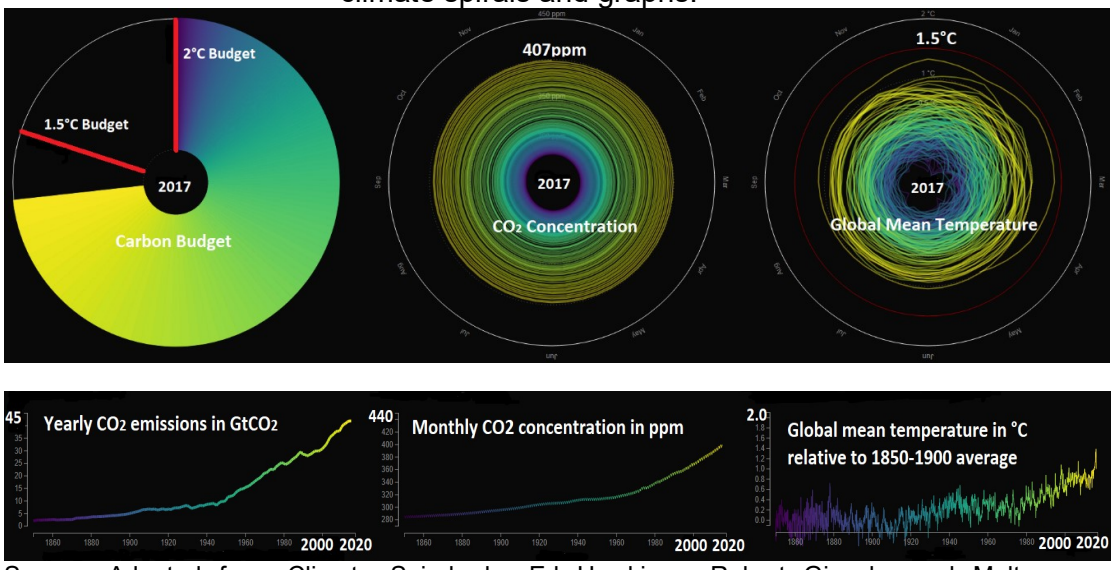
2.5 Political issues confronting the physical reality.

In a conflict between physical reality and political reality, physical reality will win.
Johann Hari

It's the economy, stupid- Science has been saying: act now before it's too late..
economists have been saying: wait until we're all richer…
Gabrielle Walker and Sir David King

Humans alter the natural global carbon cycle mainly by burning fossil fuels and through forests degradation and deforestation. The rate at which carbon dioxide is released from these sources has been identified with high accuracy and their increase and accumulation in the atmosphere as well as its impact on temperature has been effectively documented. Figure 15 shows Carbon budget, CO_2 concentration and Global mean temperature climate spirals and graphs.

Figure 15. Carbon budget, CO_2 concentration and Global mean temperature climate spirals and graphs.



Source: Adapted from Climate Spirals by Ed Hawkings, Robert Gieseke and Malte Meinshausen (PRIMAP; CMIP6; HadCRUT4): www.climate-energy-college.org/spiral/

They were developed by Ed Hawkings (Climate Lab Book), Robert Gieseke and Malte Meinshausen (PRIMAP Group, Potsdam Institute for Climate

Impact Research and the Australian-German Climate and Energy College). The first circle and graph show the increase of CO_2 emissions over the years and how close such cumulative emissions are to the related 1.5 °C of warming. The second circle and graph show the increase of atmospheric concentration of CO_2 in ppm going beyond 400ppm. Finally, the third circle and graph show the increase in global mean temperature getting closer to 1.5°C temperature. This is the physical reality, the unquestionable physical reality. On the other hand, there is the economic-political system that puts on the top of everything and everyone, growth and enrichment. These two realities, the one of the physical reality and the one of the economic-political reality constitute an antinomy, a conflict between two principles, seemingly irreconcilable. Chapter one shows historical and current undeniable information concerning the physical reality on global warming and climate change. Now, this section gathers relevant issues and critiques concerning the economic-political reality, tries to describe the source of the conflict, the antinomy, and to present the case on why it is a colossal challenge, if it not impossible, to reconcile both realities.

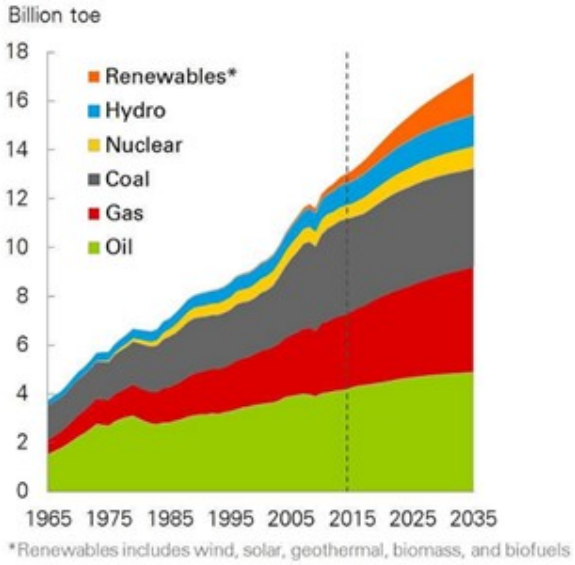
When people refer to the Anthropocene, it is understood that humankind has been the one that, with the way they develop their societies, have caused serious changes and damages to Earth (Crutzen, 2002). But why is it the Anthropocene so toxic to Earth? For around 200 years, Adam Smith's phrase "more is better" has been one of the most precious mottos for the in-force system. Smith is best known as the father of Neoliberalism, where "freedom and self-interest need not produce chaos but- as if guided by an "invisible hand"- order and concord…where trade benefits both, buyer and seller, so trade increases our prosperity… seen as the wealth of a nation in terms of its production and commerce (GDP) growing… whatever the practical difficulties of achieving it (ASI, 2017). However, such system produces more damages than good things, so growth begins to be stupid in the short term and impossible in the long one (Daly, 2010). For this system, growth is the reason itself, it is its own reason, it is not an economy for development (understanding this as an improvement in the quality of life), it is an economy

of markets, for the markets, being the financial markets a dictatorship (Latouche, 2010). It is chrematistics, the art of profit, the destruction of human beings as well as nature for high profits (Hinkelammert, 2009). From the markets point of view, fragmentary behaviour is the most profitable, but markets are a self-destructor mechanism (Hinkelammert, 2010). The society of growth is suicidal (Latouche, 2010). Humanity behaves like a suicidal, and it doesn't make sense to argue with a suicidal once he has jumped out of the window (Meadows, 2010).

This system has destroyed the sense of limits and sets growth as the solution to all problems, not just economic ones. But, when the expansion of the economy invades Earth, we will begin to sacrifice natural capital (Daly, 2010), and most certainly we are already sacrificing natural capital, because the biosphere isn't infinite, and any subsystem such as the economic one, must stop growing at some point and adapt to a dynamic equilibrium based on Earth's laws. However, the system uses too much of everything (Heinberg, 2011), but relevant to the climate change discussion, it uses too much energy and resources. Before the Industrial Revolution, human civilization used the energy equivalent of about half a billion tons of oil per year, in 2010 it was about 9 billion tones (McKibben, 2010), and today keeps growing. Figure 16 shows the primary energy consumption by fuel according to BP's energy outlook 2017, where we can see that oil, gas and coal will still be the most important sources of energy at least for the coming 20 years.

We know by now that the use of fossil fuels is a fundamental part of the global warming-climate change problem. Therefore, it has been demonstrated that the energy transition to energy efficiency and renewable energies is imperative. However, replacing something within this system involves growth. If fossil fuels are the problem, the quest is to find a substitute, but one that doesn't compromise growth (as it is the case with renewables).

Figure 16. Primary energy consumption by fuel.



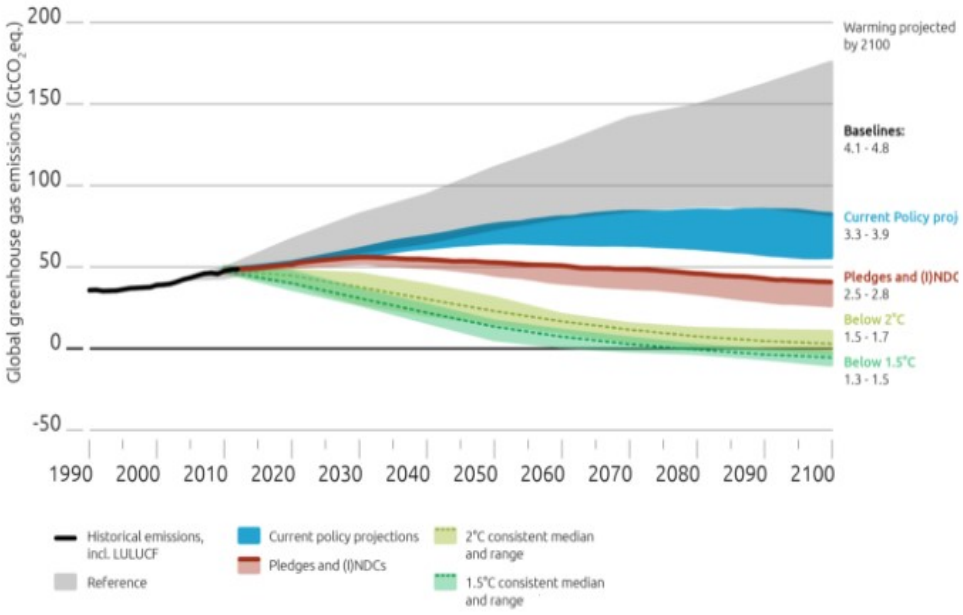
Source: BP's energy outlook 2017. https://www.bp.com/content/dam/bp/pdf/energy-economics/energy-outlook-2017/bp-energy-outlook-2017.pdf

However, replacing the fossil fuels industry will be extremely difficult, not just because of such condition, but we must counteract an industry that took more than a hundred years to be build and in which all the modern civilization is found. This industry will fight for its continuity. For example, it was reported that in 2009, when energy plans for the United States were announced, more than 2000 lobbyists were registered to work on climate change, and 85% of them were dedicated to sabotage the process (McKibben, 2010). According to James Hansen, what most politicians are doing on the climate front is greenwashing (Hansen, 2010), the same goes for the private sector (Oreskes and Conway, 2010), and big conservationist institutions (MacDonald, 2008). Greenwashing means that an organization or person expresses concern about the environment and/or climate change while do not take real actions to stop/mitigate damaging effects (Hansen, 2009). The intervention of the private sector and the strategic economic interests of the system have been fundamental in the global decision making and most politicians support that all we need is growth and trade, and that environmental problems can be fixed technologically (Lovelock, 2009). In the fight for continuity, the system has made it easier to invent terms, such as green growth, than changing

things (Latouche, 2010), and to classify the attempts to reduce greenhouse gas emissions as “not based on the political reality” (McPherson, 2010).

But what is based on the political reality is wrong for humans and Earth. In other words, is what Franz Hinkelammert calls the irrationality of the rationalised (2010). What is perfectly rational from the economic point of view, it is irrational from the life and environmental point of view. Examples of this are current pledges for emissions mitigation. Figure 17 show the effect of current pledges and policies on global temperature. We can see that in the absence of policies, global warming is expected to reach 4.1°C to 4.8°C above pre-industrial levels by the end of the century. Current policies are projected to result in 3.6°C above pre-industrial levels.

Figure 17. Effect of current pledges and policies on global temperature.



Source: Adapted from CAT. www.climateactiontracker.org
Reference in grey, 5%-95% percentile of AR5 WG3 scenarios, containing 64% of the baseline scenarios assessed by the IPCC; in lemon green, greater than 66% chance of staying within 2°C in 2100; in mint green, greater than or equal to 50% chance of staying below 1.5°C in 2100.

Pledges, including NDCs from governments around the world as of the end of 2016, would likely limit warming below 3.1°C (90% chance of exceeding

2°C). However, there is a huge gap between what governments promise and the actions they undertake (CAT, 2017).

The old geopolitical paradigm will have to get to an end and allow the rise of a new bio-political one that would bring relationships from competition to collaboration within the Earth's physiology rules (GFN, 2010). In the XVIII century, Kant concluded that Nature compels humans to build a perfect civil society (Kant, 2001), today this would still be true but now it needs to include the wellbeing of Gaia. The political reality and economic interests are fighting a battle against the biophysical limits, but this is a battle that they can't win. There are only two possible endings. The one in which the economic-political system recognises its defeat and retires before it reaches its limits, or the one in which the economic-political system finds its defeat because it reached its limits.

2.6 Research questions

Considering the framework described in the past chapters this work proposes the following research questions:

1. What are the main features of the NDC and REDD+ within the Mexican case?

2. How have such instruments worked in practice?

3. Are there synergic connections among the Mexican institutions and policies involved in developing and implementing the Mexican NDC and REDD+ strategy?

4. Are there signs that indicate there is political will and commitment for implementing strong mitigation actions in Mexico?

Chapter three

Research methods

Not everything that can be counted counts and not everything that counts can be counted.
Albert Einstein

Research questions in this work were addressed by collecting data through interviews to stakeholders that: 1) live in Mexican forest locations and execute climate change mitigation activities; 2) work for key non-governmental agencies in Mexico and are related to the implementation of such activities; 3) work for the Mexican government in carrying out such activities; 4) are researchers that have investigated the topic. Documentary research is also part of the techniques used here to look for information and/or corroborate data. The aim is to obtain stakeholders' insights that could help locating obstacles for successful mitigation outcomes in the Mexican context that are not evident or expressed in official documents released by government institutions.

3.1 Qualitative research

For some researchers it is evident that the constructivist paradigm significantly influenced the dawning of qualitative research (Mertens, 2005) and that its foundations can be traced within Immanuel Kant's work during the XVIII century when he pointed out that the world is constructed by human mind. Things do exist but we perceive them with our minds (Kant, 1993). Years later, Max Weber introduced the term *verstehen* which means "to understand", and recognizes that beyond the description and measurement of social variables, subjective meanings and broad context of studied phenomena must be considered.

A general definition of qualitative research describes it as the study of how reality is constructed by providing elements that help to understand it. Such elements are the result of the implementation of methods that include

phenomenology, ethnography, and biography for example. Within these methods some steps are commonly followed to conduct the research such as the definition of the problem, design, data gathering, analysis and the elaboration of a report. Some of the most frequent techniques that are applied for data collection are observation, participative observation, interviews, questionnaires and discussion groups. All these together pretend to get an in depth study and understanding of phenomena rather than an approach based in measurements that are typical in quantitative research.

According to Taylor and Bogdan (1986) qualitative research is the one that produces descriptive data, collects the words from people, both spoken and written, as well as observable conduct. It is also epistemologically nourished from phenomenology's hermeneutics and symbolic interactionism (Monje, 2011). This means social stakeholders are not seen as mere things or objects of study but possess a subjective aspect due to their perceptions and interaction within diverse contexts. Therefore, a critical difference from quantitative research is the interpretation of meanings, giving priority to the comprehension of intentions, motivations, expectations, reasons and individuals' beliefs. Qualitative research intends to explore, describe and comprehend social situations in an inductive manner, in other words from the stakeholders' knowledge.

In qualitative research, scientificity is achieved through the investigator's transparency by systematically gathering and recording fieldwork notes in a comprehensive and inclusive manner as well as reviewing theoretical sources (Hernandez-Sampieri, 2010). It is also important to devote enough time to conduct fieldwork to obtain the information needed to produce accurate interpretations; the researcher will obtain such information through techniques that include interviews, life stories, case studies and documentary analysis that are merged with the researcher's contextualized observations; additionally, the study must be kept into context by providing a description of the particular circumstances that are being studied, the people involved and the time period to which the research corresponds (Patton, 1990).

Interviews

One of the most frequent methods in qualitative research is the interview. This data collection method helps to acquire in depth and/or more specific material by having a conversation with those stakeholders that are involved and/or have got to some extent a level of expertise on the subject under research. Then, one can obtain insights from such people that are somehow key part of what is being investigated and get answers to the how, what and why questions.

There are different types of interviews which span one to one, focus groups, semi-structured and structured questionnaires. Structured ones for example, use a guide that includes a set of questions that the interviewee will answer in a concrete way and with no opportunity to elaborate or provide further comments. On the other hand, semi-structured interviews are conducted with a thematic guide that allows a more open interaction, flexibility and participation from the interviewee. It is usually the best way to find out motivations behind decisions, behaviour, attitude and beliefs. According to Diaz-Bravo et al. (2013), the interview phases include: 1) planning and elaboration of the questions that will guide the conversation; 2) lay down the interview conditions, such as how long will the conversation last and asking for permission to record the session; 3) development of the interview; 4) recap of the session, giving the interviewee the opportunity to deepen or to clarify a comment. Finally a synthesis is made.

Use of semi-structured interviews in this research

The reason for using this type of interviews was to obtain relevant information from stakeholders, mainly from the people outside the government. The need for obtaining this type of information rose from previous literature review from where information was found related to critiques and nonconformities from the people implementing mitigation projects funded with green funds, which are delivered by the Mexican government. Some of those critiques include no transparency in the distribution of resources, unjustified preferences for some projects over others and political corruption. Therefore, a set of questions to guide semi-structured interviews was selected as the suitable technique for

obtaining the insights and experiences from the people involved or with knowledge aside the government institutions as well as official reports that may not include some critical information for being politically sensitive.

There were four different types of stakeholders: 1) from the government institutions; 2) from NGOs; 3) people in forests implementing the projects and 4) independent researchers that have documented this topic. The questions were designed to obtain information regarding the experiences or knowledge on the relationship between government institutions and the people who receive funds for implementing mitigation actions within the Mexican context. See annex I for more reference.

Fieldwork characteristics

Interviews were conducted during the fieldwork that took place for about 10 months between 2010 and 2012 and it encompassed: 1) two visits to *ejidos* (communal land) in the Yucatan Peninsula, particularly one *ejido* in Campeche and one *ejido* in Quintana Roo to interview representatives and foresters; 2) a training course in climate change mitigation in Mexico with duration of 3 months that helped to get in touch with some stakeholders, mainly from the government because the course was organised by SEMARNAT (the Mexican Ministry of Environment and Natural Resources). The course was also equivalent to and counted as a MSc course within the PPD compulsory set of credits for obtaining a PhD at UEA; 3) interviews to representatives from organisations from the civil society and NGOs such as Rainforest Alliance, the Mexican Civil Council for Sustainable Forestry and RedMocaf; 4) independent researchers and researchers affiliated to universities in Mexico.

3.2 Description of the case study

Case studies focus on the intensive research means of approaching a unit of study: a person, a family, a group, an organisation, an institution (Stake, 1994). Moreover, this method is a rigorous way that explores in a deep manner an issue for obtaining broader knowledge (Chetty, 1996). Addressing

an issue through the investigation of a case study requires in the first instance the description of its context. This is important for understanding people and its discourse. Some of the typical elements to consider are: gender, socio-economic status, scholarship, religion, place of residence, where the interview takes place. Another relevant aspect to consider is the verification of the information through triangulation, this means to review and contrast the information with different sources. It is also important to describe social, economic and political features that could be relevant to study and better understand the topic that is being investigated.

Mexico was selected because this country gathers important characteristics related to the climate change mitigation and political issues topic which are the interest of this research. Mexico is a country that is signatory to the UNFCCC's accords; it also possesses a structure of institutions and policies concerned with environmental issues including climate change mitigation; and is home to tropical forests where mitigation policies such as REDD+ have been put into practice. Moreover, Mexico receives aid from those major international funds for tropical forests conservation related to climate change mitigation, namely the FCPF and UNREDD+. On the other hand, this country is known for being amongst the countries with highest levels of corruption in all levels and sectors, which has been proven to be a major obstacle for the successful implementation of policies.

Climate change related characteristics

The country's climate change characteristics encompass the geographical conditions of Mexico. It is located at parallels 14° 32' south and 32° 43' north latitude and a total territorial extension of 2,000,000 km^2 (Esquivel, 2000). The Mexican republic borders to the north with the United States of America, to the south with Belize and Guatemala, to the west with the Pacific Ocean and to the east with the Atlantic Ocean (Figure 18). It is part of the American continent and possesses climatic transitional characteristics between North America and Central America. Therefore, there are warm climates with average annual temperatures of 26°C, and cold climates with average annual

temperatures of 10°C. Warm humid and warm sub-humid climates cover 23% of the territory, temperate humid and sub-humid cover 21% and dry and very dry cover 49%. Average annual temperature considering the whole country is around 18°C or above because of its location in the world's tropical zone (FAO, 2005). The Mexican territory can also be divided into 3 major regions: north, central and south which are highly vulnerable to climate change due to its geographical location, meteorological conditions as well as social and economic issues (Government of the Republic, 2015).

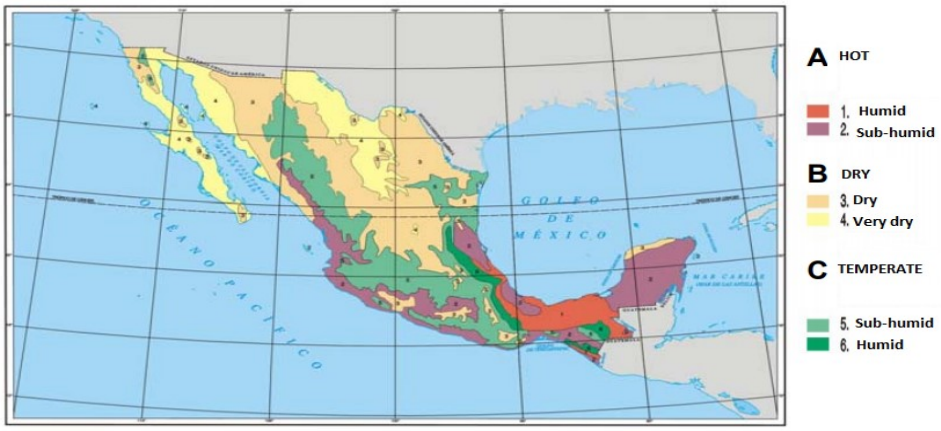
Figure 18. Mexican borders.

Source: Adapted from https://www.usnews.com/news/best-countries/mexico

25 out of 32 States that integrate the national territory are arid, and are mainly located in the north area, although one can find arid zones in a few central and southern areas. Formation and extension of such areas are consequence of determined meteorological phenomena such as: location between latitudes 14° and 32° where air currents are descendent and in their way to the ground, they heat and lose humidity which makes precipitation occurrence difficult; cold marine currents around the Baja California Peninsula; and mountain chains that act as a barrier and make difficult humid air from the oceans to enter inland (Cervantes, 1999). The south part of the national territory is, on the contrary, humid. This region encompasses varieties of soils and biodiversity in a great extension of jungle and forests. The weather is humid and hot, and annual mean temperatures round between 22°C and 26°C. The central zone of the country is a mixed region with mountains, plains and valleys. The weather is mainly temperate with

frequent rainfalls in summer in Mexico City and surroundings, semi-dry in Hidalgo, Queretaro and Puebla, and hot and wet in Morelos (Lopez, 2003).

Figure 19. Groups and sub-groups of weather in Mexico.



Source: Adapted from INEGI. Available at: http://www.inegi.org.mx/inegi/spc/doc/internet/1-geografiademexico/manual_carac_eda_fis_vs_enero_29_2008.pdf

According to climatological measurements, terrestrial and marine mean temperatures across the country have increased over the past 100 years, reaching 1.2°-1.5°C over pre-industrial levels. Mexico has become warmer and has experienced increasing extreme weather events including cyclones, sea level rise, floods and droughts (Table 24). Climate change scenarios show changes in the annual mean temperature of 2°C or beyond, mainly in the northern part and in the rest of the country more than 1.5° (Government of the Republic, 2014). Therefore, the Mexican government recognises both, the vulnerability of the country, as well as the relevance of being part of global efforts to tackle climate change. Consequently, in the past 10 years there have been reworking in the previous government structure aimed to deal with environmental issues.

Table 24. Increase in the incidence of natural events highly related to global climate change in Mexico.

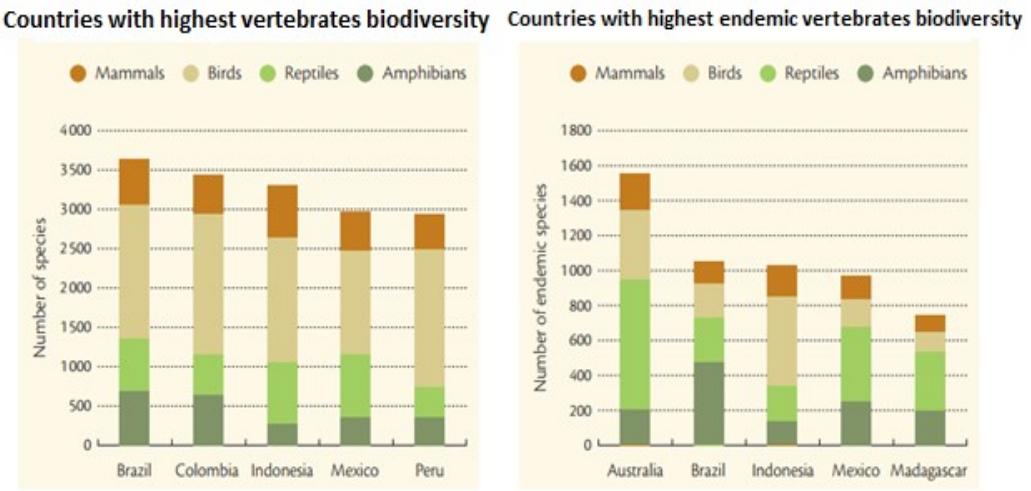
Hurricanes	Droughts	Sea level rise
Between 1970-2013 of 22 hurricanes above Saffir-Simpson's category 3, 10 occurred in the last 12 years.	Between 2000-2013, 5 extreme drought events have occurred: 2000-2003; 2006; 2007-2008; 2009 and 2010-2012. In 2011, drought affected 90% of the country. It is projected that annual precipitation reduction reaches in the short term 10 to 20% across the country. Desertification in the country has increased, many of the regions in the north are becoming into sterile soils that have included rivers drying out and death of animals and vegetation. There have been also recorded heatwaves, particularly in the north.	17 sites were studied across the Gulf of Mexico and the Pacific coast between 1950-2000. There have been increases of up to 9.16mm per year.
Temperature	**Rainfall patterns**	**Ecosystems**
In Mexico City the temperature has increased almost 4°C in the last 10 years. The glaciers of the country situated in the peaks of volcanoes such as the Pico de Orizaba, Popocatepetl and Iztaccihuatl have been alarmingly decreasing in recent years.	In several parts of the country there have been registered increase of severe storms.	Many ecosystems in the country have been affected, among them are for example, the accelerated loss of forests, associated to fires due to temperature increases and deforestation due to land use change.

Source: Own elaboration with information from: Government of the Republic, 2014; SEMARNAT, 2012; SEMARNAT, 2016.

Mexico is ranked among the 10th most megadiverse countries in the world. It possesses a variety of vegetal and animal species as well as ecosystems, and it is also among the top 5 countries that embrace 70% of the known species in the world (Figure 20 and 21) (CONABIO, 2017). There are two major biogeographic zones in the Mexican territory, the Nearctic and Neotropical. This last one is found in the southern zone of Mexico, where the Yucatan Peninsula is, and provides the conditions for tropical forests and mangroves ecosystems that exist there. In this region, there is also a biological richness related to the coastline and national waters of the Gulf of

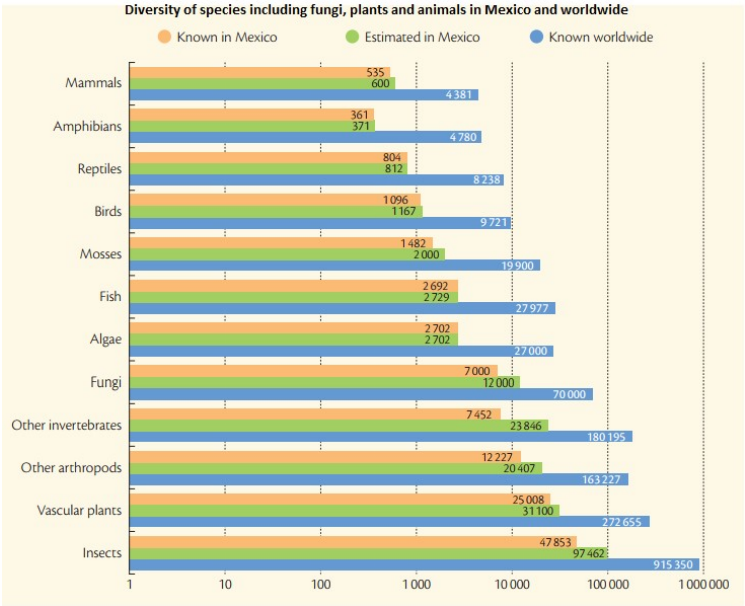
Mexico and the Caribbean Sea (INEGI, 1983). All this biodiversity is in the first instance of an immeasurable value, thinking of our planet travelling through the space protecting all that genetic variety of magnificent species and biogeochemical conditions. From a more human-societal point of view, the value dwells in the benefits (goods and services) that the planet provides to humans and their societies.

Figure 20. Mexico among the top 5 countries with highest biodiversity.



Source: Adapted from Sarukhan et al., 2010.

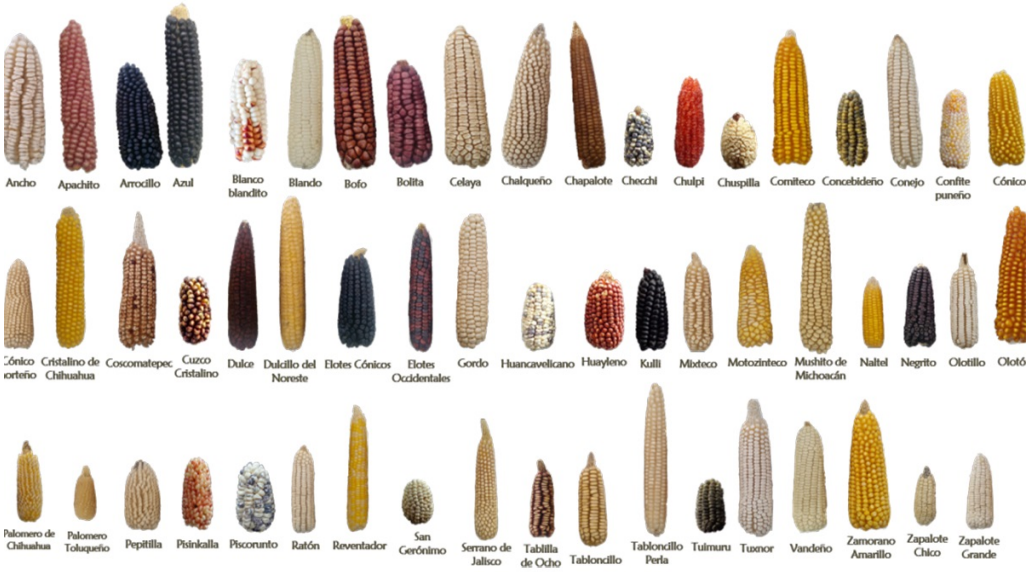
Figure 21. Mexico's biodiversity.



Source: Adapted from Sarukhan et al., 2010.

Around 60% of the known species in Mexico are endemic, therefore, once they become extinct, they are lost forever from the world. There are more species in the tropic areas than in the nation's temperate ones, and this is closely linked to the complex topographic and geological composition of the land that enables a rich ecological variability with a scope of climates and microclimates, providing lots of habitats. Additionally, Mexico also stands out for being a country where there exists a close relationship between its biological and cultural diversity (Sarukhan, et al., 2010). It is an important centre of agricultural tradition, being the cultivation of maize one of the most representatives (Figure 22). Much of this knowledge has its origins in ancestral practices of those indigenous peoples living in Mexico centuries ago. Nowadays, there are still around 60 indigenous groups that are descendants of those who were living in Mexico before the Spanish invasion that took place more than 500 years ago.

Figure 22. Biological diversity of maize in Mexico.



Source: Adapted from delmaiz.info. Available at: http://delmaiz.info/tipos-de-maiz/

In synthesis, Mexico has a rich and diverse heritage, including biological diversity of vegetation and animals, many of them endemic; ancestral

agricultural knowledge linked to indigenous peoples; a great variety of ecosystems that provide a vast scope of habitats and more. The Yucatan Peninsula is part of this great heritage and it is integrated by three States, namely Quintana Roo, Campeche and Yucatan. (Figure 23) (Figure 24). It is a region of extreme national and even international relevance because it contains various ecological conservation areas and it is part of the Mesoamerican Biological Corridor together with Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama. The Peninsula is one of the most endangered regions in Mexico due to a high level of anthropogenic pressures over its natural resources (CONAFOR, 2017; *pers. comm*), that have been the target of irrational use and overexploitation.

Figure 23. The Yucatan Peninsula.

Source: SEMARNAT-CONAFOR. Available at: http://www.conafor.gob.mx/web/temas-forestales/bycc/redd-en-mexico/acciones-tempranas-redd/peninsula-de-yucatan/

Figure 24. The States within the Yucatan Peninsula.

Source: Adapted from SEMARNAT-CONAFOR. Available at: http://www.conafor.gob.mx/web/temas-forestales/bycc/redd-en-mexico/acciones-tempranas-redd/peninsula-de-yucatan/

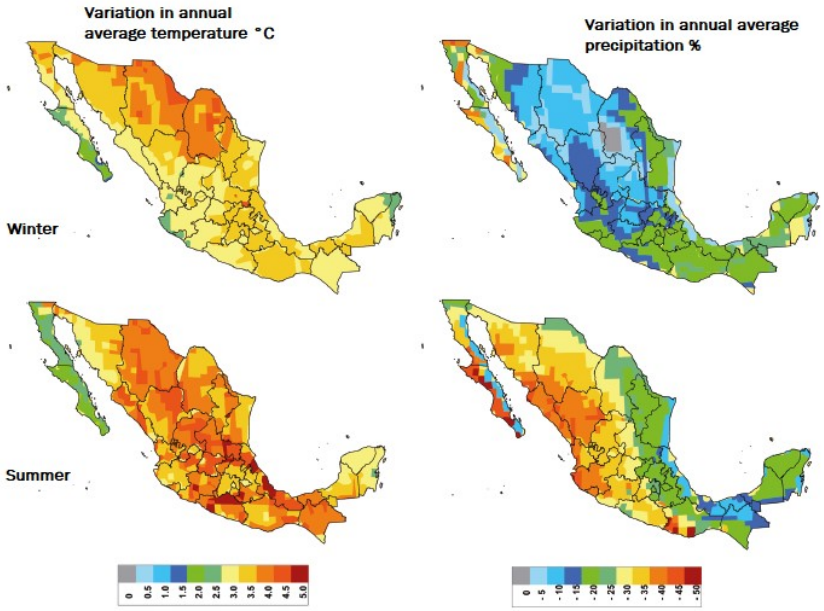
Climate change projections

Climate change is one of the most important problems that human societies must tackle if adverse climatic derived conditions are to be avoided. All countries are already experiencing changes and risks will increase as climate change keeps progressing. Some of the threats that have been identified in the Mexican case include: sea level rise, floods in coastal areas, extreme tropical hurricanes, variations in rainfall patterns and droughts (Rodriguez-Velazquez et al, 2015). Such risks are very likely to get worse according to climate change projections. General circulation models include 4 components: 1) atmosphere, 2) oceans, 3) land and 4) ice and they are designed to estimate the evolution of the climate system and then climate change projections can be made (Montero and Andrade, 2015). Based on this type of studies, Liverman and O´Brien (cited in Montero and Andrade, 2015) found that climate change could bring warmer and drier conditions to Mexico. Later, among several projection exercises, regional projections for Central America and Mexico that were documented in the IPCC-AR4 estimated an average warming variation in the region between 1980-1999 and 2080-2099 of 1.8 to 5.0°C with a median of 3.2°C. Additionally, based on the results from the Climate Research Unit assemble of 23 models for the A2 scenarios (carbon intensive economy) and adjusted to a regional scale with the Statistical Downscaling Model (SDSM), annual average temperature is projected to increase between 0.5-4.8 °C in the period 2020-2100 (Figure 25). Derived from these climatic changes Mexican ecosystems could be exposed to extreme conditions that exceed their adaptation capacity and therefore, many species could be facing extinction in the years to come. For example, in the southern area of the country extreme hydrological events are expected to happen, affecting tourism, forestry and agriculture. Additionally, coastal zones could be severely damaged due to sea level rise of 1 to 5 meters (Weiss and Overpeck, 2012 cited in Sosa-Rodriguez, 2015).

In a publication from 2009 (Orellana-Lanza, Conde-Alvarez, Gay-Garcia), researchers completed an atlas of climate change scenarios of the Yucatan Peninsula that using general circulation models (HADCM3, CGCM2, GFDL-

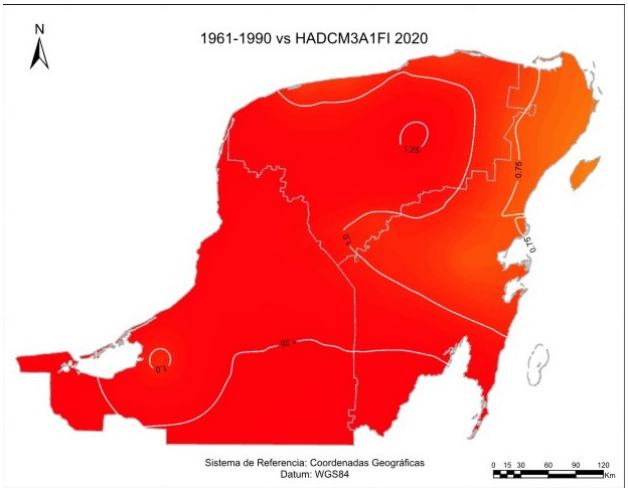
R30, ECHAM4) projected scenarios for the year 2020 in which an increase in temperatures is shown (Figure 26).

Figure 25. Precipitation and temperature anomalies 2020-2100 in Mexico.



Source: Adapted from Sosa-Rodriguez, 2015

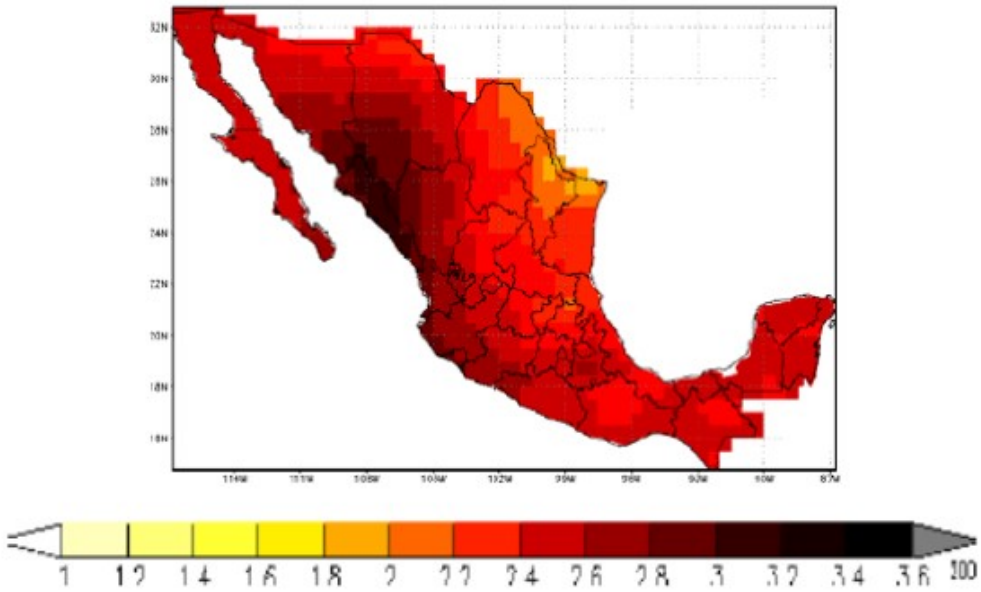
Figure 26. Temperature projection 2020 for the Yucatan Peninsula.



Source: Adapted from Orellana-Lanza, Conde-Alvarez, Gay-Garcia, 2009.

Projections for the period between 2080-2100 in the Peninsula also show an increment in regional annual average temperatures between 2 and 4.5°C considering climate change A1 scenarios (fast and sustained economic growth and implementation of new and more efficient technologies) (CINVESTAV, INECC, BID, 2014).

Figure 27. Temperature projection 2080-2100 for the Yucatan Peninsula.



Source: Adapted from CINVESTAV, INECC, BID, 2014)

These changes are expected to have serious consequences such as: an increase of evapotranspiration, diminishing crops growth; an increase of stress conditions for regional rainforests; pest propagation; prolongation of the annual period without rain increasing the risk of fires and plagues; reduction of land covered by rainforest and less forestry productivity; species extinction; floods; soil erosion; heat waves among others (CINEVSTAV, INECC, BID, 2014).

Unfortunately, many countries do not invest enough in the eradication of those issues that hinder progress towards climate change mitigation and reducing vulnerability. The investigation on such issues could help to understand whether mitigation policies may or may not reach their objectives.

Chapter 4

The Mexican mitigation policy and its political context

The possession of power inevitably spoils the free use of reason.
Immanuel Kant
Laws are like spiders' webs, will only entangle and hold the poor and weak, while the rich and powerful will easily break through them.
Anacharsis

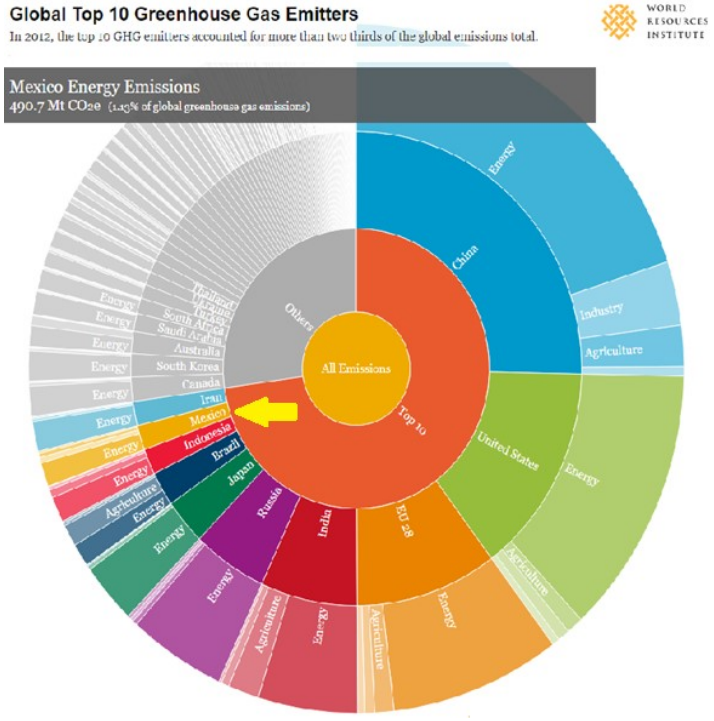
4.1 Climate change mitigation in Mexico

Mexico is an important contributor to climate change. In 2012 emitted around 1.4% of the total globally, positioning the country among the top 10 emitters, with 665 million tons of CO_{2e} (SEMARNAT, 2016b) (Figure 28). Therefore, responding to the commitment acquired, Mexico has stated a plan in its NDC that includes the whole economy plus land use, land use change and forestry comprising as well, an initial reduction of emissions of 672MtCO_{2e} by 2020. However, according to the Climate Action Tracker analysis, the plan is insufficient and not consistent with limiting warming below 2°C (Figure 29). In the first image in figure 29 we can see Mexico as part of the group of countries which their NDC are rated insufficient, understanding for this a contribution to global warming resulting in more than 3°C because of their mitigation proposals. In a more detailed view, the second image shows that Mexico's historical emissions have been increasing, leaving Mexico's 2020 pledge far from accomplishment under business as usual. Moreover, current policy projections show emissions increasing at least by the year 2030, making difficult to reach the 2030 pledge as well.

The Mexican government has been working for many years on its institutional structure for addressing environmental issues. Some of the highlights include the General Law on Climate Change (LGCC), the National Strategy on Climate Change (ENCC) and the Special Programme on Climate Change (PECC) 2014-2018 which were designed to meet the need of having schemes and implement actions to protect and manage national natural resources and make climate change mitigation and adaptation arrangements.

According to one of the Climate Action Tracker's analysis, Mexico has good progress in policy planning and institutional development, and in turn this has attracted the international attention because is one of the world's first countries and first among developing countries to have a climate Law, the LGCC, in which Mexico proposes to reduce 50% of emissions from 2000 levels by the year 2050 (CAT, 2017b).

Figure 28. Mexico's contribution to global GHG emissions.



Source: Adapted from the World Resources Institute: http://www.wri.org/blog/2015/06/infographic-what-do-your-countrys-emissions-look

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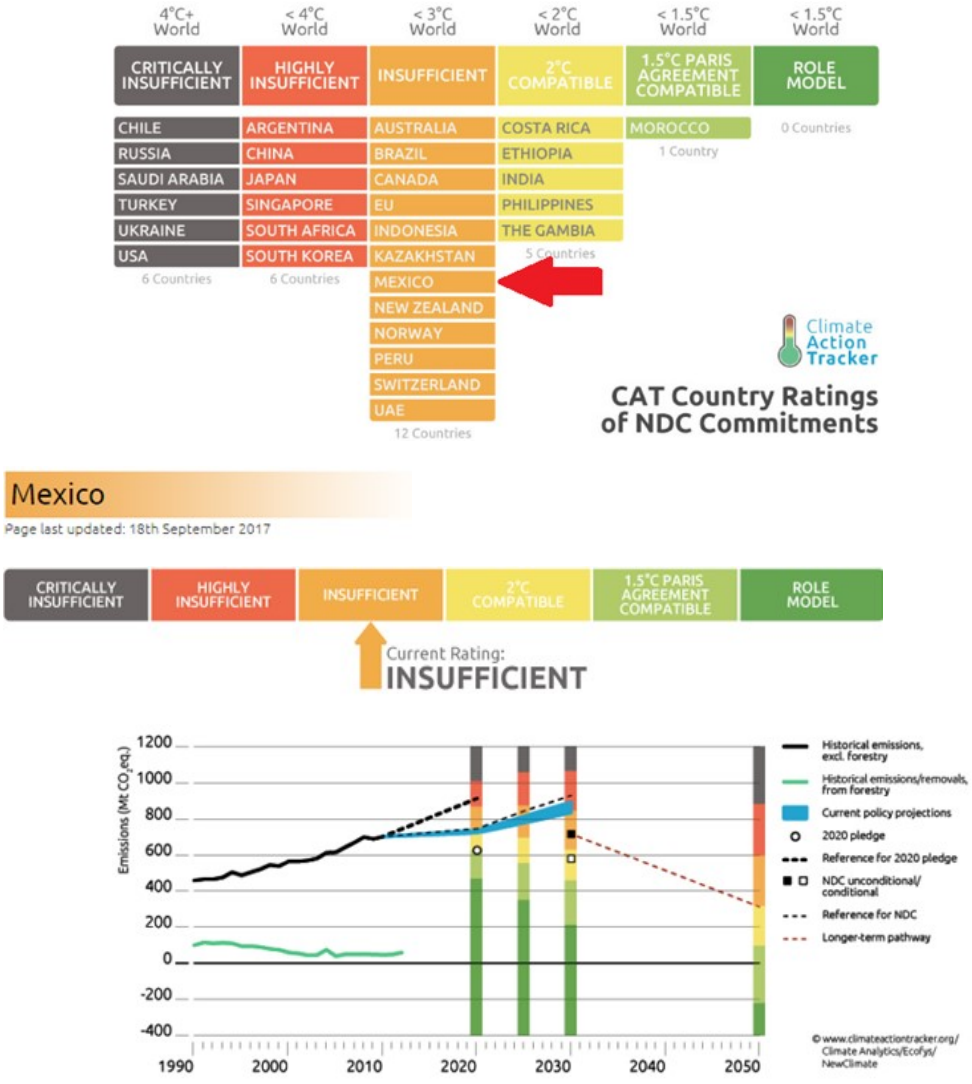
Nevertheless, Mexico is not in the trajectory to fulfil its 2020 and 2030 pledges as mentioned before, and it doesn't have a 2025 goal to be consistent with the five-year cycle commitments that most countries are adopting. But far from the inefficiency of the Mexican pledges, there are many times corrupt political practices involved.

Figure 29. Rating of Mexico's climate change mitigation pledges.



Source: Adapted from Climate Action Tracker. Available at: http://climateactiontracker.org/countries/mexico.html

Table 25. The Mexican mitigation stance.

Climate change target	672MtCO_2e by 2020; 22% by 2030; 50% from the year 2000 by 2050.
UNFCCC negotiations	Among the top ten emitters. Ratified the Paris Agreement in 2016.
NDC	Includes the whole economy plus LULUCF. Lacks a 2025 goal to be consistent with the five-year cycle commitments. Not in trajectory of fulfilling its 2020 and 2030 pledges.

Source: Own elaboration.

The institutional framework that oversees the NDC and REDD+ includes, among others, the Ministry of Natural Resources (SEMARNAT), and the National Institute of Ecology and Climate Change (INECC). This last one concentrates scientific research on monitoring emissions and climate change science to inform at the national and international level about Mexican actions. For example, the INECC integrates the Biennial Reports (BUR) being the first one presented in 2015, greenhouse gases inventories and National Reports on Mitigation Actions. Among other responsibilities was the submission of the Intended Nationally Determined Contribution (INDC) and the Nationally Determined Contribution (NDC) to the UNFCCC. Another action that INECC oversees is the design of Measure, Report and Verification (MRV) systems to demonstrate the fulfilment of the Mexican NDC.

Table 26. Policy lines and goals for climate change mitigation in Mexico.

Policy lines	Goals
• Climate change mitigation through: • Coordination of scientific and technological research projects. • Obtain technical and scientific support to the Ministry. • Publish criteria, methodologies and results. • Analysis and elaboration of strategies and programmes for each sector. • Evaluation of objectives' fulfilment as stated in the Climate Change Mitigation Law.	• To promote the protection of ecosystems, sustainable development and the right to live in a healthy natural environment. • To mitigate climate change through the reduction of national emissions, programmes and schemes that foster the transition to sustainability. • To promote the substitution of the use and consumption of fossil fuels for renewable energy sources as well as energy efficiency practices. • To promote the alignment and congruency of programmes, budgets, policies and actions to tackle climate change by stopping and reversing deforestation and degradation of forest ecosystems. • To promote the alignment and congruency in the reduction of carbon emissions from the generation and use of energy.

Source: Adapted from INECC. Available at: https://www.gob.mx/inecc/acciones-y-programas/mexico-ante-el-cambio-climatico

Other institutions, programmes and laws within the political structure that are linked or meant to deal with climate change mitigation in Mexico are stated below. However, they are mostly related to a fully functional demagogy and institutionalism (Zuckerman, 2016; Flores and Espejel, 2008; Dieterich, *pers.comm*). Here follows a concise description of such structure.

a) Institutions

- *Inter-secretarial Commission for Climate Change (CICC):* It was created in 2005 as a permanent institution and it is integrated by the heads of the following seven Ministries:
  1. Ministry of Environment and Natural Resources (SEMARNAT)
  2. Ministry of Agriculture, Livestock, Fisheries and Food (SAGARPA)
  3. Ministry of Communications and Transport (SCT)
  4. Ministry of Social Development (SEDESOL)
  5. Ministry of Economy (SE)
  6. Ministry of Energy (SENER)
  7. Ministry of International Affairs (SRE)

The CICC coordinates actions regarding the elaboration of policies that promote the development of strategies and programmes to fulfil Mexico's commitments under the UNFCCC. The CICC's Working Group for International Negotiations (GT-INT) is coordinated by the Ministry of International Affairs and it gathers the Ministries' views to obtain the stance that Mexico presents in international forums such as the COP and the UNFCCC's subsidiary bodies meetings.

- *National Institute of Ecology (INECC):* Its mission is to produce, integrate and publish scientific knowledge to support the elaboration of environmental policies and inform the decision-making process for sustainable development. It also conducts research on climate change in Mexico for both mitigation and adaptation strategies and to fulfil national commitments acquired before the UNFCCC.

- *National Forestry Commission (CONAFOR):* It was created in 2001 to develop forest productive, conservation and restoration activities as well as to formulate and implement sustainable forests management programmes.
- *National Commission of Natural Protected Areas (CONANP):* This commission manages one of the most important strategies for conservation of forest ecosystems, the National System of Natural Protected Areas (SINANP). It oversees the protection of biodiversity, natural resources and the integrity of many important ecosystems.
- *Federal Agency for Environmental Protection (PROFEPA):* Illegal logging remains one of the most important drivers of deforestation in Mexico. Therefore, PROFEPA together with CONAFOR is meant to fight illegal logging and traffic of illicit forest products.
- *Technical Advisory Committee on Environmental Services:* Consultancy body where NGOs, academic and social organisations such as the Mexican Civil Council for sustainable forestry (CCMSS) and PRONATURA participate.
- *National Institute of Statistics and Geography (INEGI):* Provides land cover and LULUC maps. There are Series of data taken during the 1970s and 1980s decades (series I), from 1993 (series II) and from 2002 (series III).
- *Ministry of Agriculture, Livestock, Fisheries and Food (SAGARPA):* Provides guidance to improve production while it integrates rural activities to productive chains from all other economic activities in the country.
- *National Commission for the Knowledge and Use of Biodiversity (CONABIO):* Provides support, coordinates and lead activities related to knowledge on biodiversity for its conservation and sustainable use. Aims to work as a link among academy, society and government on this issue.

b) Programmes

According to the government, sustainable forestry development is of great importance to reduce carbon emissions in Mexico (CONAFOR, 2014;

pers.comm). Therefore, there have been developed several programmes which either directly or indirectly aim to conserve forest cover.

- *Management units for wildlife conservation (UMAS):* It is a system that began operations in 1997 to reinforce the development of rural communities and biodiversity conservation.
- *Mexican Programme of Carbon (PMC):* Is a group of national researchers that coordinate scientific activities related to the carbon cycle.
- *ENAREED+:* Envisioned to cover the period between 2017-2030. It is an strategic plan that aim to promote actions towards climate change mitigation and adaptation in the forestry sector.

In theory, the institutional framework (including institutions, policies and programmes) for environmental issues such as LULUCF, seems to be robust, comprehensive and well structured. Such a framework would suggest results to some extent. Unfortunately, institutional lethargy, bureaucracy, inconsistency of legal norms, together with corruption have obstructed progress (CCMSS, pers.comm; Fernandez and Mendoza, n/d). As mentioned before, much of this is closely linked to demagogy and institutionalism (Dieterich, pers.comm).

Aristotle defined demagogy as the daughter of democracy but in its most corrupt and degenerated form (Zuckerman, 2016). In Mexico it is of great use for politicians and politics. For example, it helps to justify power on democratic foundations within an authoritarian regime; hiding and/or justifying inefficiency; and creating a functional public image (ITAM, 1988). According to Latinobarometro, a private non-profit organization based in Chile that carries out an annual public opinion survey on Latin-American peoples' perception on their governments, institutions and general socio-political and economic issues (Moreno, 2017; Latinobarometro, n/d), the evidence reflects that democracy as it operates in Latin-America, doesn't produce democrats or at least the type of politicians that could help to improve political processes in these countries (Rivapalacio, 2016). As it is customary in Mexico, such rationale is frequently reaffirmed. For example, in its opening speech before

the 71st UN General Assembly, the current Mexican president offered more transparency, accountability and freedom of expression in the country. Paradoxically, those variables are some of the ones which their performance within the country is regrettable (Rivapalacio, 2016). There have been hundreds of journalists and activists killed and persecuted, and more recently, on December 2017 it was approved the National Internal Security Law (Ley de Seguridad Nacional) by the Mexican Senate, which indicates that the Mexican Armed Forces could intervene to settle internal threats (Nicolai, 2017). But there is more than meets the eye. The Law gives complete authority to the Armed Forces to repel or neutralize any act of resistance without any human rights safeguards, situation that has been highly criticised by national organisations as well as international ones such as United Nations (Nicolai, 2017; Tourliere, 2017). Moreover, it is unconstitutional, against international treaties, and its ambiguity leaves an open door to excess in the use of a totalitarian decision taken by the president to use the force at will (Cardenas, 2017; Vergara, 2017; Proceso, 2017). Here we are taking about the same regime and the same armed forces that are linked to illegal businesses such as drug trafficking (Alanis, 2017). Otherwise, how is it that the armed forces coexist in those places all along the country where they are supposed to persecute criminals but still drug cartels operate every day in normality? Or how is it that the spying software called Pegasus acquired by the Defence Ministry end up spying activists, journalists and civil society in general instead of chasing criminals? (Alanis, 2017; *Dieterich*, *pers.comm*).

4.2 Political issues confronting the physical reality in Mexico

If you really think the environment is less important than the economy, try holding your breath while you count your money
Guy McPherson

Earth provides enough to satisfy every man's need but not for every man's greed.
Mahatma Gandhi

Most of the Mexican government officials argue that their millionaire salaries prevent them from stealing from public treasury. The truth is that they steal and get away with their crimes because of impunity reigning in Mexico. Just one of them has robbed the equivalent to ten thousand years of his salary.
Jorge A. Máynez, (independent social-democrat deputy)

Mexico has a history of corruption that has affected the performance of offices and policies across all sectors. Mexico is a country of fictional politics. The truth behind such fiction is not easy to access and in most cases, brings terrible costs for those who dare to expose it. The fictional version is constructed and tailored for telling a story where everything happens according to consented rules of what should be done in the best interest of the country and its people. However, what really happens is far beyond any pejorative adjective. Mexican politics have evolved into something like the underworld Tartarus, that place in Greek mythology where terrible monsters and criminals are banished and imprisoned, in this case not to be punished but to rule. Mexican politics is controlled by monsters and criminals who are owners of the power, together with factual powers in the hands of the private sector (including big national and international companies), and even illicit business, particularly drugs cartels.

According to GAN Integrity, which helps companies all over the world to mitigate corporate risk and also produces the Business anti-corruption portal, corruption is a major risk for companies that want to invest or are already doing it in Mexico (GAN integrity, 2016). In GAN's corruption report, one can find that it is clear there is widespread collusion among police, judges and criminal groups together with impunity and weak law enforcement. Moreover, reliability of police in Mexico to protect companies from crimes is amongst the

lowest in the world because police is notoriously corrupt, incompetent, and unreliable due to its association with criminal gangs as well as being influenced by corrupt politicians.

Mexico is by its political constitution a democratic republic, in the facts there is a different story. Mexico has actually been called *La Dictadura Perfecta*, which means, The Perfect Dictatorship. The title was given by Nobel Prize in Literature Mario Vargas Llosa, back in 1990 (Ponce, 2014). Since then, things have only changed for worse. Sergio O. Saldaña Zorrilla, researcher at the International Institute for Applied Systems Analysis (IIASA) in Vienna and guest columnist for Forbes magazine Mexico, stated that there is a false perception created to the people in Mexico to make them feel that they have the power to vote and elect the people in public-political charges, while such power is controlled by the Presidency of the Republic (Saldaña-Zorrilla, 2015). In the same article, he regrets that the Mexican State is falling apart and the history of an illusion of democracy repeats itself recurrently. He, like many other critics, have exposed fraudulent elections that have positioned in the end, people chosen by those in the power, being the most recent case governor elections for one of the most important states in Mexico by means of the now exposed and well-known strategies that include: manipulation of ballots counting, buying votes, deviation of public funds to support candidacies, destruction of ballots and any other evidence against them, people killed and disappeared (Saldaña-Zorrilla, 2015; Pezet, 2017; LaFuente, 2017; Delgado;2017; Flores, 2017; Martinez, 2017).

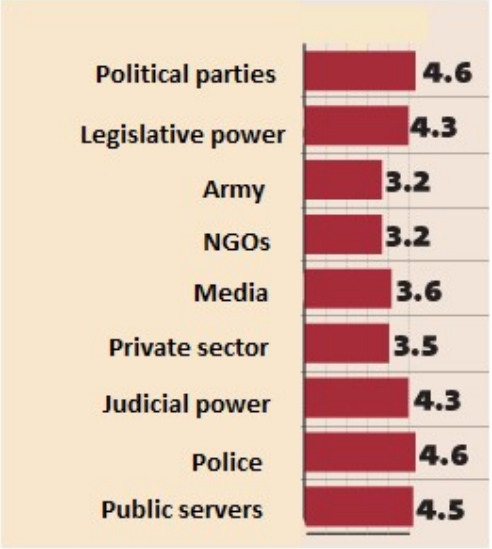
Another example is corruption, including deviation of funds involved in peculation, for political interests or personal illicit enrichment. According to *Reporte Indigo*, one of the most prestigious magazines and best known for publishing rigorous and objective research on political matters in Mexico, la Secretaría de la Función Pública (SFP), in charge of monitoring government officials' performance, recognised that less than 1% of the total denounced crimes, end in legal verdict and punishment. From 2002 to 2016, just 0.67% of such files against government bureaucrats concluded in penal or administrative process. Moreover, the SFP has received more than 400

denounces for illicit enrichment, fraud and abuse of authority in 15 years, although they recognize there are more cases that aren't even denounced. Among the people in public charges that fall into this category are: the president of the Republic (AFP, 2005; Hernández, 2012; Financiero, 2014; Carabaña, 2016; Change.org, 2017), judges of the Supreme court (Mendez, 2014; Camacho-Servin, 2014; Mosso, 2015), officials of federal offices such as the commission of electricity (Hernandez-Julián, 2012; Perez de Acha, 2016; Araizaga, 2017; HuffPost, 2017), states governors (Reuters, 2016, Reuters, 2016b; Hernandez-Borbolla, 2016; Austria, 2017), union leaders (Martinez, 2013; Heras, 2014; Gamboa-Pascoe, 2015; Paullier, 2015), and political parties' representatives (García y García, 2015; Saldaña, 2016; Cruz, 2017).

According to a study conducted by Transparency International in 2013, Mexico is the most corrupt country in Latin America, being the police, political parties and government representatives perceived as the most corrupt (Forbes, 2015) (Figure 30). Such perception derives from cases that, although politicians try to hide, the evidence has been exposed to the public one way or another. Just to illustrate, one of those many cases is that of the ex-president Carlos Salinas de Gortari's brother, Raul Salinas de Gortari, who was accused and found guilty of a high-level homicide and for which he was sentenced to life imprisonment. However, after 10 years in jail, he was absolved, and a few years later, a Supreme Court's judge ordered to hand in to him 19 million dollars distributed in 12 accounts plus 41 real-estate properties (Forbes, 2015).

A long list of corrupt officials, mainly ex-governors of the various Mexican states, such as Javier Duarte, Tomas Yarrington, and at least 10 more that are under investigation and fighting prosecution related to corruption and peculation charges have been seen around the world behaving as if they were free of any guilt and spending absurd amounts of money that do not match their declared official salary (Malkin, 2017).

Figure 30. Citizens' perception of corruption inside Mexican government bodies.



1=no corruption, 5=extremely corrupt

Source: Adapted from Transparency international. Available at: https://www.transparency.org/research/gcb/gcb_2015_16

According to Max Kaiser, an expert on anticorruption working at the Mexican Institute for Competitiveness, "the decades of impunity have generated a level of audacity and absurdity", to the extent of being more public and cynical than ever (Malkin, 2017). Javier Duarte, ex-governor of the State of Veracruz, has been found guilty of public funds deviation in his favour and personal enrichment as well as diverse political frauds. Conservative audits traced the amount in more than 700 million dollars, while more rigorous ones fixed the amount in more than 3,500 million dollars (Máynez, 2016). However, the Office of the General Prosecutor (PGR), the Federal Government's executive branch responsible of investigation and prosecution of federal crimes, estimated the amount in just 11 million dollars (Roldán, 2017). Duarte's monthly salary was 4,400 dollars (Ávila, 2016), therefore, he would have needed 66,287 years to accumulate such figure (it is even more than the whole Holocene geological era).

Violence in diverse forms is another recurrent crime perpetrated by politicians and other government officials in Mexico. It has taken the form of espionage

(Franco, 2017; Ahmed, 2017d; Agren, 2017), repression and no freedom of expression (Pámanes, 2017), direct threats and intimidation (Semple, 2017; Ahmed, 2017; Ahmed and Perlroth, 2017; Ahmed, 2017b; Ahmed, 2017c), and forced disappearance (Vulliamy, 2015). One of the most recent examples of a mixture of threats, intimidation and repression is a press conference held in June 2017, where the Mexican president acknowledged that his administration acquired an Israeli sophisticated software called Pegasus but denied that it has been used to spy on his critics, including human rights lawyers and activists, journalists, and media organisations that have been investigating the issue. However, as he frequently contradicts himself, he highlighted that he would use it with those that have raised accusations against the government. Victims of hacking attempts reacted in shock, and after a round of questions from the New York Times, the president's spokesman said that in no way the president was attempting to threat The New York Times or any of those groups (Ahmed, 2017d). The software, that is exclusively sold to governments, was sold to the Mexican government under the strict condition that it would be only used against terrorists and criminals, but there have been many reports from most prominent journalists, activists and victims that they have been targeted by the government and already been spied, so they have demanded for an independent investigation (Semple, 2017; BBCNews, 2017; DW, 2017). This group includes lawyers working on the case of the 43 students that disappeared in 2014, the leader of an initiative to pass anticorruption legislation, and a journalist that exposed a scandal involving the president and his family, among others.

The situation in Mexico is critical, evidence points to increasing unscrupulous repression as the Americas director at Amnesty International points out, stating that there is a clear pattern of illegal use of technology to control any criticism against those in power (Semple, 2017). Moreover, there are direct and explicit threats, including from the president himself. A recent example that attracted the attention of international and national media and even of a group of businessman allied with the government that were left in shock, was a meeting that took place in May 2017. Top business leaders gathered with

the president, among them was Mr. Claudio Gonzalez Laporte, chairman of Kimberly-Clark in Mexico. According to his statement together with the information collected from 5 more attendees, the president told Mr. Gonzalez that his son, a recognised anticorruption advocate, should stop his criticism against the government (Semple, 2017; Ahmed, 2017). Mr. Gonzalez Jr. has been targeted with espionage and he had been asked to hand in to the authorities his mobile. But, analysis conducted by researchers at R3D, a digital rights group in Mexico and Citizen Lab at the University of Toronto, showed that phones aren't needed to prove the illegal use of Pegasus (Ahmed, 2017). Suspiciously, the prosecutor (on the government's side) in charge of Mr. Gonzalez' investigation asked ironically for the phones involved as a proof to base the accusation against the government of snooping in Mr. Gonzalez. Balbina Herrera, a presidential candidate in Panama and victim of espionage with Pegasus, stated that it is absurd that the Mexican government asked for the victims' phones, they are re-victimizing them with this act (Ahmed, 2017) he said. Furthermore, in that same business meeting, attendees declared that the president "warned the business leaders that by financing the anti-corruption initiative they would be helping a leading opposition candidate in the next year's presidential elections" (Semple, 2017). Harassment against Mr. Gonzalez Jr. has been very explicit, not only by this declaration but with a series of audits to his organisation and some other companies that took place on a single day. Intrigued by this, Mr. Gonzalez Jr. asked an economist to calculate the probability of even 5 audits taking place on a same day, randomly, and to companies to which he is somehow linked to, and the answer was 0.00000000000000000000000204 percent chance (Ahmed, 2017).

Another side of violence are homicides and forced disappearance, mainly of critics to the government. 20 years later of the Mexican Revolution in 1910, the Institutional Revolutionary Party (PRI) took the presidency's power thereafter (except for the period from 2000 to 2012) and monopolized media coverage in its favour. When neo-liberal politics began to enter into force in Mexico and give way to the privatization of media in the 1980's decade,

some journalists began to work outside the control of the government and started to investigate Mexican politics from a critical point of view. Such freedom of expression and the right to know and expose criminal behaviour from those in the power have had an extremely high cost. Mexico ranks third in the world for the number of journalists killed (Guevara, 2017; Woodtson, 2017; Aljazeera, 2017), just after Syria and Afghanistan according to reporters without borders (ElUniversal, 2017). There are hundreds of journalists that have been life threatened, harassed and killed in Mexico since 2000, and more than 800 serious cases of harassment, homicide or assault just in the past 6 years with only 2 cases that convicted suspects (Ahmed, 2017c), which leaves 99,75% of the cases left in impunity (ElUniversal, 2017). All cases are closely related to investigations on the drug war in Mexico (Anderson, 2017; Agren, 2017b) and unveiling corruption in the political arena (Ureate, 2017; Riquelme, 2017; Expansión, 2017; Ahmed and Perlroth, 2017).

On the other hand, forced disappearance that is defined as a person's deprivation of liberty by the hand of the State, either using the States' own agents and public authorities or hired groups and people that act with the States' consent, has been an increasing practice of the Mexican government to silence detractors of corruption. Such act is a multiple and grave violation of human rights, being among them, freedom, acknowledgment as a legal person, integrity, life and it can be considered as a crime against humanity as well. The National Registry of Disappeared People in Mexico (RNPED), counts more than 28,000 people disappeared from 2007 to 2016, but no resolution of a single case because of the overwhelming corruption and impunity in the Mexican political and legal system (ElUniversal, 2017; LaJornada, 2017). At least 300 recommendations on the matter have been issued to Mexico from international organisations in the last 11 years, such as the United Nations Working Group on Enforced or Involuntary Disappearance (OHCHR) and the Interdisciplinary Group of Independent Experts designated by the Inter-American Commission on Human Rights. Ariel Dulitzki, head of the OHCHR from 2010 to April 2017, emitted an

evaluation on the Ayotzinapa case, stating that Mexico has failed in everything, particularly on three characteristics: truth, justice and compensation (Camacho, 2017). The Ayotzinapa case is one of hundreds in Mexico which show the extent of impunity, government's involvement in corruption, forced disappearance, violence and manipulation of the information. 43 school teaching students from a rural community in Ayotzinapa, nearby Iguala, Guerrero were on their way to Chilpancingo, capital city of Guerrero State, on September 26, 2014. According to the investigations, mainly from national and international journalists, the students planned to arrive to Mexico City to be part of the big march taking place on October 2, to honour and manifest against the government for the massacre that took place back in 1968 in Tlatelolco, Mexico City. Rural schools like this one have two strong ideological pillars, the first one is to fight for better social and economic conditions for the people and second, are critics to the government's policies because they embrace Marxist thoughts (Forbes, 2014). Regarding to what happened, there have been several statements from the local and federal governments that are contradictory and show serious flaws, to the extent that an independent group of experts, including forensics and journalists, have been investigating and studying the case.

In synthesis, the group of experts have demonstrated that the government was dishonest when said that according to the official investigation, the 43 students were found incinerated by a group related to drug cartels and their rests left in a dump (Aristegui, 2017). However, what the independent group of experts found in such dump, were the rests of other incinerated people and hundreds of bullet caps. According to their investigations, in such dump there have been killed people for the past 10 years, but there are no traces of all of the students in that place (Arce, 2016). The Mexican government has received pressure from the United Nations, the Organization of American States, Amnesty International, the students' parents and families, Mexican NGO's, Mexican universities and civil society since their disappearance but haven't clarified anything on the case. On the other hand, after the event, Mexican officials tried to bribe the students' parents to leave things as they were and stop asking for answers (Telesur, 2014). Meanwhile, a famous

priest in Mexico, well-known for his movement in defence of migrants in Mexico, Alejandro Solalinde, claimed he had been contacted by close sources to the tragic event and released key information to the Russian news agency Nóvosti, to which he declared that the students are dead, most of them burnt alive and that the government was involved in (AnimalPolitico, 2014). The case is still open, there aren't clear answers from the government; on the contrary, there is more evidence that points out the government's involvement in the 43 students' disappearance and that has been hindering the pathway to show the truth (Proceso, 2016).

Chapter 5
Case study

In the past pages, there have been described examples that show business as usual in Mexican politics. Here are some examples related to environmental issues that demonstrate these ones are not the exception.

5.1 In the practice

Mexico ratified the Paris Agreement in September 2016, and for this reason is in line with the international movement under the UNFCCC to tackle climate change. In the Mexican voluntary commitments presented before the UNFCCC, the goal is to reduce greenhouse gas emissions in 22% by the year 2030 (CAT, 2017). The official stance of Mexico in front of the climate change challenge includes the support to achieve a global legally binding agreement in which all UNFCCC's Parties participate aiming to keep global mean temperature below 2°C. Among the actions taken to this end, the government implemented the LGCC that entered into force in 2012, and recognises the establishment of institutions and effective instruments to reduce GHG as well as to give priority to mitigation actions. Together with the ENCC adopted in 2013, they set the pathway for the next 10, 20 and 40 years. Additionally, PECC 2014-2018 oversees GHG and short-lived climate pollutants monitoring. All of them coordinated within SEMARNAT that is supposedly to act in synergy with other sectors and their Ministries such as the Ministry of Energy (SENER) that oversees the Energy Reform 2014. In 2016, Mexico submitted its NDC to the UNFCCC which includes both adaptation and mitigation. Mitigation includes unconditional and conditional measures, the first ones are those that the country will implement considering its own resources, on the other hand conditional measures are those that could be developed depending on external funding and technical support through international cooperation.

Table 27. Conditional and unconditional measures agreed in the Mexican NDC.

Conditional	Unconditional
	Committed to reduce 22% of its GHG from business as usual by the year 2030.
The 22% unconditional reduction could increase to 36% conditional to international carbon price, technical cooperation, access to low-cost financial resources, funding and technology transfer.	An ecosystems-based adaptation approach that consists on the conservation of ecosystems and biodiversity such as mangroves and forests.
Development of technologies to increase adaptive capacity will be subject to international financial and technical support.	Conserve and restore ecosystems in order to increase ecological connectivity of all Natural Protected Areas.
	Consider equitable participation of the population.
	Transformation of the Energy sector.
	Reach a rate of 0% deforestation by the year 2030.

Source: Information from UNFCCC- Mexican NDC.

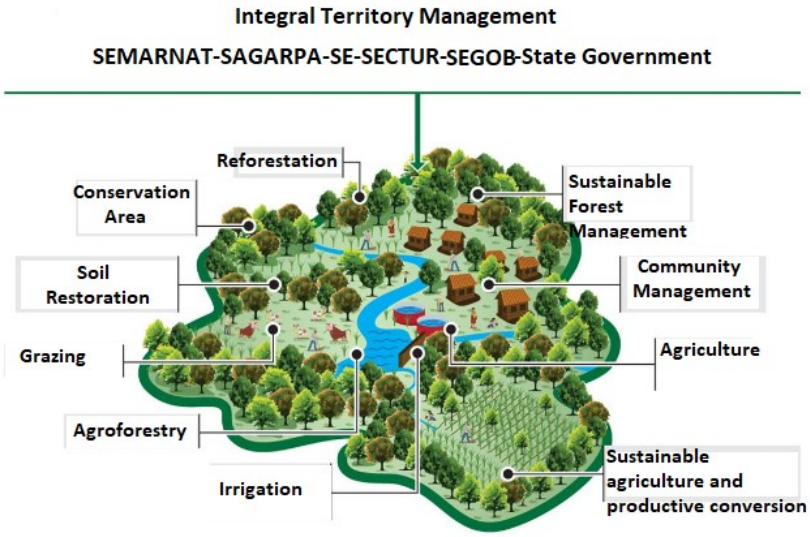
Speaking of the Land use, Land use-change and Forestry (LULUCF) sector, the Mexican NDC comprises afforestation, reforestation, deforestation, forest management, cropland management and grazing land management. All these are targets for action within the ENAREDD+, which means National Strategy REDD+ that has been under design since 2010, aiming to deal with LULUCF issues through policies and actions prioritizing Rural Sustainable Development (DRS) and biodiversity conservation (CONAFOR, 2015). The government acknowledges DRS as an integral territory management model which considers national deforestation and forest degradation the result of internal and external problems that not only affect conservation and contribution to global GHG emissions but the communities' quality of life. As said by an officer from CONAFOR:

"*the government is trying to integrate all elements and possible issues that are needed for an integral model that improves territory management and a good implementation of REDD+ to tackle climate change"*

(Field interview, pers.comm).

Figure 31 shows the Mexican institutions involved in DRS as well as key areas that are intended to be covered.

Figure 31. Integral Territory Management (DRS) in Mexico.



Source: Adapted from CONAFOR. Available at: http://www.conafor.gob.mx/web/temas-forestales/bycc/redd-en-mexico/

The government proposes the joint action among several institutions such as SEMARNAT, SAGARPA, SE, SECTUR, SEGOB and different State Governments, as confirmed by an officer from SEMARNAT:

"the aim is to achieve synergies among several institutions by adding efforts and advance towards the government's goals and contribute to climate change mitigation "

(Field interview, pers.comm).

The envisioned areas within DRS are: reforestation, conservation areas, soil restoration, grazing, agroforestry, irrigation, sustainable forest management, community management, sustainable agriculture and productive conversion. On the other hand, regarding biodiversity conservation, it was during COP16

celebrated in Cancún, Mexico, where safeguards for this issue were proposed. However, from the national point of view, there haven't been adequate discussions on this topic. Some stakeholders, including NGO's such as the CCMSS, propose that biodiversity conservation should be included within ENAREDD+, taking as a reference, safeguards and standards that have been issued by the FCPF and the Social an Environmental Principles and Criteria by UN-REDD as well as the UNFCCC's safeguard e) (CCMSS, 2014) (Table 28).

Table 28. References for including biodiversity conservation within ENAREDD+.

FCPF	UN-REDD+	UNFCCC's safeguard e)
The FCPF asks countries to conduct a social and environmental assessment as part of their REDD+ strategy development. This includes: 1) environmental assessment; 2) natural habitats; 3) forests; 4) physical cultural resources; 5) pest management; 6) involuntary resettlement; 7) indigenous peoples; 8) safety f dams; 9) projects involving international waterways; 10) projects in disputed areas.	Provides guidelines for countries to integrate biodiversity into their REDD+ plans. However, UN-REDD+ only encourages but do not forces countries to include biodiversity conservation. There are 7 safeguards in place also known as Cancun safeguards: 1) actions complement or are consistent with national forest programmes and international conventions; 2) transparent and effective governance structures; 3) respect for indigenous and local communities; 4) effective participation of relevant stakeholders; 5) actions consistent with forests and biodiversity conservation; 6) actions to address the risks of reversals; 7) actions to reduce displacement of emissions.	Compatibility between natural forests conservation and biological conservation, emphasising the importance of the conservation and protection of forests instead of forests conversion for enhancing carbon sequestration for example.

Source: Own elaboration with information from UN-REDD+. Available at: http://www.unredd.net/knowledge/redd-plus-technical-issues/safeguards.html; UNFCCC, 2011. available at: http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf; FCPF SBSTA expert meeting. Available at: https://unfccc.int/files/land_use_and_climate_change/redd/application/pdf/fcpf_sesa+esmf_presentation_8oct2011.pdf

On the other hand, in 2016, the Mexican legislation issued the following articles to support the development of ENAREDD+: 1) the Mexican Law

concerning the forestry sector prioritizes the implementation of policies that warrantee climate change adaptation and mitigation, specifically, to reduce the vulnerability of the Mexican population as well as national ecosystems; 2) to encourage the transition towards a competitive sustainable and low carbon economy; 3) restoration, conservation, management and sustainable management of all natural resources within the country; 4) develop a low carbon and sustainable economy promoting the implementation of energy efficiency and renewable energy (SEGOB, 2017). As said before, ENAREDD+ is the official Mexican plan for climate change mitigation in the forestry sector that is part of the NDC submitted to the UNFCCC. The plan is proposed to rule between 2017 and 2030. The components of ENAREDD+ comprise: 1) legal framework and policies, 2) finance, 3) institutional arrangements, 4) MRV, 5) social and environmental safeguards, 6) communication and capacities development, and 7) social participation and transparency (CONAFOR, 2017). Details of each component are shown in table 29.

In synthesis, the official stance is that ENAREDD+ is meant to be a key part of the Mexican NDC and should be understood as the group of strategic lines designed to promote climate change mitigation and adaptation measures at the same time, through the implementation of an integral territory management that enhances sustainable rural development (CONAFOR, 2017), moreover, the officer from CONAFOR mentioned that:

“it is a priority for the government to work along with rural communities to achieve sustainable development in this sector ”

(Field interview, pers.comm).

As the ENAREDD+ has been evolving since 2010, there are other associated issues that have been prepared at the same time, such as the forests emissions reference, the national monitoring system for REDD+ activities reporting, and a system to inform on how to approach and respect the associated safeguards (CONAFOR, 2017; SEGOB, 2017). The two focal

components of the national strategy are DRS and biodiversity conservation. However, for ENAREDD+ to succeed, DRS have obstacles to overcome such as current interinstitutional inefficiencies and corruption, according to representatives from RedMocaf and CCMSS:

"it is complicated to set aside interinstitutional blockages as well as corrupt practices"

"the implementation of this strategy has been inefficient due to conventional institutional schemes, big changes are needed such as good communication among institutions because there isn't any at the time"

(Field interview, pers.comm).

Speaking of biodiversity conservation, it may be almost impossible to achieve in the Mexican context. The attention has been given to the design and implementation of the information system while consensus on the establishment of the biodiversity conservation working group has not been successful until now (SEGOB, 2017).

Table 29. ENAREDD+ components.

Legal framework and policies
• The LGCC stipulates mitigation goals in all sectors: 30% from baseline by 2020 (although they do not specify which baseline); 50% from 2000 levels by 2050. • Rate of 0% deforestation by 2030. • Lines of action: 1) articulate and improve policies and instruments linked to the implementation of REDD+; 2) adjust sectors' policies for a whole territory vision; 3) design and operate plans, programmes and policies with a long-term view that delivers sustainability; 4) integrate and boost a legal changes agenda for the implementation of REDD+.
Finance
• Open to bilateral and multilateral finance mechanisms from the UNFCCC. • Under the LGCC it has been created the Climate Change Fund to attract and canalize financial resources from public and private sources. • Lines of action: 1) identify and manage finance alternatives that incentivise greater investments; 2) promote international finance mechanisms for REDD+; 3) design financial instruments to manage and distribute resources; 4) improve rural and local institutions that aid land owners; 5) promote REDD+ markets.
Institutional arrangements
• Collaboration between national institutions such as CONAFOR, CONABIO, SAGARPA; SEMARNAT and local communities. • Lines of action: 1) improve local governance; 2) make necessary institutional arrangements that improve rural sustainable development.
MRV
• The objective is to consolidate a robust and transparent system that monitors GHG emissions from forests and contributes at the same time to monitor emission reductions achievements.
Social and environmental safeguards
• Mexico acknowledges REDD+ safeguards stablished in the Cancun Agreement. The national objective on this issue is to design and implement a system of safeguards to inform on how to approach and respect REDD+ safeguards considering national and international regulations. • Lines of action: 1) ensure safeguards in the ENAREDD+ implementation; 2) articulate a national safeguard system; 3) design and implement the safeguards system; 4) execute necessary measures for the implementation of the system; 5) promote an inclusive process for the design and implementation of the system; 6) enhance the capacities of the diverse government levels involved as well as other stakeholders.
Communication and capacities development
• Capacities development is a conceptual approach that focuses in two aspects: comprehension of obstacles and improvement of conditions and abilities to overcome such obstacles. • Lines of action: 1) design and implement a communications strategy that improves stakeholders' participation.
Social participation and transparency
• Assure transparency within actions aimed to fulfil REDD+ goals.

Source: Own elaboration with information from CONAFOR, 2017; SEGOB, 2017.

5.2 Are there synergies?

Mexico has been an active member at the UNFCCC, adhering and supporting actions to tackle climate change. What really happens is something far from compromising with that cause. For example, works began to build a gas duct property of TransCanada in May 2017 (IEA, 2017). It will be 800 km long connecting Texas with Veracruz and will transport 2,600 million cubic feet of natural gas daily, equivalent to 32% of current demand in Mexico. The head of the Ministry of Energy (SENER), stated that “the duct, is the beginning of a new era for the energy sector infrastructure and comes to be part of the effort to make fuel run through the metal arteries that are already spread throughout all the Mexican territory” (El Economista, 2017). At the same time, the head of the Federal Commission of Electricity (CFE) stated that there are 8 ducts already operating and 16 more are under construction. TransCanada is the first private company to build and operate gas ducts since the mid 1990’s and by 2018 will operate 7 major systems of ducts in Mexico (IEA, 2017). Additionally, CFE has recently announced a new contract with Arcelor Mittal, the most important industrial consumer of natural gas in the country. This, in the one hand, is one example of many related to national policies aligning with economic interests rather than following international recommendations of beginning decarbonization of the economies.

The energy sector in Mexico is strongly in favor of the fossil fuels industry. One can see this in other similar actions such as the destruction of the national company Pemex that was owner of all Mexican oil reserves and acted as representative of all Mexicans on the matter. However, the oil market has recently been opened in the country, letting companies such as Shell, Chevron and BP to commercialize Mexican oil (Hernandez-Borbolla, 2016). These actions in the energy sector do not fit easily into the longer term strategy of decarbonisation and the supposedly Government’s commitments to the UNFCCC. It seems that there is a lack of ccordination across Ministries, with the Ministry of the Environment promoting REDD+ policies and the Ministry of energy incentivizing oil production expansion.

Moreover, there are many examples that show actions turning into ecocides deliberately manufactured. Table 30 synthetizes some of them. For example, a terrible acidified cooper sulphate spill took place in 2014 in the Mexican state of Sonora. The Buenavista del Cobre mine, property of Grupo Mexico, was responsible of the worst socio-environmental disaster related to the mining industry in Mexico. Serious damages to the people's health, the economy and ecosystems of the Sonora River's basin including 8 surrounding municipalities occurred (Luque- Agraz et al, 2019).The mine did not fulfilled any of the environmental protection requirements stablished by the Mexican Law at the time of the disaster, but even more critical, the three levels of government overlooked this (Toscana-Aparcio and Canales, 2017). Requests for access to information from PROFEPA revealed that officials from this federal organization visited the mine only 2 times within the period 2000-2018 and these were after the disaster occurred. The revisions made during those visits detected 55 irregularities captured in 4 files adding a total of 8,128 sheets confirming that the mine was operating in violation of the environmental law and failing to comply with fundamental security regulations (Cardenas, 2018). The environmental impact was vast and it is considered a terrible ecocide, from which Grupo Mexico remains unpunished (Ibarra-Barreras and Moreno, 2017; Rojas, 2019). Part of such ecocide took place at the Natural Forest Reserve (a Natural Protected Area) called Ajos-Bavispe which covers 200 thousand hectares of forests (70% of it are pines and oaks) that were severely contaminated with acidic waters, cooper sulphates, and other harmful metal substances Luque-Agraz et al, 2019) .

The Mexican Federal Government executes contradictory decrees and laws. On the one hand, the Natural Protected Area is the instrument that the government uses to protect the national biodiversity. However, a study revealed that the Ministry of Economy has granted more than 1,500 mining concessions that cover one million and a half hectares of Natural Protected Areas, Ajos-Bavispe included (Armendariz Villegas, 2015).

Table 30. Examples of ecocides that contradict REDD+ aims.

Ecocide in Tepoztlan, Morelos.	**Ecocide in Tajamar-Cancún Mangrove.**
The Pera-Oacalco freeway extension is a project that is already being executed. This construction when finished will cut down 2,800 trees. Such deforestation should be avoided due to environmental commitments but economic interests behind this project are more important. At the same time, this freeway destroys an important pre-Hispanic site, but the Anthropology and History Institute (INAH) itself, gave the consent to do so (Rivera, 2017; Brito, 2017).	Since 2005, the National fund for Tourism (FONATUR) presented the project Tajamar to the Ministry for the Environment and Natural Resources (SEMARNAT), the one that authorized urbanization works in 59 hectares of a protected Mangrove in the State of Quintana Roo. In 2008, SEMARNAT authorizes 30 more hectares for the urbanization project. In 2015, formal complaints from environmentalists and civil society are presented based on the Mexican Political Constitution. However, in January 2016 at 2am, more than 70 dump trucks and bulldozers, supported by local and federal police and anti-mutiny police that enclosure the zone for around 24 hrs, while the entire zone was being devastated leaving crocodiles, birds and other fauna dead bodies all over the place and no trees left (Greenpeace, 2016; Varillas, 2016; AnimalPolitico, 2017).
Ecocide Grupo Mexico In August 2016, Buenavista del Cobre quarry, property of Grupo Mexico, spilled in Sonora river, toxic metallic fluids that polluted the water which feeds El Molinito dam, the one that supplies with potable water the north region of Hermosillo, capital city of Sonora state. The National Laboratory of Sustainable Sciences (LANCIS), proved the presence of arsenic, lead, cadmium, copper and zinc in plants and animals in levels well over national and international standards. Moreover, the same analysis stated that 50% of the inhabitants of Hermosillo consume such water and found those metals in their bodies, putting their health at high risk. SEMARNAT, disappeared the findings of this research, protecting with this, the company and people responsible (Gomez-Lima, 2016; Dealba y Ramirez, 2016).	**Depletion of the protected ecological reserve Nevado de Toluca** The former Mexican president signed and approved for its publication in Official Documents of the State, a decree in which he removes the category of National Park from the area known as Nevado the Toluca, including the volcano, that was also a natural protected area. Now, such park only covers 4% of what once was, so the rest 96% is now available to urbanization, recreation activities, cattle raising, public and private infrastructure (Martinez, 2013; Vera, 2013).

Source: Own elaboration with information from: Rivera, 2017; Brito, 2017; Greenpeace, 2016; Varillas, 2016; AnimalPolitico, 2017; Gomez-Lima, 2016; Dealba y Ramirez, 2016; Martinez, 2013; Vera, 2013.

Regrettably, there is a long history of poor environmental management policies (Greenpeace, 2009; Sarukhan et al., 2010; Ruiz-Funes, 2017). Moreover, there is evidence that show clear linkages between political-economic interests and the ecological devastation of the Mexican ecosystems (López, 2016). As said by a professor-researcher in Economics at an important public University in Mexico:

"in this nation, natural resources, the environment, has shockingly deteriorated in the past 3 decades, and there is a strong relationship between this and economic interests "

(Field interview, pers.comm).

This work focuses in the REDD+ strategy implementation in Mexico and whether it could contribute to reduce GHG emissions as part of the country's commitment stated in its NDC presented before the UNFCCC to tackle climate change. Historically, Mexican policies have not favoured conservation or sustainable use of natural capital. For example, in 1976 the original extent of the country's vegetation showed a reduction of 38%, by 1993 it was of 46%, and by 2002 the loss was of 70% of the original extent (Sarukhan et al., 2010). This has contributed to the fragmentation of ecosystems that has reached a severe point, especially in the case of the tropical zone, where only a territory of no more than 15% includes uninterrupted areas greater than 20km^2. Such fragmentation has been identified to be a major contributor to an increase in the rate of species extinction for example, reaching a loss of 127 species from which 74 were endemic (Jimenez-Sierra, et al. 2010).

During the 20th century, an agrarian reform in Mexico had an enormous impact on land ownership, from which consequently, approximately 53% of the national territory became social property when forests were redistributed with management transferred to communal *ejidos.* Together with colonization programmes to occupy forests as well as extensive livestock pasture development programmes, communities and the Federal government promoted deforestation in the central and southern part of the country during the 1970's and 1980's decades. The most affected states were Chiapas, Veracruz, Tabasco and Quintana Roo (INE, 2002). Unfortunately, in more recent years things have not changed and there are increasing examples of bad policies having severe environmental impacts (Table 31).

According to Global Forest Watch and Reforestamos Mexico, thousands of hectares have been deforested in the Yucatan Peninsula due to the

expansion of cattle ranching and agriculture, and just in Campeche the loss has been in the range of more than 57 thousand hectares in 2016, questioning once more supposed achievements from forests conservation policies (Restrepo, 2017; CCMSS, *pers.comm)*. Additionally, the Yucatan Peninsula suffers a severe deterioration of aquifers due to industrial activities and the use of agrochemicals. Both are consequence of the un-fulfilment of any environmental policy framework (Restrepo, 2017).

Table 31. Examples of environmental impacts from bad policy in Mexico

Water	Tropical forests	Other ecosystems
Most of water bodies are contaminated. 95% of rivers have a degree of contamination and 29% have a high level of contamination by chemical substances, heavy metals and narcotics. An example is Rio Atoyac in Tlaxcala and Puebla where 4 industrial corridors are based including more than 80 industrial plants and small towns concentrating at least 280,000 people that illegally discharge contaminants to the river. The North American Free Trade Agreement incentivizes the settlement of foreign industries in the Mexican territory and these are hardly environmentally regulated. One of the most criticized examples is the Canadian mining industry which includes forced displacement, violent deaths, adverse health consequences, and environmental impacts mainly to water bodies.	Mexico is one of the 8 countries invited to participate as a pilot country and receive support for the implementation of REDD+. However, Mexico has not been able to reach full and successful implementation, particularly due to the lack of effective inclusion of indigenous peoples and ejidos which most of them are in poverty. Remittances from illegal Mexican migrants in the USA help their families in Mexico to endure poverty that has been a consequence of insufficient and inefficient official forestry and rural programs. Recent data show that in 2016 deforestation grew more than one third in comparison to the period 2010-2015. The loss in 2016 was of 253 thousand hectares. The most affected States were the ones within the Yucatan Peninsula: Quintana Roo, Campeche and Yucatan.	Mexico has open the energy sector to foreign investment through the Energy Reform (2013). So, the National Hydrocarbons Commission is envisioning fracking in the coming years no matter the environmental impacts that have been already registered due to this practice such as contaminated water from the mixture of water and toxic chemical compounds. Another example is the touristic sector that has privileges over natural conservation. There have been many examples of ecosystems destruction to give way to touristic infrastructure. Cases include the destruction of the mangrove Tajamar; Punta Paraíso in Nayarit invading turtles' sanctuaries; Yum Balam a Natural Protected Area in Quintana Roo suffering land use change and many more.

Source: Own elaboration with information from CCMSS, 2011; Partida, 2017; Mendoza, 2014; Restrepo, 2017; Working Group on Mining, n.d.; Clemente, 2017; Santos, 2017;

In Mexico there is an institutional framework including laws and guidelines that has been growing for more than 20 years aimed to managing the environment.

However, in most of the cases it is of no use and on the contrary, is completely unsustainable (CCMSS, pers.comm).

(Field interview, pers comm.)

There have been examples that show that the reasons may vary but they are greatly related to being technically wrong (Saynes, et al, 2016), working without an inter-sectoral approach, or to being unfulfilled and disobeyed (CCMSS, 2011).

Moreover, there is a high incidence of low profiles and incompetence among officials at all levels across the whole governmental structure as well as wide spread corruption and bad practices (CCMSS, pers.comm; Hodgon, Chapela, Bray, 2013; Grillo, 2015 Cossio Diaz, 2017; Lomnitz, 2017; Redaccion AD, 2017; Espinosa, 2019).

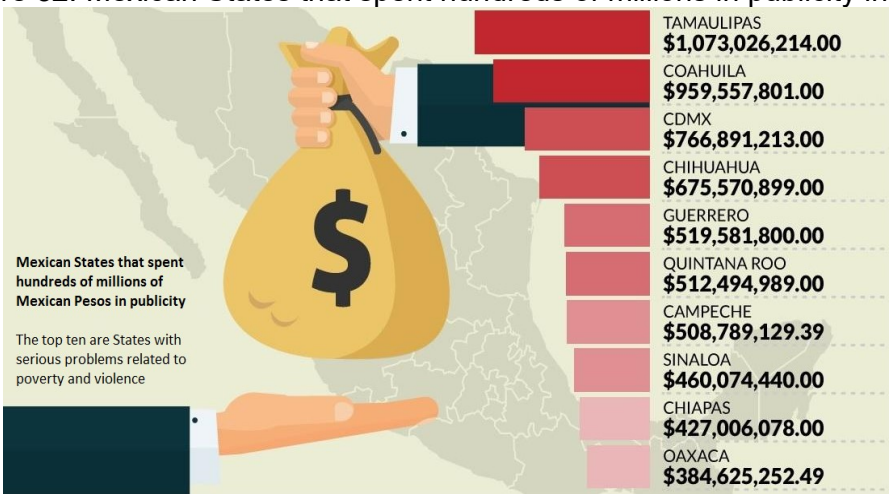
Field interview, pers comm)

For example, the Federal government has spent 34,707 million Mexican pesos in the period between 2012-2017 providing gratifications for punctuality and assistance to the workers of governmental offices, while getting on time and assisting to their jobs is part of their implicit responsibilities (Villa y Caña, 2017). Additionally, the Federal and States' governments spend hundreds of million Mexican pesos in publicity for their campaigns and every day's public image, no matter their people is living under constant violence and poverty (Barragán, 2017). According to a research conducted by the Mexican Institute for Competitiveness (IMCO), in 2016 the States spent 139% (5,534 million Mexican pesos) more than they could spend on publicity (Figure 32). All the Mexican States incur in this

practice but among the top ten we can find two that are part of the Yucatan Peninsula (Quintana Roo and Campeche).

The institutional framework comprises numerous offices, programmes and policies that in theory were created, among other things, to manage conflicting interests and promote sustainable forest management. Two of the oldest and still in force institutions are the National Institute of Ecology (INE) and the Federal Agency for the Protection of the Environment (PROFEPA) that was created in 1992.

Figure 32. Mexican States that spent hundreds of millions in publicity in 2016.



Source: Adapted from Barragán, 2017.

Additionally, regarding programmes, to recover some of the forested land that had been lost before the 1990's decade, the government promulgated in 1993 the National Programme for Reforestation (PRONARE) that has been coordinated by CONAFOR since 2001 within the Programme for Conservation and Restoration of Forested Ecosystems (PROCOREF) (*CONAFOR, pers.comm*). The National Forestry Commission (CONAFOR) is part of the Federal administration as a decentralised office part of the Ministry of the Environment and Natural Resources (SEMARNAT). CONAFOR oversees the development and fostering of productive activities, conservation and restoration in the forestry sector through plans, programmes and the implementation of sustainable development policy (*CONAFOR*, *pers.comm*). Therefore, CONAFOR is the focal point for the development of REDD+ in

Mexico (*CONAFOR, pers.comm*). Additionally, CONAFOR works in close relation with the National Commission of Natural Protected Areas (CONANP) because there are 181 of these concentrating more than 90 million hectares along the country, from which many of them are in the Yucatan Peninsula (CONANP*, pers.comm*).

This institutional framework runs the implementation of environmental policies related to the forestry sector, and the most important programme of recent adoption is ENAREDD+ (National Strategy REDD+) (CONAFOR, pers.comm).

(Field interview, pers comm)

Such programme has its origins in the document that Mexico presented to the UNFCCC in 2010 with the title "Mexico's vision of REDD+" (*SEMARNAT*, *pers.comm*). The document describes the mitigation and adaptation aims, highlights the importance of the integration of policies and finance, and focuses on reducing deforestation, forest degradation and the progress of sustainable development (CONAFOR, 2014).

The ENAREDD+ considers as a focal point Rural Sustainable Development (DRS) and the best way to come REDD+ true in Mexico (SEMARNAT, pers.comm). The ENAREDD+ also considers that having a perspective of transversely work among sectors is vital and only with such approach would be possible to tackle pressures on forest ecosystems (SEMARNAT, pers.comm; CONAFOR, 2014).

Field interview, pers. comm)

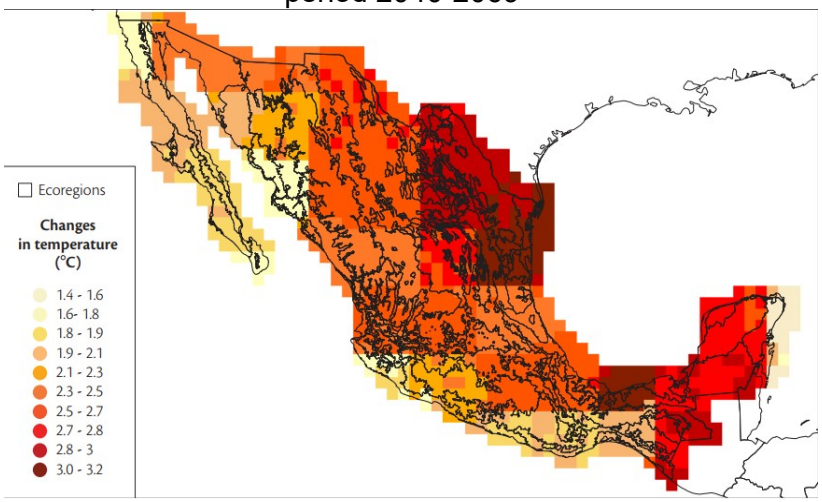
ENAREDD+ also stablishes as a key objective its accomplishment by the year 2030, specifically, that greenhouse gas emissions from the forestry sector should be reduced (the aim is to reach net zero deforestation by the year 2030); that carbon reserves within forest ecosystems should be preserved and enhanced (reducing the net rate of national forest degradation and increasing forested areas through sustainable management); to promote

sustainable forest management (preserving biodiversity); and full implementation of REDD+ (including the development of social and economic circumstances of the people from the rural communities) (*CONAFOR*, 2014*;* CONAFOR, *pers.comm*).

Additionally, the Political Constitution of Mexico through the General Law of Sustainable Forest Development (LGDFS) acknowledges private property of land in the form of ejidos, rural and indigenous communities among others, and in the article 134bis of the same law it stablishes a safeguard of inclusion and territory, cultural, social and gender equity of such communities. This political structure may appear straightforward, however, there is a much more extended and complicated political network that is linked to climate change mitigation in Mexico. Unfortunately, as the case study shows, that doesn't mean it is effective.

In addition to the policy background, climate change has come to increase the risk of degradation and loss of the Mexican natural and cultural stock. Climate change projections indicate that most of the Mexican territory will experience severe increases in the average annual temperature (Figure 33) that will certainly have bad consequences to ecosystems (Sarukhan, et al, 2010). It is projected that the Yucatan Peninsula will experience changes in the range of 1.6 to 3°C for example. Global warming will affect all the world, and what countries will do to tackle this issue will define climate change everywhere. To this work's end, the attention is on LULUCF that has been targeted as an important contributor to global warming and a key part of climate change mitigation efforts. Mexico is part of those countries with the responsibility to reduce carbon dioxide emissions from LULUCF.

Figure 33. Projection of changes in average annual temperature for the period 2040-2069



Source: Adapted from Sarukhan et al., 2010.

According to INEGI's data, there was an important forest loss in the period between 1985 and 2002. In its most recent publication it is reported that the loss has been stabilizing since 2002, reaching in 2013 just 4.9% (32MtCO_2eq) of the total emissions in the country (SEGOB, 2014; INEGI, 2017; *INEGI*, *pers.comm*). However, the information from other sources contradicts the one from INEGI.

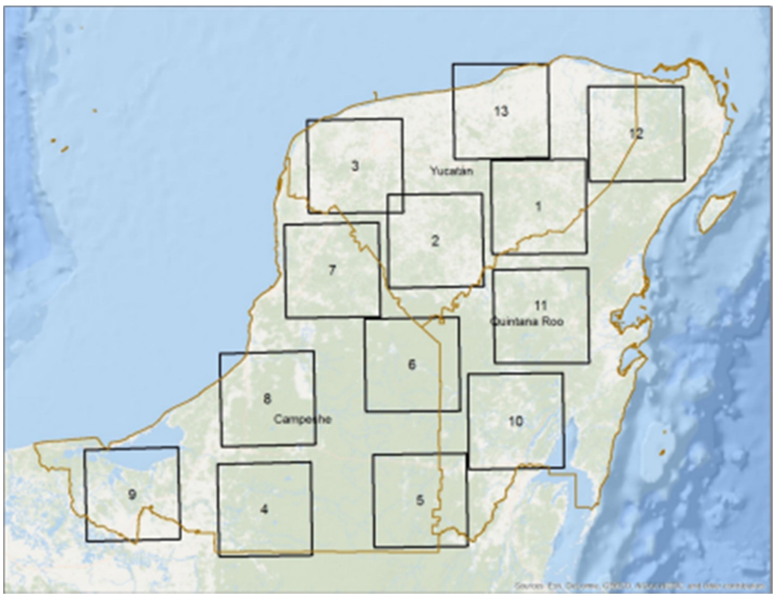
"According to landowners there have been at least three factors that have been increasing the loss of forests in the Yucatan Peninsula (Ejidos, pers.comm). The first one is agricultural expansion, the second is expansion of touristic infrastructure, and the last one is related to illegal plantations of soy and those linked to drugs cartels

(Field interview, *pers.comm*).

According to INEGI (2014), drivers of deforestation in Mexico include: expansion of agricultural and livestock activities, illegal logging, expansion of urban and industrial areas and plagues. In the Yucatan Peninsula, the main drivers of deforestation have been identified as the expansion of agricultural and livestock activities related to government programmes for production

development, fires and urban development related to tourism (Ellis E.A et al., 2017) Figure 34.

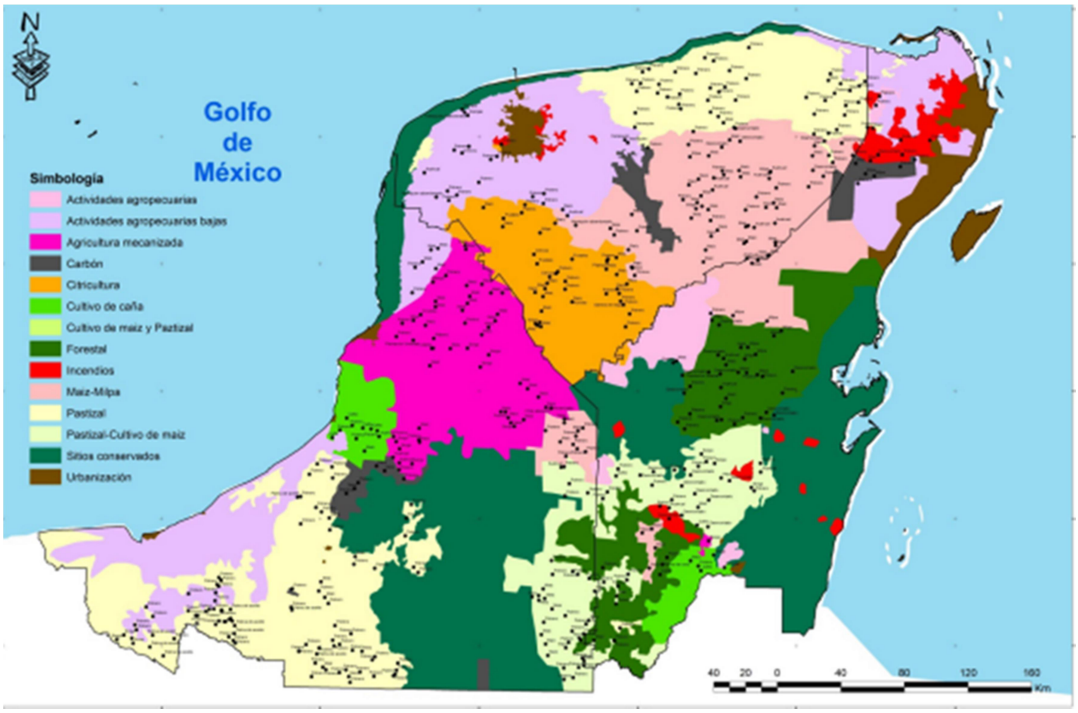
Figure 34. Identified areas with major deforestation issues in the Yucatan Peninsula between 2000 and 2013.



Source: Causas de deforestacion en la Peninsula de Yucatan. Memoria del Taller. 24 y 25 de junio de 2015, Tantakin, Yucatan. UICN, CONABIO, CCMSS, Alianza Mexico REDD+, USAID. Available at: https://www.biodiversidad.gob.mx/corredor/cbmm/pdf/18-2-memoria-taller-tantankin.pdf

However, a more detailed study conducted in collaboration by the UICN, CONABIO, CCMSS, Alianza Mexico REDD+ and USAID revealed that causes of forest loss such as fires and urban development are not as relevant in the Peninsula as other causes such as livestock and agriculture activities. It is important to notice that there is still a big area of forest and conservation. It is in such forest and conservation area where the fieldwork of this thesis took place. Such information can be corroborated with documented cases and personal statements from people living in those strategic regions.

Figure 35. Causes of deforestation in the Yucatan Peninsula.



Note: The main drivers of deforestation correspond to: 1)Light lilac: livestock activities; 2) Deep lilac: mechanised agriculture; 3) Light green: pastureland-maize crops; 4) Orange: citric-agriculture; 5) Pink: corn-cornfield; 6) Red: fires; 7) Brown: Urban development; 8) Deep green: forest and conservation areas.

Source: Causas de deforestacion en la Peninsula de Yucatan. Memoria del Taller. 24 y 25 de junio de 2015, Tantakin, Yucatan. UICN, CONABIO, CCMSS, Alianza Mexico REDD+, USAID. Available at: https://www.biodiversidad.gob.mx/corredor/cbmm/pdf/18-2-memoria-taller-tantankin.pdf

For example, just in 2016 Mexico lost 250,000 hectares of forests due to the expansion of agricultural and livestock activities (Beauregard, 2017). According to Global Forest Watch and the civil society Reforestamos Mexico, deforestation in Mexico grew 36% in 2016 which is 100,000 hectares more than the average reported by the Mexican government before FAO in the period between 2010-2015, being the most affected states the ones in the Yucatan Peninsula (Beauregard, 2017; *Ejidos, pers.comm*). A recent study conducted by the Centre for Social Studies and Public Opinion (CESOP) of the Chamber of Deputies, places Mexico among the top 5 countries in the world with an intensive rate of deforestation (CESOP, 2017). The CESOP's

Informative Portfolio 77 entitled “Deforestation in Mexico”, starts with the statement: “the rate of deforestation in Mexico is one of the most intensive on the planet: each year there is a loss of 500 thousand hectares of forests and tropical forests” (CESOP, 2017). The drivers of deforestation detected by this study are the expansion of the agricultural and livestock frontier, illegal logging linked to poverty alleviation, anthropogenic fires and industrial activities such as mining and development of infrastructure for touristic or industrial purposes (CESOP, 2017). Some of the examples provided include the degradation of the Biosphere Reserve *Los Tuxtlas* of which more than 90% has been destroyed and more than 50% lost in the National Park *La Malinche.* Additionally, various intrinsic factors have weakened local governance within ejidos and therefore stewardship of forests (*Ejidos, pers.comm*). Within ejidos, some of the problems detected have been immigration of the rural population looking for better live conditions; old age of the people that remains in their communities; economic and cultural issues; and diversification of income sources to outlast poverty (*Ejidos, pers.comm*). Additionally, many people have been in the need to sell their properties or have been forced to leave them due to pressure from drugs cartels that use their lands for illegal plantations (*Ejidos, pers.comm;* CONAPO, s/f; Rojas, 2009). Such circumstances are both, a social and environmental problem.

Among Latin-American countries the emissions from burning fossil fuels and land use change in Mexico are among the highest, which also places the country among the top 20 global emitters (Viscidi and O’Connor, 2016). Therefore, reducing emissions from the forestry sector is an important part to consider in any strategy for climate change mitigation in Mexico. Forest ecosystems in Mexico have been estimated to absorb around 26% of the total emissions of GHG of the country and possess an estimate of carbon stored within forest biomass of around 2,043 million tons of CO_2 (SEGOB, 2014) being the Yucatan Peninsula the densest area (Figure 36). According to the official unconditional mitigation pledges for the period 2020-2030, there should be a reduction of emissions of 210MtCO_2eq within such decade, from

which 46MtCO2eq could be achieved from mitigation actions in LULUCF (*INECC, pers.comm*), with the potential to reach even 173MtCO_2eq (SEGOB, 2014; *INECC, pers.comm*). Moreover, the General Climate Change Law (LGCC) indicates that there should be a net zero rate of deforestation by the year 2030. Also, in its NDC Mexico proposed two mitigation components: the first one responds to the unconditional pledges (a reduction of 25% of the nation's emissions) and the second to the conditional ones. In this last one component, Mexico adopts a reduction of 40% conditional to the transfer of additional resources (finance and technology) from the international community within the UNFCCC (*INECC*, *pers.comm*).

Figure 36. Aboveground carbon density in Mexico.

Source: Adapted from NASA. Available at: https://earthobservatory.nasa.gov/IOTD/view.php?id=86695

Within the unconditional mitigation plan it is envisioned the ENAREDD+ which has been developed since 2010 following COP16. This includes the implementation of the Yucatan Peninsula Special Programme, which is at the same time part of the Early Actions REDD+ (ATREDD+) that began in 2012 (*CONAFOR, pers.comm)*. According to SEMARNAT:

“the succesful implementation of ENAREDD+ will significantly contribute to the fulfillment of the Mexican NDC’s pledges”

(Field interview, pers comm.)

The official stance also considers that the market mechanisms that have been proposed and used for emisions reductions are a good way to attract the necessary financial resources from abroad (*SRE*, *pers.comm*). Additionally, the Mexican government shares international perspectives such as the integration of mitigation strategies in other key sectors (aviation, industry and energy) that involve carbon compensation and become a way to incentivize improvement of carbon stocks within forest conservation projects (*CONAFOR, pers.comm; SRE, pers.comm*).

“the government trusts the ENAREDD+ will aid to achieve the Global Goals for Sustainable Development, particularly fighting poverty, estimulating sustainable economic growth and tackling climate change”

(*Field interview, pers.comm*).

Such positive contribution would be that as long as the strategies within the sector would work and those in other sectors would also come true. This means that it is necessary to have a well estructured plan of transversality among Ministries working towards the same objective by consolidating coherent and sinergic policies that facilitate achieving mitigation goals. However, there are examples that prove wrong that policies in the forestry sector are working and that there is a plan of transversality taking place. There aren’t coherent and sinergic climate change mitigation actions behind those speeches and written statements.

The Ministries declared in the document of the ENAREDD+ by SEMARNAT that should be involved in the sustainable rural development and REDD+ through the Inter-ministerial Commission for Sustainable Rural Development (CIDRS): Ministry of Communication and Transport (SCT); Ministry of Social Development (SEDESOL); Ministry of Economy (SE); Ministry of Public

Education (SEP); Ministry of Finance and Public Credit (SHCP); Ministry of Agrarian, Territory and Urban Development (SEDATU), Ministry of Environment and Natural Resources (SEMARNAT); Ministry of International Affairs (SRE); Ministry of Health (SALUD); and presiding the Commission Presidency, the Ministry of Agriculture and Rural development (SAGARPA). Their stated objective is to achieve transversality, coordination, coherence and integral operation of programmes and policies that are beneficial for REDD+ (SEMARNAT, 2015). However, there is no reference to REDD+ in the web page of the Ministry of Communications and Transport; the Ministry of Social Development; the Ministry of Economy; the Ministry of Public Education; the Ministry of Finance and Public Credit, the Ministry of International Affairs; and the Ministry of Health; the Ministry of Agriculture and Rural Development; and the Ministry of Agrarian, Territory and Urban Development. The Ministry of Environment and Natural Resources is the only one that contains information regarding REDD+.

5.3 Considerations on the sustainability of the climate change mitigation policy in Mexico.

In the first place, there are issues surrounding what is happening in the forestry sector and climate change mitigation actions. There is a gap among three components: 1) the information that the government places within official documents, 2) what really happens in the practice, and 3) what from that ultimately reaches the international community. Secondly, there are issues regarding other sectors and the so called transversality that is vital for the success of climate change mitigation efforts.

Regarding the first point, it is frequently seen that official documents affirm and pronounce what is thought or expected to be correct and suitable (although there are occasions which even if something is incorrect or unsuitable, it is established). However, there are always issues and caveats. Consequently, what really happens in the practice is something different from what was correct and suitable to do. Lastly, if it is the case that such

affirmations or pronounciations have an interest from the international community, what will reach them is the correct and suitable form of such pronunciations and not what happened in the practice. The following examples will make this clearer. The Energy Reform of 2013 is a constitutional reform presented by the current President and approved by the Senate and the Chamber of Deputies. The general objective is the further development of the oil and other hidrocarbons industry under the State's control, that according to the government will bring benefits such as: 1) the improvement of the economy of the mexican families due to a reduction in the cost of gas and electricity; 2) due to the reduction of costs in gas and electricity there will be a reduction in the costs of foods; 3) due to the increase of investment and opening to foreign companies in the sector there will be new jobs created (around half a million during the current presidential period and 2 million by the year 2025); Pemex and CFE will remain 100% property of the Mexican people as declared in the Reform of 1938 and 100% of public property (Mexican Senate, 2014). Nonetheless, there is a package of 21 modifications called the Secondary Law that include "the small letters" (Muciño, 2014; Martinez, 2014) and contradict those pronounciations that were allegedly correct and suitable. Among those contradictory facts or statements are: 1) Legal servitude: which refers to the right to coerce owners to give away their properties would such are needed by the industry for any activity involved in the exploitation of energy resources, particularly hydrocarbons; 2) Economic criteria: refers to the contracts for exploration and exploitation that will be given to those who offer the highest gains to the government; 3) Open market: allows imports of foreign gasoline; 4) National contents: refers to the % of national participation in exploration and extraction projects that will be up to 35% by the year 2025; 5) Law of foreign investments: exploration and extraction of energy resources mainly hydrocarbons, will be given to contracts between Pemex and foreign companies or foreign companies on their own; 6) Law of mining: exploration and extraction activities of hidrocarbons and other resources will have priority over any other land use, at groud level and subsoil; 7) Pemex and CFE passives transferred to public debt: such passives ascend to more than 1.7 billion Mexican pesos.

These are some of the contradictory issues within the Energy Reform itself. However, they also enter into a conflict with other Laws and official statements. For example, the just mentioned Law of mining establishes that exploration and extraction activities of hydrocarbons will have a priority over any other land use, at ground level and subsoil which goes undeniably against the LGCC, that was enacted in 2012, and establishes that the preservation of ecosystems and reduction of emisions from any land use change are a priority for the Mexican government. And if by any chance this could only be a written mistake on a paper, it unfortunately isn't like that. For example, there is evidence proving that fracking has been operational in Mexico since 2010 (AN, 2014; Serdan, 2015; AMCF, 2017) and there are around 4,000 active wells using fracking for shale gas extraction to 2017 (Flores, 2017; Garcia, 2017). Fracking wells are located in the Mexican States of Nuevo León, Coahuila, Puebla, Tabasco, Tamaulipas and Veracruz concentrating together 3, 780 wells according to Pemex (Garcia, 2017).

According to a study conducted by Victoria Cheneaut, researcher at the Centre for research and studies on social anthropology in Veracruz, this State is one of the most affected by fracking and very likely to remain like that due to a bidding that took place in 2017 for exploiting 900 thousand hectares that could potentially be occupied for fracking in the coming years (Avila, 2017; LaJornada, 2017). The Energy Reform not only pronounces one thing and then contradicts itself with other pronunciations within the same document; it also goes against other Laws such as the LGCC, specifically by prioritizing the exploration and extraction of hydrocarbons affecting environmental and social features. Another example is the General Law of Biodiversity (LGB) that was approved by the Senate in December 2017 with just but a few knowing this was happening (Lira, 2017). A couple of months earlier, when it was supposedly still open to debate, the LGB that establishes as a general objective the protection of biodiversity, had been severely criticised by academics, scientists, NGOs and civil society for numerous flaws which show that rather than protecting, affect biodiversity, (as well as water, soil and air) for example it removes the status and protection to

endangered species such as the sea turtle (Greenpeace, 2017; Ecosfera, 2017; Gonzalez-Dávila, 2017).

Specialists had been arguing that such flaws appear more like a strategy to eliminate what is left of environmental and social protection in the country that remain an obstacle for full resources exploitation and private-industrial commercialisation (Greenpeace, 2017; Ecosfera, 2017). Now, that it has been approved by the Senate, the LGB doesn't adopt in its text, provisions on the intrinsic value of biodiversity; doesn't adopt the precautionary principle; doesn't forbid the settlement of the mining and hydrocarbons industry inside Natural Protected Areas, including forests; and excludes the Nagoya Protocol (which refers to the access to genetic resources and the fair and equitable sharing of benefits arising from their utilization top the Convention on Biological Diversity) out from the Mexican legislation (Gonzalez-Dávila, 2017; Castro, 2017; Lira, 2017). Table 32 summarizes important elements that have been presented.

As seen in the past examples, there are contradictions within policies themselves. Moreover, there isn't a transversely approach among sectors and policies. But another worrying issue is the information that reaches the international community. In the case of the Energy reform for example, it is of the international community's interest those plans and actions towards the decarbonization process and the advances in the reduction of emissions that Mexico proposed.

However, what the Mexican government is doing with its policies, is promoting hydrocarbons exploitation instead. Regarding the Biodiversity law, it is of the international community's interest what Mexico does for biodiversity conservation, because Mexico is signatory to the CBD and highlights its condition as a mega-biodiverse country. But, the recent Biodiversity law removes previous safeguards that were part of the legislation. Therefore, what the government is doing is unprotecting biodiversity, and even more it is promoting destruction by allowing the invasion of natural protected areas and forests for hydrocarbons and mining

activities (Martinez-Gomez, 2017; Enciso, 2017; Proceso, 2017). Table 33 presents examples of these laws and contradictions.

Table 32. Contradictions within the Mexican policies affecting climate change mitigation.

Policy **Reform to the Energy Law (2013)**	**Policy** **General Law of Biodiversity (2017)**
Official statement -Further development of the oil and hydrocarbons industry under the State's control. -Reduction in the cost of hydrocarbons. -Reduction in the cost of foods. -More than 2 million new jobs created by the year 2025. -Pemex and CFE will remain 100% public and Mexican property. -Advance clean and renewable energy. -Environmental Protection.	**Official statement** -Incorporate the Nagoya Protocol within the Mexican legislation. -Integrate biodiversity issues within a unique Law. -Protect biodiversity in Mexico. -Respect the right to have access to a healthy environment.
Contradictory official statements -Legal servitude: coerce owners to give away their properties would such are needed by the industry for any activity involved in the exploitation of hydrocarbons. -Economic criteria: contracts for exploration and exploitation will be given to those who offer highest gains. -Open market: allows imports of foreign gasoline. -Law of foreign investments: exploration and extraction of hydrocarbons will be given to contracts between Pemex and foreign companies or foreign companies alone. -Law of mining: exploration and extraction activities of hydrocarbons will have priority over any other land use at ground and subsoil level. -Mining activities will be respected.	**Contradictory official statements** -There aren't provisions on the intrinsic value of biodiversity. -It doesn't adopt the precautionary principle. -It doesn't forbid mining activities or hydrocarbons extraction inside Natural Protected Areas, including forests. -Excludes key points from the Nagoya Protocol out from the Mexican legislation.
Conflict with other policies Relevant to this work: -In conflict with the General Law on Climate change and ENAREDD+.	**Conflict with other policies** Relevant to this work: -In conflict with the General Law on Climate change and ENAREDD+.

Source: Own elaboration.

Now, there are more examples linked to LULUCF and climate change mitigation. The Yucatan Peninsula on its side, has structured a regional plan called the "Sustainability Agreement of the Yucatan Peninsula (ASPY) 2030" that was signed by the governors of the three states, Quintana Roo, Yucatan

and Campeche during the COP13 of the CBD that was held in Cancun in 2016 (TNC, 2016).

In such document the signatory states agreed to reduce deforestation by 80% by the year 2020 and achieve net-zero deforestation by 2030; restore 2 million hectares of land and jungle; and 50% of the terrestrial and coastal territory of the Yucatan Peninsula will be under conservation and forest management schemes. Unfortunately, there are also contradictory official statements in this case.

Table 33. What reaches the international community.

What happens in Mexico	What reaches the international community
Constitutional Reform to the Energy Law (2013). General Law of Biodiversity (2017).	-Decarbonization: Deep decarbonization project modelling for the energy system in Mexico to 2050. -Pledges before the UNFCCC: Reduction of 25% of emissions below BAU by 2030 (equivalent to 72% above 1992 levels and 9% above 2010 levels excluding LULUCF). 50% below 2000 levels in 2050. -Goals for zero net emissions related to LULUCF by 2020. -Pledges before the CBD: A strategic plan for biological Diversity 2011-2020 which includes the Aichi goals (tackle causes of biodiversity loss; reduction of direct pressures over biodiversity; improvement of the biodiversity security safeguarding species and ecosystems; protection of natural protected areas; protection to endangered species.

Source: Own elaboration.

For example, the Mexican President asked the Supreme Court to revoke the decree made by the governor of Yucatan (in response to the pressure made by Mayan indigenous communities) that the state was free of transgenic seeds (Ita, 2016). However, the pressure from Monsanto was bigger (Ita, 2016; Echanove, 2016).

"Monsanto received the authorization from the Federal government to plant and produce transgenic soy in vast territories of Mexico including a huge extension in Yucatan, Quintana Roo and Campeche"

(*Field interview, pers.comm*).

Additionally, the Ministry of livestock (SAGARPA) provides incentives to peasants for the expansion of the agricultural activity and the cattle ranching frontier

(FAO, n/d; Márquez-Espinoza, 2017; *Field interview, pers.comm*).

Under this scheme the industry of transgenic soy has destroyed the tropical forest of Campeche, from where more than 38 thousand hectares have been cleared and just in the area of Hopelchen, Quintana Roo, in the period between 2000 and 2008 more than 20 thousand hectares were cleared (*Ejidos, pers.comm*). In a document about the methodology for the implementation of REDD+ activities for the Yucatan Peninsula (Garcia-Contreras and Vega, S, 2014) it is stated that there are opposing institutions to REDD+, among them the Ministry of Agriculture and Rural Development, that promotes extensive agriculture and livestock activities and opposing projects to REDD+ such as transgenic crops (Garcia-Contreras and Vega S, 2014). The expansion of transgenic soy crops (mainly illegally) has been a major driver of deforestation in Brazil for example (Greenpeace, s/f); (Kill Jutta, 2019), moreover it has been a machinery of hunger, deforestation and socio-ecological devastation in many regions (Altieri y Pengue, 2006). In Mexico, transgenic soy has been an important driver of deforestation as well. In the Yucatan Peninsula, particularly in the State of Campeche, beekeeping is in danger due to transgenic soy crops as well as an increase of deforestation in big areas of forests to give space to illegal soy plantations (Rivera y Ortiz, 2017); (Enciso, 2018); (EFE, 2019).

According to a study conducted by The Nature Conservancy, in the Yucatan Peninsula there has been an increasing loss of tropical forests caused by

rural development projects implemented by the Federal government such as the one called MasAgro (Curiel, 2016; *Ejidos, pers.comm*).

"These kinds of policies have affected Mayan practices that are considered sustainable among the Mayan people and include the production of organic honey and maize"

(Field interview, *pers.comm*).

As said by the peasants from the Ejidos:

"*Industrial practices that have been promoted by the government have intensified the rate of deforestation and have other environmental impacts such as the contamination of water bodies due to the use of agrochemicals that consequently, triggered the disappearance of lakes Cancabchén and Ik*".

(Field interview, pers comm.)

For more than 15 years, the government through CONAFOR has implemented policies related to forests conservation but they have been unsuccessful (Enciso, 2017). ProArbol for example, was a policy that was meant to tackle deforestation but, in the end gave way to the industrial sector and commercial plantations between 2008 and 2012 (Enciso, 2017; *Ejidos, pers.comm*). The same idea continued during the current Presidential period (2012-2018) but with a different name, PRONAFOR. However, its activities have been focused on industrial forestry and wood exploitation (*Ejidos, pers.comm*). To make things even worse, during the period 2012-2018 there have been reductions to the budget that CONAFOR receives (Benet, 2016). CONAFOR operated in 2017 with 50% less compared to the budget it had in 2016 and according to the institution the distribution of the resources was: 54.1% to personal expenses; 26.3% to operation expenses (that included the disappearance of the communitarian forestry and climate change offices; and just 19.6% to subsidies such as forest restoration and reforestation (Sánchez, 2017).

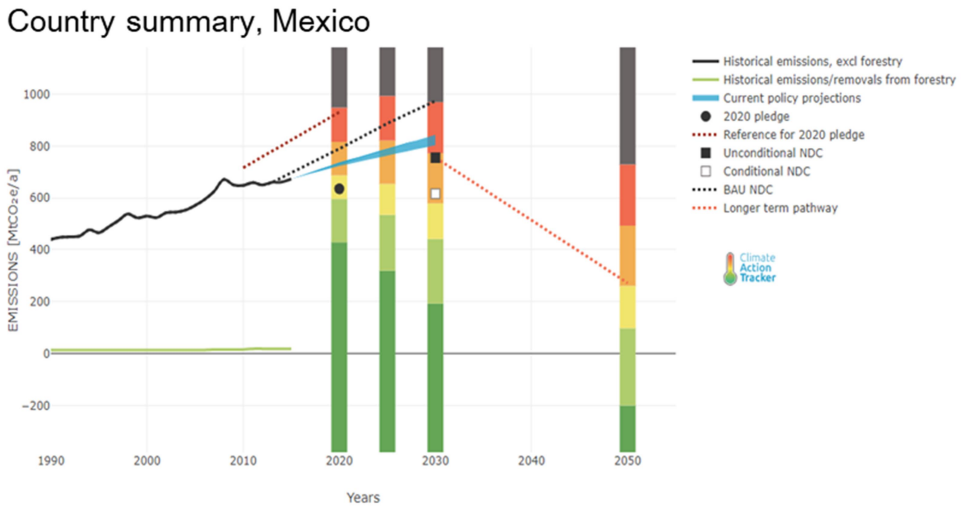
Mexico was number 12 in the chart of global carbon emissions with 477MtCO2 ahead of Brazil in 2018 (Global Carbon Altlas, n/d). At the end of the 60’s decade it registered 102MtCO2, at the end of the 70’s decade it registered 268 MtCO2, at the end of the 80’s decade it registered 361 MtCO2, at the end of the 90’s decade it registered 391 MtCO2, at the end of the 2000’s decade it registered 464MtCO2, and by 2018 it registered 477 MtCO2 according to the same source. Currently, Mexico is the country that contributes the most with CO2 emissions in Latin America, most likely due to the privilege given to fossil fuels exploitation and use (CAT, 2019; elAgora, 2020).

In the country summary published by the Climate Action Tracker (2019) the situation is described as follows:

- “Mexico’s new administration under López Obrador, who entered office in December 2018, has taken a step backwards on climate favouring fossil fuel over renewable energy generation. Some of these changes are driven by a new budget allocation to the “modernisation” of coal, diesel, gas and oil fuelled power plants… the new administration deprioritised the development of other renewable energy projects by also cancelling Mexico’s 2018 “Long term electricity auctioning” round…

… The scheme was introduced in 2015 as one of Mexico’s main instruments to achieve its clean energy targets…under its Transition Law and General Climate Change Law…The decision to favour fossil fuel generation over renewable energy now puts Mexico on a path that is even more inconsistent with the steps needed to achieve the Paris Agreement’s 1.5 ° C… The Mexican government’s recent decisions also brings into question whether it will achieve its clean energy targets and its mitigation target spelt out as part of its Paris Agreement commitment….Our analysis suggests that Mexico will not meet its “insufficient” emissions reduction targets for 2020 and will need to implement additional policies, and reverse direction on coal to do so

….In October 2019 the preliminary rules for Mexico’ s carbon market were published (DOF-Diario Oficial de la Federación, 2019). The formal start of the ETS-originally planned for August 2021 together with the entry into force of the Paris Agreement- has been delayed to January 2023 (Secretaria de Medio Ambiente y Recursos Naturales SEMARNAT 2017,2018; DOF-Diario Oficial de la Federación, 2019)”.



CAT, 2019. Country summary, Mexico. Available at: https://climateactiontracker.org/countries/mexico/2019-09-19/

During the last 20 years only 6 countries have registered an increment in their forest cover, namely, Chile, Costa Rica, Cuba, San Vicente y las Granadinas, Santa Lucia and Uruguay (CEPALC, 2015).

In the case of Mexico, a study found that in the period 1993-2008 there is a relationship between high fragmentation levels and forest areas disappearance, and that through all these years the loss of forests increased (Moreno-Sanchez et al., 2014). The loss of forest land has continued, and in 2016 the expansion of agricultural frontiers accounted for 98% of deforestation (Dominguez and Barrera, 2019; Mondragon and Lopez, 2020).

Table 34. Inconsistencies among diverse elements involved in climate change mitigation in the Yucatan Peninsula.

Policy MasAgro (2014)	**Policy ASPY2030 (2016)**	**Policy ENAREDD+2017-2030 (2017)**
Official statements -It is defined as the programme for the sustainable modernization of the traditional agriculture and promotes the intensification of maize and wheat production. Among its goals are the improvement of native seeds with the participation of local communities and indigenous peoples. **Conflicting facts** -The Mexican President requested the revocation of the Yucatan State declaration of a free of transgenics State. -Transgenic soy cultivation spread against the will of the Mayan communities will.	**Official statements** -Zero-net deforestation by 2030 and 80% by 2020. -Sustainable agroforestry production. -Restoration and reforestation of degraded or lost forests. -Promote Mayan biocultural landscapes. **Conflicting facts** -Promoting the invasion of Mennonite communities. -Advance transgenic soy crops and contamination of organic honey and maize traditional production of the Mayan communities.	**Official statements** -USAID and The Nature Conservancy have a project to aid in the process of REDD+ implementation in the Yucatan Peninsula. Last document published in 2015. -IUCN sponsored by the German government conducted an analysis on The Yucatan Peninsula and REDD+ in 2015. -AlianzaMexicoREDD+, is a national research on REDD+ published in 2015. **Conflicting facts** -Advance of deforestation for commercial, industrial and touristic uses.
Conflicting policies		
Energy Law 2013 – Biodiversity Law 2017 – MasAgro 2014 – ASPY2030 – ENAREDD+ - PRONAFOR- General Law for Sustainable Forestry		
What reaches the international community		
-**The REDD desk**: In its web page explains that a programme called ProArbol is a good and successful example of experiences with payments for ecosystem services in Mexico and a sample to follow for the implementation of REDD+. Additionally, it is referred to as an active initiative as well. However, none of both statements are correct. ProArbol in the first place was finished back in 2012. A new project took its place with a different name due to the beginning of a new Presidential period, which is a common practice within Mexican politics for gaining recognition for "creating" new and functional policies. The new programme covers the period 2014-2018 and its name is PRONAFOR. The end of the current Presidential period on December 2018 will for sure bring a new programme with a different name for the next Presidential period that goes from 2018 to 2024. -**The Nature Conservancy Document on ASPY2030:** Presents the ASPY2030 as a policy that positions the Yucatan Peninsula as a leader nationally and internationally in low-emission sustainable landscape development. It is proposed to align efforts from different sectors such as biodiversity and agricultural sectors as well as stakeholders such as the private sector, academia, civil society and international bodies. -**CAT evaluation on the Mexican Pledges**: Based on the evaluation of the official Mexican pledges, it is highly probable that Mexico won't meet its 2020 and 2030 emission targets and will most certainly need to implement additional policies to do so. There are renewable energy targets that if achieved could reduce emissions from the electricity sector. Mexican pledges are consistent with a global warming between 2° and 3°C. Under the General Law on Climate Change (LGCC) Mexico proposes to reduce its emissions by 50% from 200 levels by 2050.		

Source: Own elaboration.

Another change to the Mexican legislation that comes to drastically alter actions affecting forests conservation is the General Law for Sustainable Forestry Development approved by the Senate in September 2017. The official statement says that this Law will enhance ecosystems conservation and secure a healthy environment, while it is perfectly aligned with other official policies such as the climate change Law. But, according to the CCMSS there are severe problems with such Law, for example the elimination of the social participation from the opportunity to participate in activities of monitoring, supervision and discussion of initiatives affecting forests management which makes clear there will be a new stage of corruption that most certainly will bring more degradation and deforestation (CCMSS, 2017).

Energy Law:

Official statements: Reform to the Energy Law (2013): Further development of the oil and hydrocarbons industry under the States' control. Reduction in the cost of hydrocarbons. Reduction in the cost of foods. More than 2 million new jobs created by the year 2025 in this sector. Pemex and CFE will remain 100% public and Mexican property. Advance clean and renewable energy. Environmental protection.

Conflicting facts: Legal servitude: coerce owners to give away their properties that are requested by the industry for any activity involved in the exploitation of hydrocarbons. Contracts for exploration and exploitation of hydrocarbons will be given to those who offer highest gains. This reform includes an open market criteria which allows imports of foreign gasoline. It includes a Law of foreign investments which means that exploration and extraction of hydrocarbons will be given to contracts between Pemex and foreign companies alone. There is also a Law of mining which says that exploration and extracting activities of hydrocarbons will have priority over any other land use at ground and subsoil level.

ENAREDD+:

Official statements: USAID and The Nature Conservancy have a project to aid in the process of REDD+ implementation in the Yucatan Peninsula.

IUCN, sponsored by the German government, conducted an analysis on the Yucatan Peninsula and REDD+ in 2015.AlianzaMexicoREDD+, is a national research on REDD+ published in 2015.
Conflicting facts: Advance of deforestation for commercial, industrial and touristic purposes.

MasAgro:
Official statements: It is defined as the programme for the sustainable modernization of the traditional agriculture and promotes the intensification of maize and wheat production. Among its goals are the improvement of native seeds with the participation of local communities and indigenous peoples.
Conflicting facts: The former Mexican President requested the revocation of the Yucatan State declaration of a free of transgenics State. Transgenic soy cultivation spread against the will of the Mayan communities.

Biodiversity Law:
Official statement: Incorporation of the Nagoya Protocol within the Mexican legislation. Integrates biodiversity issues within a unique law. Protection of biodiversity in Mexico. Respect the right to have access to a healthy environment.
Conflicting facts: There aren't provisions on the intrinsic value of biodiversity. It doesn't adopt the precautionary principle. It doesn't forbid mining activities or hydrocarbons extraction inside Natural Protected Areas, including forests. It excludes key points from the Nagoya Protocol out from the Mexican legislation.

General Law for Sustainable Forestry:
The General Law of Biodiversity (LGB) was approved by the Senate in December 2017, with just but a few knowing this was happening. A couple of months earlier, when it was supposedly still open to debate, the LGB that establishes as a general objective the protection of biodiversity, had been severely criticised by academics, scientists, NGO's and civil society for numerous flaws which show that rather than protecting, affect biodiversity, (as well as water, soil and air) for example it removes the status and

protection to endangered species such as the sea turtle (Greenpeace, 2017; Ecosfera, 2017; Gonzalez-Davila, 2017). Specialists had been arguing that such flaws appear more like a strategy to eliminate what is left of environmental and social protection in the country that remain an obstacle for full resources exploitation and private-industrial commercialisation (Greenpeace, 2017; Ecosera, 2017).

All of it that has been discussed up to this point, not only comes to relevance for a discussion on climate change mitigation and the political context in Mexico. It is also relevant for the discussion on the adoption, implementation and development in Mexico of what is agreed by the UNFCCC. The Paris Agreement's bottom-up approach means that the realities, including social-economic and political aspects of each country will serve to put forward solutions and adopt others that will be better integrated because the NDCs contain that view and knowledge. However, this may prove not to be as simple and prolific as expected. For example, the implementation of REDD+ in those countries for which it is designed, is supposed to take advantage of the institutions, programmes and experience that they already have. With this it is expected that better results will come from the implementation of REDD+. So, while some countries have made some changes to improve monitoring, Mexico decided to implement a governance model focused on advancing Sustainable Rural Development (DRS). The CCMSS conducted a study to analyse some of the experiences related to REDD+ that have been put into practice in Mexico (CCMSS, 2015). The analysis found that the DRS model seeks the convergence of the institutions and policies involved and that Mexico has not been successful in the implementation of the DRS model and the so called Early Actions for REDD+ (PEATREDD+). Moreover, the chances of hindering and even having regressions in the performance of REDD+ in Mexico will be strongly affected by the changes that the Mexican legislation is making not only to policies directly linked to the topic but due to those from other sectors such as the Energy one (Table 35).

As seen before, recent changes in the Mexican legislation will have negative and significant consequences on the general climate change mitigation

objective as well as on the development of mitigation strategies such as REDD+. Moreover, the political context in Mexico will make even more difficult the accomplishment of mitigation promises and actions oriented to this end. There are political priorities that are evident in the actions of the government. These actions go against the objectives of climate change mitigation and environmental conservation. For example, the Mexican government has been criticised by diverse NGOs due to giving priority to hydrocarbons exploitation in Mexico by allocating 683,600 million pesos to this end, moreover, it is an action that clearly goes against environmental objectives (EFE; 2019). In the Federation expenditure budget project 2020 reflects the continuity and deepening of a public policy that prioritizes hydrocarbons exploitation as a source of energy and public income (Ministry of Finance and Public Credit, 2019). Additionally, there still exist those unresolved obstacles and criticisms against REDD+, which until now has hardly prove to be a promising option for tackling the issues surrounding forests and their contribution to climate change.

Table 35. Conflicting policies that affect REDD+ development in Mexico.

Conflicting Policies	REDD+ cross cutting themes affected by the Mexican policies
-Energy Law **-Biodiversity Law** **-General Law for Sustainable Forestry** **-PRONAFOR** **-ENAREDD+** **-MasAgro**	-Forest Governance: considers the participation of local communities as a key issue and it is considered to be determinant in the success of REDD+. The UN-REDD+ programme supports countries such as Mexico, to establish governance schemes. -Tenure security: involves reconciling customary rights and law; including the participation of all stakeholders and respect indigenous peoples. -Stakeholder engagement: it is a priority for REDD+ the effective participation of stakeholders, particularly indigenous peoples and local communities. -Legal framework and policies: the LGCC's mitigation goals such as net-zero deforestation by 2030. -Institutional arrangements: Intersectoral cooperation and synergies. -Social and environmental safeguards.

Source: Own elaboration.

Notes: **Energy Law**: Official statements: Reform to the Energy Law (2013): Further development of the oil and hydrocarbons industry under the State's control. Reduction in the cost of hydrocarbons. Reduction in the cost of foods. More than 2 million new jobs created by the year 2025 in this sector. Pemex and CFE will remain 100% public and Mexican property. Advance clean and renewable energy. Environmental protection.

Conflicts: Legal servitude: possible coercion of owners to give away their properties that are requested by the industry for any activity involved in the exploitation of hydrocarbons. Contracts for exploration and exploitation of hydrocarbons will be given to those who offer highest gains. This reform includes an open market criteria which allows imports of foreign gasoline. It includes a Law of foreign investments which means that exploration and extraction of hydrocarbons will be given to contracts between Pemex and foreign companies alone. There is also a Law of mining which says that exploration and extracting activities of hydrocarbons will have priority over any other land use at ground and subsoil level.

ENAREDD+:

Official statements: USAID and The Nature Conservancy have a project to promote the process of REDD+ implementation in the Yucatan Peninsula. IUCN, sponsored by the German government, conducted an analysis on the Yucatan Peninsula and REDD+ in 2015.AlianzaMexicoREDD+, is a national research on REDD+ published in 2015.

Conflicts: Advance of deforestation for commercial, industrial and touristic purposes.

MasAgro:

Official statements: It is defined as the programme for the sustainable modernization of the traditional agriculture and promotes the intensification of maize and wheat production. Among its goals are the improvement of native seeds with the participation of local communities and indigenous peoples.

Conflicts: The former Mexican President requested the revocation of the Yucatan State declaration of a free of transgenics State. Transgenic soy cultivation spread against the will of the Mayan communities.

Biodiversity Law:

Official statement: Incorporation of the Nagoya Protocol within the Mexican legislation. Integrates biodiversity issues within a unique law. Protection of biodiversity in Mexico. Respect the right to have access to a healthy environment.

Conflicts: There aren't provisions on the intrinsic value of biodiversity. It doesn't adopt the precautionary principle. It doesn't forbid mining activities or hydrocarbons extraction inside Natural Protected Areas, including forests. It excludes key points from the Nagoya Protocol out from the Mexican legislation.

General Law for Sustainable Forestry: The General Law of Biodiversity (LGB) was approved by the Senate in December 2017, with just but a few knowing this was happening. A couple of months earlier, when it was supposedly still open to debate, the LGB that establishes as a general objective the protection of biodiversity, had been severely criticised by academics, scientists, NGO's and civil society for numerous flaws which show that rather than protecting, affect biodiversity, (as well as water, soil and air) for example it removes the status and protection to endangered species such as the sea turtle (Greenpeace, 2017; Ecosfera, 2017; Gonzalez-Davila, 2017). Specialists had been arguing that such flaws appear more like a strategy to eliminate what is left of environmental and social protection in the country that remain an obstacle for full resources exploitation and private-industrial commercialisation (Greenpeace, 2017; Ecosera, 2017).

Table 36 Conflicting issues behind the Mexican mitigation pledges.

Pledges	Policy	Political Context
Net-zero deforestation by 2030. A reduction of emissions of 50% from 2000 levels by 2050. As they are now, the official mitigation pledges of Mexico are consistent to a warming between 2° to 3°C. According to the Climate Action Tracker, Mexico would need to implement additional policies to reach its proposed NDC targets. (However, such statement is based on the idea that the official promises as well as policies aims, and actions are true and congruent, but as seen in this work, it is not the case).	Conflicting policies for achieving climate change mitigation objectives: -Energy Law -Biodiversity Law -General Law for sustainable forestry. -PRONAFOR -ENAREDD+ -MasAgro	An illusion of democracy where there is: -Corruption in the form of fraudulent elections, illicit enrichment, abuse of authority. -Violence, espionage, threats and intimidation, forced disappearance and homicides. -Harassment against freedom of expression, especially to journalists and government critics.

Source: Own elaboration.

In the case of Mexico, a still tricky and even utopian strategy becomes a terrible companion to the political and legislation context. And, unlike to what it is officially stated and conceived by the international community, there is a deeper, complex and corrupt reality behind the Mexican mitigation pledges. For what is evident, the combination of these elements will most likely have terrible consequences. Not just for preventing the Mexican mitigation pledges from happening but something even worse, by keeping and increasing the contribution of Mexico to global warming and climate change.

Conclusions and Further research

An increasing amount of research has demonstrated that global warming and the associated climate change are a threat that needs global actions. The UNFCCC has established as its main objective, the stabilisation of atmospheric greenhouse gases concentration at a level that would prevent dangerous anthropogenic interference with the climate system. Global mean temperature should stay below 2°C above pre-industrial levels. Therefore, climate change mitigation policies and their outcomes are extremely important for preventing a global disaster related to runaway global warming. The new strategy, created at COP21 held in Paris in 2015, comprises the bottom-up approach NDCs, which is meant to be a tool to enable and facilitate the task of meeting each country's mitigation commitments. However, further research on what should be the target for preventing an anthropogenic climatic disaster shows that, a cumulative warming commitment delivers a calculation of an emissions budget as a better way for orienting policies and actions. Furthermore, there is a worrying conclusion. Greenhouse gasses emissions need not only to stop but to go back.

Here is when strategies and actions aimed to reduce such emissions come to a crucial relevance. All sectors and countries will have to cooperate whether the aim is to be achieved. Unfortunately, there are issues to be resolved in both, the international and national grounds. There has been a persistent lack of international political will for example. On the other hand, national circumstances in each country are different and full of particular issues.

Mexico, as well as the other countries, is both a contributor to anthropogenic climate change and vulnerable to it. Consequently, its participation in the global movement and national actions are compulsory. Mexico is part of international conventions and agreements, such as the UNFCCC and the Paris Agreement. Additionally, there are national institutions and policies oriented to work on the issue. Nevertheless, studies reveal that the Mexican commitments for tackling climate change and the contribution to its mitigation

are insufficient, which means that they are consistent to a global warming between 2°C to 3°C or even more.

Regrettably, this is not the most critical issue. Assessments made by international bodies refer to the Mexican case as to achieving good progress in policy planning and institutions development. This leads to the question: what are the main features of the NDC and REDD+ within the Mexican case? The attention has been attracted to Mexico as one of the world's first countries and first among developing countries to have a climate Law, the LGCC. Moreover, there has been international recognition as well, regarding the Mexican forestry framework and its significance for enhancing the REDD+ strategy. But, how have such instruments worked in practice? On the one hand, the development of REDD+ has been complex. While there are advocates who keep their hope on the strategy, there are critics who have exposed large problems with it, which may turn it into a utopian proposal. In Mexico for example, pilot projects that have been already put into a test, have shown that there are too many related issues to overcome to be able to say that the strategy works. Among such issues there are some that impose higher risks for mitigation actions to come true and that are not that easy to bring into the analysis. One of such issues is the political reality within the countries. In this case, the international community trusts in what each country submits to the UNFCCC and other international bodies. Surely because one would think that the governments acknowledge the relevance of being accurate and honest with this information. In the end, this is about ending madness against mother Earth. It should be clear enough now that science has made big steps towards the understanding of the relationship between humans and the planet on which their survival depends. There are limits to anthropogenic pressure on Earth, and humans are transgressing several of them already, including the one on climate change. It is a confrontation based on the irrationality of the political reality against the physical reality.

Disgracefully, the case study analysed here is an example of it, and shows that in Mexico the irrationality has taken over the situation. Although Mexico is by its political constitution a democratic republic, in the facts there is a

different story. The Mexican State has been falling apart and the story of an illusion of democracy repeats itself constantly. Moreover, the political framework in Mexico is plagued by corruption, violence, lies, frauds, manipulation, illicit enrichment, forced disappearance, repression, intimidation, espionage to mention some. The political context in Mexico is in the extreme of irrationality. Just one of those many corrupt politicians has accumulated more than 700 million dollars that considering his officially declared salary, would have needed 66,287 years to earn it.

Such irrationality is also found in the Mexican environmental politics to the extent of creating Laws that contradict their general objective within the same document. So, are there synergic connections among the Mexican institutions and policies involved in developing and implementing the Mexican NDC and REDD+ strategy? No, there is no congruence and synergy among diverse Laws. There is a long history of poor environmental management policies in Mexico, and there are clear linkages between political-economic interests and the ecological devastation of the Mexican ecosystems. Examples across the country exist, but here it was discussed the information gathered regarding the Yucatan Peninsula.

Are there signs that indicate there is political will and commitment for implementing strong mitigation actions in Mexico? No, it does not seem there is. The whole country's ecosystems, including the Peninsula, are being devastated by irrational policies put in place by the Mexican government. Examples of such policies are the Energy Reform (2013), the General Law of Biodiversity (2017), MasAgro (2014), PRONAFOR (2014) and the General Law for Sustainable Forestry (2017). Such changes in the Mexican legislation will certainly bring more negative consequences for ecosystems and the general climate change mitigation objective as well as on the development of strategies such as REDD+. Moreover, the political context in Mexico will make even more difficult the accomplishment of the mitigation pledges that are already insufficient as they are.

In the case of Mexico, a still tricky and even utopian strategy together with the political context makes a terrible mix. Unlikely to what it is officially stated

and therefore perceived by the international community, there is a deeper, complex and corrupt reality behind the Mexican mitigation pledges. It is evident that such context not only will prevent the mitigation pledges from happening but could lead to something even worse, by sustaining and increasing the contribution of Mexico to global warming and climate change.

Annex I

Questionnaire 1 (Peasants)

1. What is your name? (Although This information was only for my own record because all interviewees asked for anonymity).	13. Do you receive financial aid from the government's programmes?
2. For how long have you been part of this ejido?	14. Do you think you have enough information on how the financial and technical aids for rural projects work?
3. How would you describe the development or evolution of the ejido through the years?	15. Are there any doubts or questions on this matter that you would like to ask to the government representatives?
4. How is the relationship among the people that is part of the ejido?	16. How would you describe and evaluate the work that the government agencies do?
5. What kind of productive activities do you carry out in your land?	17. Do you think there is an even and fair allocation of resources?
6. What kind of techniques have you used or currently use for forest management?	18. What would you say about your experience with the implementation of REDD+?
7. Do you know what climate change is?	19. Do you think that policies such as the ones from tourism, transport and energy clash with rural policies? Are there any corruption or illegal activities?
8. Do you know what climate change mitigation is?	20. Do you think that policies such as REDD+ help boosting your activities and rural development?
9. Do you know what REDD+ is?	21. Do you think that REDD+ can help to manage forests to reduce environmental impact and climate change?
10. Which have been your sources of information regarding this strategy?	22. What would be the differences between traditional practices and arrangements made under REDD+?
11. How has the relationship with government offices been? Historically and since REDD+ has been introduced for forest management in this ejido?	23. What would you say about your experience with the implementation of REDD+? Any final comments you would like to add?
12. What is your perception regarding the intervention of government offices and government programmes in the management of the ejido?	

Note: The questionnaire was asked to a total of 10 peasants from 2 different ejidos in the Yucatan Peninsula. One ejido is located in the State of Quintana Roo (5 interviewees) and the other one in the State of Campeche (5 interviewees). The interviewees were selected from a total of 13 in Quintana Roo and 11 in Campeche. The selection of the respondents was made after making a previous research about their characteristics. The most important differences detected were: the level of their enterprises' development and their connection or closeness with the representatives from federal organizations. There are coincidences among these characteristics that make two groups: 1) enterprises with higher development and higher closeness with representatives; 2) lower development and lower closeness with representatives. Then, I got a sample from the two sites by taking into account 5 interviewees from the first group and 5 interviewees from the second group. The selection was random in the sense that the interviewees were not deliberately chosen from each group. From the ejido in Quintana Roo, I obtained 2 interviewees from group 1 and 3 interviewees from group 2; and from the ejido in Campeche I obtained 3 interviewees from group 1 and 2 interviewees from group 2. After the one to one interviews were performed, it was conducted a round table with all the participants in each ejido. The leader of each ejido was present in the round table only. All interviewees asked for anonymity due to sensitive information commented during the interviews.

Key notes from questions

5. Most frequent activities include beekeeping, chewing gum production, sawmills, maize crops, sustainable tourism activities, orchid cultivation.
13. All of the interviewees receive to some extent financial aid although there are other peasants within the ejidos that don't receive such aid yet.
14. and 15. More than half of the interviewees claimed not to have enough information and still have some doubts of how financial aids work.
16 and 17. All of the interviewees from group 2 said that government agencies are not transparent and that is an open secret that there are hidden arrangements between those and some of the ejido representatives or other ejidatarios. All of the interviewees from group 2 said that the process of resources distribution/allocation is not transparent and they openly know that some receive more than others. Those who receive more say that it is

because they meet all the criteria required by the government. Those who receive less say that it is because they are not as close to the leader of government officials as others. All of the interviewees referred to some extent to lack of transparency from the government. Although those who have a closest relationship with the officials stated to be a minor issue and not too severe. On the other hand those who are not that close to the officials say that it is an important issue and all the process should be more transparent.

18. All of the interviewees mentioned to some extent that there have been some big obstacles to maintain and develop their activities such as arrangements between the government and big crop companies to establish certain rules to keep cultivating maize. Another issue that was mentioned with fear was the intrusion of illegal loggers and drugs dealers groups that take over part of their lands (this information was revealed with the condition to remain as safe as possible within my thesis and they asked for anonymity).

19. All of the interviewees said that it is clear that other policies contradict natural resources conservation, sustainable management and rural development. The most cited example is touristic development and the construction of the necessary access roads.

20. Most of the interviewees think that REDD+ may help with better technical support and more financial aid. However, they see a problem having the government managing such resources. They say that this condition makes no difference whether there is more money flowing from abroad or if these are national resources. There should be another body that manage the resource in which they could trust.

23. Most of the interviewees said that it is still early to say that it is a failure or a success. The strategy could help to deal with some difficulties such as lack of technical support and more financial aid. However, they see very difficult that illegal and corrupt practices could change with this as well as relationships between acquaintances that give preference to some above others.

Questionnaire 2 (Government institutions)

1. What is your name?	11. What would you say are the main obstacles that peasants face to carry out their productive activities? Obstacles for the implementation of REDD+?
2. Which are your position and/or responsibility within this institution?	12. Is there any information regarding corrupt and/or illegal activities?
3. What is the participation of this institution regarding climate change mitigation?	13. Do you think that other policies such as the ones from tourism, transport and energy clash with rural policies? Do you know an example of this?
4. What is the participation of this institution regarding REDD+?	14. Do you think that policies such as REDD+ help boosting peasants' activities and rural development?
5. How many projects and/or programmes are conducted and/or include the participation of this institution in the Yucatan Peninsula?	15. Do you think that REDD+ can help to manage forests to reduce environmental impact and climate change?
6. What are the criteria for selecting and allocating the financial aid?	16. What would you say about your experience with the implementation of REDD+? Any final comments you would like to add?
7. Do the government representatives always make sure to provide enough information to the peasants about the financial aid?	
8. How has the relationship with the ejidos and ejidatarios been? Historically and since REDD+ has been introduced for forest management?	
9. What is your perception regarding the intervention of government offices and government programmes in the management of ejidos?	
10. Do you think there is an even and fair allocation of the resources?	

Note: This is the questionnaire that was asked to a total of 10 government officials from 5 different federal institutions such as SEMARNAT, INE, FND, SHCP, CONAFOR (2 interviewees per each institution). The interviews were conducted one to one. Interviewees asked for anonymity.

Key notes

5. The interviewees said that they don't know but they could provide a database with the information.
6. The same information could be found in the database provided.
6. Some of the relevant elements considered are how well structured is the development of the enterprise in case it is consolidated. On the other hand there are aids for those who are planning to consolidate one. They said that more information can be found in the databases.
7. All of the interviewees said that it is very important that all the pertinent information is given to the peasants and to this end workshops and seminars are arranged to make sure this happens.
10. The officials state that the allocation of resources is always attached to official guidelines.
11. The obstacles that they referred to were more related to the conditions of

the ejidos and its people. For example, poor organization among the members. Alternatively, they mentioned that there are indeed problems with illegal activities but those are very difficult problems to deal with or even to solve. They mentioned to be almost intrinsic to the Mexican reality.
13. All of the interviewees said that it is difficult to match everything but there are necessities that need to be covered in each sector.
15. All of the interviewees said that REDD+ is likely to succeed, it is just a matter of time and hard work. Having help from external entities, such as the UNFCCC, the World Bank and many more institutions should be of great help to boost rural development and tackle climate change.

Questionnaire 3 (NGOs)

1. What is your name?	9. How would you describe and evaluate the work that your organisation does?
2. Which are your position and/or responsibility within organisation? For how long have you been working for this organisation?	10. What is your perception regarding the intervention of government offices and government programmes in the management of ejidos?
3. What is the participation of this organisation regarding climate change mitigation?	11. Do you think there is an even and fair allocation of the resources?
4. What are the activities that your organization performs regarding climate change mitigation and REDD+?	12. What would you say are the main obstacles that peasants face to carry out their productive activities? Obstacles for the implementation of REDD+?
5. How many projects and/or programmes are conducted and/or include the participation of this organisation in the Yucatan Peninsula?	13. Is there any information regarding corrupt and/or illegal activities?
6. What do you think about how the financial aid is managed by the government?	14. Do you think that other policies such as the ones from tourism sector, transport and communications and energy clash with rural policies? Do you know an example of this?
7. Do you think that the peasants have enough information on how the economic aids for rural projects work?	15. Do you think that policies such as REDD+ help boosting the peasant's activities and rural development? Do you think REDD+ can help to manage forests to reduce environmental impact and climate change?
8. How would you describe and evaluate the work that the government agencies do?	16. What would you say about your experience with the implementation of REDD+? Any final comments you would like to add?

Note: This is the questionnaire that was asked to a total of 3 people from 3 different organizations, namely CCMSS, Rainforest Alliance and RedMocaf. Interviewees asked for anonymity.

Key notes

3 and 4. Among the activities that these organizations share are accompany the peasants throughout the process of implementation, helping them to understand and implement steps towards the sustainable management of their land. They also help as a bridge of communication between them and the government institutions. Another activity is the organization of seminars.
6. The people from these organizations think that there are still things that can be improved and some bad practices should be avoided. There should be more monitoring on the performance of the government institutions.
7. They agree that most of the people in the ejidos need constant help to understand this kind of strategies and their process, they are most of the times immerse in their everyday lives and are not so easily in touch with more technical or scientific information.
9. They agree that the work that they do is very important and of much help

to the communities. Otherwise it would be more difficult for them to thrive all what is involved to manage their lands and live. They think their job is a key part of a continue process towards good results for both, climate change mitigation and sustainable management of their land.

8. All of the interviewees said that historically there have been bad practices from the government making it difficult to improve their livelihoods and now to help them contribute to mitigate climate change. There are bad things that are a separate issue to address from climate change mitigation, and such issues have been a problem and difficult to eradicate. Now climate change mitigation could be an excuse to change them but still is difficult to believe such things could change.

10. They have heard from ejidos' members that unjust practices are seen every day and that are difficult to change because there is no authority that could change it. Apparently there is a more complex and hidden mechanism that works behind what is seen. Trying to change it could be a great risk for anyone that dares to go into it. There cited examples of journalists and activists that went into this issues and were murdered without further investigations.

14. They all agree that it is evident and an everyday topic that one can even watch in the news that policies among the sectors are not working or thought to work synergistically. Additionally, there is also evidence that there are other interests prevailing over environmental aims.

16. REDD+ could be a good strategy which can help the communities to achieve both, successful sustainable management of their resources and climate change mitigation. However the interviewees think that there are other problems that should be addressed but most certainly are out of the reach of this type of policy and strategy.

Questionnaire 4 (Academics)

1. How would you describe and evaluate the activities that the government agencies do regarding climate change mitigation and REDD+?	6. Do you think that other policies such as the ones from tourism sector, transport and communications and energy clash with rural policies? Do you know an example of this?
2. What do you think about how the financial aid is managed by the government?	7. Do you think that policies such as REDD+ help boosting rural development?
3. Do you think that the peasants have enough information on how the economic aids for rural projects work?	
4. Do you think there is an even and just allocation of the resources?	
5. What would you say are the main obstacles that peasants face to carry out their productive activities?	

Note: These are a selection of questions (others such as name, position, years working with this issue are not included here) that were asked to a total of 2 academics, a sociologist and an anthropologist that have deeply studied the topic of this thesis. Interviewees asked for anonymity.

Key notes

1. Some of the steps taken are following the basics; however there is still much work to do from their part. It is not just climate change mitigation, it si in all fronts of environmental sustainability, social justice and economic development not for some but to all. There is still much to do to find the right combination between development and environmental sustainability. Unfortunately, it is well known that the Mexican government has been mostly inefficient to work for the welfare of the majority and has privileged the enrichment of few including foreign interests. This rationale makes it difficult to think that there will be strong measures to protect the environment in the country.
2. As said before, they think it is difficult to believe that thing can be as transparent as needed, and even more when it is about financial resources. There is still the need for having good monitoring and a body that truly practice justice and avoid impunity that is still common in Mexico.
3. Both researchers think that most of rural people do not know and grasp all the information involved in this type of issue. There is too much information, technical, scientific, political, economic and social that is easy to surpass them. It is important that non-governmental organizations for example keep walking the roads with them and help them understand how big and critical this issue is.
4. The researchers believe that it is difficult to get a just allocation of the resources because many time those who are in charge of the administration and monitoring are at the same time judges and parties.
5. The academics said that from their research what they have seen as obstacles include bad organization and differences among the members that could be strong enough to hinder their work. Another thing is illegal practices including logging and drugs trafficking that are not commonly and openly discussed. The experience also points out to bad policies that have deserted

rural communities leaving many of them in poverty and struggling for their survival. Others have found their way to maintain some activities that they have been doing for years such as beekeeping. Others have been incorporating other practices that have been a better source of income such as touristic activities.

6. Both researchers agree that there are many cases that have been discussed surrounding policies that pull on opposite sides. Many of them obey to politic and economic interests that are difficult to fight.

7. This strategy could help to improve the livelihoods of the people living in forests. However, there is so much work to do in other fronts for this to succeed. Unfortunately, this strategy depends on other policies as well, other sectors, other actions that should be planned conscientiously and then work together.

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