# Chile's exemplary climate mitigation towards COP25

# A study about Climate mitigation in Chile and how they can be an example to the rest of the world towards and during COP25

"Climate change does not respect border; it does not respect who you are - rich and poor, small and big. Therefore, this is what we call 'global challenges,' which require global solidarity."

Ban Ki-moon, 2015



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Bachelor thesis Geography, Planning & Environment (GPE)

Radboud University Nijmegen

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Cover image: View down on the smog covered city of Santiago de Chile from Mirador Virgen de la Inmaculada Concepción, Cerro San Cristóbal, Santiago de Chile. Personal collection. 27<sup>th</sup> of July 2017.

#### Preface

Dear reader,

In front of you lies my Bachelor's thesis about Climate mitigation in Chile and how Chile can be seen as an example to the rest of the world. With this thesis I hope to finish my Bachelor's degree in Human Geography, Spatial Planning and Environmental studies at Radboud University. Since I was very young I have always been very interested in the Spanish language and the Spanish / Latin American culture. This is also the reason why in high school I did my school research project (Profielwerkstuk) for the school subject 'Spanish' about nationalism in Basque Country. Moreover I always knew I wanted to go on exchange to a Spanish speaking country when I would be in university. So when I saw Chile in the list of opportunities for the exchange there was no doubt that Chile should be the country I had to go to.

In the first few years of the Bachelor I always was more interested in Human Geography than in the other two areas of the bachelor. Hence I always thought that I would write my thesis about a Human Geography topic, specifically more in the sense of border and conflict studies, which also would have been more the area of my supervisor Henk van Houtum. However during my stay in Chile I was shocked about the amount of smog there was, especially in the winter. My Chilean friends Payo, Alonso and Nico told me that it used to be even worse up to a few years before that, but that Chile was on its way to improve. On whatever trip we went they pointed out new government projects like windmill and solar panel parks that would help fix Chile's environmental problems. That is why first of all I would like to thank them and all the other people I met in Chile, both Chilean and other foreigners that showed me what a wonderful and amazing country Chile is. Because of them and the impression Chile made on me I immediately knew I wanted to write my thesis about it. Although I always was more interested in Human Geography I realised that if I wanted to write about a very urgent problem in Chile it had to be about the environment instead. That is why in the beginning of this academic year I already started gathering information and news articles about this topic, so that as soon as the thesis started I would already know what I wanted to write about. Then I got assigned to my 3<sup>rd</sup> choice, which was different than the topic I had in mind. But when talking to my assigned supervisor Henk, he immediately made it possible for me to still write about the environmental problems in Chile as long as it would be from a policy approach. Making this possible for me is the main reason I would like to thank him, especially since this is not his area per se. I hope reviewing this thesis for him therefore was still as interesting as it was for me to write it. Furthermore I would like to thank him for giving me advice when I needed it and for putting me back on the right track when I got lost. Besides that I would also like to thank my friends and family for supporting me during the hard times.

Thank you and I hope you enjoy reading my thesis,

Nick Rovers

Goirle, August 2019

#### **Summary**

The earth is warming up and  $CO_2$  levels are higher than ever seen in human history. Environmental catastrophes will happen if nothing changes. Climate change is already noticeable in daily life. Severe land degradation due to global warming is already affecting 168 countries in the world. According to Ban Ki-Moon, former Secretary General of the United Nations it is caused by human behaviour and therefore we must change to preserve our planet Earth in a much more sustainable way. A lot of cities in the world experience air pollution. Santiago is one of these cities that almost on a daily basis is covered with a blanket of smog. Santiago is the 7<sup>th</sup> most air-polluted city in Latin America, and the top 5 are all located in Chile as well. When Chilean president Piñera entered office in 2018 he decided that this had to change. He put a ban on plastic bags and started investing more in renewable energy sources. Solar, wind, geothermal and hydroelectric are the energy sources that Chile is investing in. Besides the energy source Chile also tries to change at the end of the chain. Santiago used to be full of very polluting diesel buses but now the most polluting part is changed by electric buses or less polluting buses. Piñera wants to convert Chile from a polluting developing country into a environmental friendly developed one. He says this is possible and that environmental policies and economic growth will go together.

This year Chile is going to be host and chairman of the climate summit of 2019 (COP25). Here Piñera hopes to make the difference and that he will be able to succeed where France failed at the Paris Climate Summit in 2015. France did its best to mediate between all parties but in order to make everybody sign they had to make sacrifices. The United States for example would not sign of the agreement contained punishments or specific obligations for them pertaining reducing pollution. In order to tackle this and other issues Chile will face at COP25 Piñera started a team of experts on climate change but also on negotiation. With this team Piñera plans to create a strategy to persuade the other countries.

Chile has the world's largest reserves of lithium, which is a key element in electric car batteries. With this lithium Chile can try to make deals with countries like the United States and China. These two countries have the two most important electric car manufacturers, Tesla and BYD. When the world demand for electric vehicles rises these nations will earn money through the taxes that these car manufacturers pay to these countries.

Also it is in the interest safety for the United States and China to sign. These two countries are besides the biggest polluters also the countries that by far experience the most environmental disasters. Therefore they are only shooting themselves most in the foot when they do not cooperate.

But most important, Chile as a developing country has proved to be able to make change rapidly, drastically and sustainable. It was done by smart usage of local sources and willpower. Hence Chile can be seen as an example to the world. Even without being as rich as the developed countries, it is still possible to do something in order to make a difference. Therefore there are no excuses for countries to not cooperate since all of them are able to do so as long as they set their mind to it, Piñera says.

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#### **1. Introduction**

The earth is warming up and air quality is decreasing rapidly, therefore the environmental problems have become quite urgent. Smog in urban areas is becoming a more significant problem and the earth has reached CO<sub>2</sub> levels that are much higher than everything we have ever seen in human history (Griffiths, 2019). Even when the apparently already too ambitious plans of the Paris Agreement of 2015 are met, and we keep the maximum temperature increase to a maximum of +1,5 degrees Celsius, it still will not be enough to prevent an environmental catastrophe from happening. Climate change is probably going to reverse the last decades of development, global health and poverty reduction. The estimation is that by the year 2030 over 120 million additional people will be pushed into poverty. This will have the most serious impact in the poorer countries where food insecurity and unemployment will become huge problems. Then a mass migration will occur of the people that are able to afford to migrate, leaving the poorer people behind (United Nations Human Rights, 2019). Research by the United Nations Desertification Convention, shows that severe land degradation is affecting 168 countries in the world already and warn that if nothing changes food insecurity will become a global daily issue (King, 2013).

Moreover the change is already noticeable in daily life today. There are bigger storms than ever before, there are droughts where there used to be floods and vice versa, and the supply of water is getting alarmingly low. The change is noticeable in every single country on this planet (Bloomberg, 2018). In Germany for example, drinking-water supplies are getting so low that some households might not be able to get potable water out of the tap during the summer of 2019 (van der Werf, 2019). In Chile drought is becoming a more serious problem in the centre of the country near Santiago and the landscape is becoming

more similar to the arid north of the country. Near Santiago used to be a big lagoon, Laguna Aculeo. Just less than 10 years ago the lagoon was still at is natural size with a diameter of 6 kilometres, but in the period between 2011 and May 2018 the whole lagoon evaporated entirely due to the increasing droughts over the last couple of years (Sepúlveda Jara, 2019; AFP News Agency, 2019). Climate change is happening and much faster than one may expect. According to Ban Ki-Moon, the former Secretary-General of the United Nations, this is caused by human behaviour and therefore we must change our own way of living and we have to preserve our planet Earth in a much more sustainable way. Investing in climate change is the way to put an end to global poverty and is the way to make our cities more liveable, healthier and safer (Ban Ki-Moon, 2015).

Previous academic year I have spent a semester abroad in Santiago de Chile. While staying there I noticed that they were very behind on grounds of

environmental policies compared to the Netherlands. The first impression you get from



Figure 1.1: Air quality ranking of Latin American cities. Source: World Air Quality Report, 2018

your airplane window while descending towards the airport is the big blanket of smog that floats above the city. Santiago is one of the most air-polluted cities in Latin America. According to the 2018 World Air Quality Report Santiago was the 7<sup>th</sup> most polluted city in Latin America in 2018 and the top 5 places were also all located in Chile (Figure 1.1). However Chile is on a good path to change this, as they are putting a lot of effort in changing from a polluting developing nation into a leading environmental friendly developed one.

That is why in this thesis I wanted to research how Chile can be seen as an example for other nations, since they are trying hard to improve now that they are hosting the next Climate Conference (COP25). Also I have looked at how Chile can make other nations follow during COP25. So that is why the main question in this thesis will be: How can the current climate mitigation in Chile be seen as an example for COP25 and how can they globalise this in a way that a tragedy of the commons is avoided?

In this thesis I will first talk about the path Chile is taking at the moment to become a leading country for the rest of the world regarding climate mitigation and environmental friendliness. Then I will explain why this research is both scientifically and socially relevant. After that in the methodology I will explain how I am planning to achieve this and what the plan is to get to the answer of the main question. The methodology will be followed by the main part of the thesis, starting with an explanation of the Paris Agreement of 2015 (COP21). Afterwards I will draw an overview of the current environmental policies in three regions. The first region will be the countries of the NAFTA agreement (Canada, the United States and Mexico). Second will be the environmental policies of European Union and afterwards will be Chile and its climate mitigation policies. After the policies of these three regions I will talk about the concept of a tragedy of the commons, which will be continued by the COP25 in Santiago de Chile and what Chile can do during COP25 to convince all the other countries to cooperate so we can avoid a tragedy of the commons. Finally I will draw a conclusion and give a recommendation for future research and then I will end with a personal reflection on this thesis.

# 2. Chile's path of becoming an environmentally friendly leader to rest of the world

As mentioned in the introduction above, Santiago is one of the most air-polluted cities in Latin America. One of the reasons for this is because Santiago is surrounded on all four sides by mountain ranges over 2000 meters and therefore lies in a basin, which means the smog cannot float away (Chen, Simpson, Blake, & Rowland, 2001). Another reason is the population concentration in the urban area of Santiago. Over 7 million out of 17 million inhabitants of Chile live in Santiago (Villalobos, 2017). The main source of the airpollution however is urban transport. About 40% of all vehicles in Chile are from the capital and as can be seen in Appendix 1, almost all of them run on fossil fuels (Instituto Nacional de Estadísticas, 2018). Among these vehicles are also the 72.868 buses and taxis in Santiago, of which all are diesel engines. These diesels mostly do not have any sootfilters at all and are highly polluting, especially in the sense of Nitrogen oxides (NO<sub>x</sub>) and Carbon monoxide (CO). According to a study of Universidad de Chile in 1998 this is one of the worst kinds of pollution, since NO<sub>x</sub> gasses are very toxic and lead to the visible smog blanket over the city. Even the tiniest amounts cause damage to the lungs and disrupt the blood oxygen transport. Urban transport is by far the biggest contributor of these gasses, since 94% of the CO emissions come from urban transport. Moreover out of all NO<sub>x</sub> gasses polluted in Santiago about 83,7% comes from urban transport. The diesel buses in Santiago in contribute 33,4% of the total NOx emission in the city, as can be seen from the table in Appendix 2 (O'Ryan & Larraguibel, 2000). Emission from residential sources however is in Santiago 'only' 5%, which is very low compared to other cities in Chile and abroad (Ministerio del Medio Ambiente, 2011).

When you look further into the city after arriving and went to one of the many supermarkets you would have seen that almost every single product was wrapped in plastic. Even when you bought a bag of buns every single bun would also have been wrapped in plastic. Then when you went to pay for your groceries you got one bag per product and sometimes even 2 bags per product. This over-usage of plastic bags leads to a consumption of more than 3,4 billion plastic bags per year, which are only used for about 30 minutes (Hidalgo, 2017). The majority of these bags do not get recycled and about 97% of those plastic bags ends up at dumpsites or somewhere in nature or sea (Ministerio del Medio Ambiente, 2016). Plastic takes 400 years to decompose so this means that this creates a huge problem for the environment. When this plastic ends up in the ocean it is especially dangerous because sea animals might eat it or get strangled by it. The urgency of this problem is visible when looking at the big plastic soup in the ocean. There are already 5 big concentrations of plastic trash in the big oceans of which the North Pacific Garbage Patch is the biggest. In March of 2018 a study found that the North Pacific Garbage Patch was even up to 16 times bigger than previously thought. The plastic island in the pacific turns out to be roughly the same size as four times California (Albeck-Ripka, 2018; Lebreton, et al., 2018). Also was found out that there was a South Pacific Garbage Patch in the Pacific Ocean near Chile and in Chile they started noticing that fish they caught to eat started to contain micro particles of plastic as well (Andrade & Ovando, 2017). In the south of Chile, as well as in other places on earth, researchers discovered micro particles of plastic in snow and in raindrops (Lepe, 2019).

So obviously something needed to change not only in Chile but also in the rest of the world. Chile meets seven of the nine characteristics of the United Nations Framework Convention on Climate Change (CMNUCC) and is therefore very vulnerable to the effects of climate change (Ministerio de Medio Ambiente, 2014). That is exactly what President Piñera from Chile also thought. Sebastián Piñera is the current President of Chile and is leader of the country since March 2018. He was also president from 2010 to 2014 so this is his second time as the leader of Chile. Both times his predecessor was Michelle Bachelet. During the UN Climate Conference in Paris of 2015 Piñera was also there even though he was not president of Chile at that time. He was there to give an interview and presentation on the importance of the cooperation of all members in which participation of the US and China is crucial to be able to succeed in the agreement to limit the mean temperature increase to +1,5 degrees. He emphasised that this does not have to be at the cost of economic growth but that climate friendly policies and economic growth will go together (Piñera, 2015).

One of the first laws Piñera enforced last year when becoming president was regarding the plastic usage in Chile. He created a law that forbids the usage of plastic bags in shops and supermarkets. The law was instated in August 2018 making Chile the first Latin American country to ban plastic bags for businesses (Montes, 2019). As an alternative, people can buy a re-usable canvas bag, which is more sustainable than a plastic bag. Since this new legislation was so sudden they had a transition period from August until January. During this transition period only 2 plastic bags were allowed per client. If during or after

the transition period this law is broken then this will lead to a fine for the businesses involved, of 230.000 Chilean Pesos, about €300, per plastic bag (Wentworth, 2018). This seems like a lot of money but Piñera says it is absolutely necessary so that people take this seriously.

Another thing the new Chilean government tries to do something about is the pollution. As said before the diesel buses in Santiago contribute 33,4% to the total emission in Santiago. Therefore the government ordered fully electric buses to replace the most polluting part of the fleet of the Transantiago buses. The first 100 of those are already delivered and driving around since December 2018 (Liencura, 2018). Another 100 are already being shipped (March 2019), and more are on the planning. Chile is already after China the country in the world with most electric public buses. Since it is not possible to change the entire fleet at once they also ordered some new buses that still do run on fossil fuels but are way less polluting than the old buses they have now. These will change the second most polluting part of the fleet. Eventually they will phase out the fossil fuel buses so that they will have an electric bus fleet only. Besides making the public transport system cleaner Piñera also tries to promote electric cars, scooters, taxis and trucks (Arce, 2018). Chile has a big copper industry since it is the largest copper supplier in the world. Also it has the biggest reserve of lithium and is world's second biggest supplier. Lithium is a key component in electric vehicle batteries. So for Chile this could mean economical gain when more countries start going for electric vehicles and the demand for lithium increases. One of the goals is to also change the diesel mining trucks into fully electric trucks. The goal of Piñera is to increase the number of electric vehicles in the country by 10 times before the end of his term in 2022 (Ramos Miranda, 2018).

Obviously the energy to power and charge these electrical vehicles has to come from somewhere. Since this has to be created in a sustainable and environmental friendly way as well, there needs to be invested in new energy sources. There are many plans for new renewable energy sources of which some are already put in action. Since Chile is a very long country it has many different climate zones. In the Atacama region in the north, which is the driest desert in the world, a lot of solar panels are being placed. The biggest solar park of South America with almost 700.000 solar panels is also here. This solar park alone creates as much energy per year as 189.000 Chilean households use (Cooperativa CL, 2016). They also build a separate solar park that is especially build to empower the metro system of Santiago, which is the second biggest energy consumer in the country (AFP, 2019). Besides the solar panels in the dry north Chile is also making progress in the windy and rainy south. In the south Chile has already been creating hydroelectricity for a long time. Due to the many hydro energy plants such as dams in South America it is and has been the continent with the cleanest energy for decades now. However, since these dams are far from enough to provide the amount of electricity needed, extra windmills are being built in these windy regions. Besides solar-, wind-, and hydro energy Chile is also investing in geothermal energy. The Cerro Pabellón geothermal plant supplies energy for 165.000 households and is Latin America's first geothermal power plant (Londoño, 2017).

As Piñera mentioned at the Climate Conference in Paris in 2015 it is key that nations work together to make sure that the climate goals will be reached and that it is crucial for the US and China to cooperate. This is because China is responsible for 29.51% of the carbon emissions worldwide and the US for 14.34% (Emission Database for Global Atmospheric Research (EDGAR), 2016). Chile on the other hand is accountable for 'only' 0.22% of

global carbon emissions. So even though Chile is trying to improve, other countries and especially the big polluters like the US and China have to cooperate as well if we want to reach the climate goals set during the Paris Agreement.

That is also the difficult part, because how can we make the big polluters cooperate and make them take their responsibility for what they pollute? The Paris Agreement was not ratified by all participating countries in the end, so even though big polluters like Russia signed the agreement, they still do not have to keep their promise to reduce their pollution since the agreement is not ratified in Russia and therefore does not have a legal status. This is the case in 12 out of the 197 participating countries (United Nations, 2019). Moreover not every country that ratified the agreement is on schedule to reduce the greenhouse gasses it pollutes. Since then three other climate conferences have passed but still there is not a lot of progression, because the obligations for nations in the Paris Agreement were still vague. Chile wants to change this and wants to speed up the process. That is why they want to try to achieve this during the next Climate Conference, which will be in the beginning of December 2019, in Santiago de Chile. This also means that Chile will be chairman of this conference. The Chilean Government therefore made some strategies and ideas to try to overcome the problems that the Paris Agreement had. They did this so that they can improve, update and add new ideas to the old Paris Agreement. This also means that they have to think of a way that gives the Santiago Agreement a binding status, with obligations and potential punishments when countries violate the agreement. This might create a problem because during the Paris Agreement some countries threatened that they would not sign if the agreement contained obligations and punishments. However, President Piñera hopes that during this conference the big polluters and the countries that did not ratify the old agreement yet, can be convinced to sign the Santiago Agreement that will be made, and that he can persuade them to ratify this agreement. Like President Piñera said during the interview at the Paris Conference, it is key that the United States and China cooperate so he therefore hopes to convince the United States that Climate Change is a real and urgent issue. This is necessary because the United States are already doubting the Paris Agreement and President Trump is trying to back out of this agreement.

#### 3. Relevance and objective

To answer the main thesis question, written in the introduction before, it is necessary to look at different current climate mitigation policies in the world and see what good aspects and flaws they have. In addition there needs to be looked at COP25 and what Chile can do to make COP25 more successful than COP21 was. In my opinion this is a very current issue especially since President Trump of the United States made a statement to withdraw his country from the Paris Agreement of 2015 (COP21). This did not happen yet since there is an article in the agreement that for the first 3 years a country can't withdraw from the agreement and after which there is a one-year wait for a leave to be completed. So it might happen that Trump does not succeed with his withdrawal since the date of the completion of that leave will be the day after the new elections (Mooney, 2018).

How can we make sure that countries stick to the climate treaties that already exist and to the ones that will be made in the future, in this case COP25 and proximate ones? This is important to avoid the issue of a tragedy of the commons where the bad cars, in this case the countries breaking the agreement or not signing in the first place, drive out the good cars, in this case the countries participating and trying their best to reduce pollution.

#### 3.1. Social relevance

Climate change has become more and more an important topic over the past decades. Especially now all countries in the world are experiencing some of the consequences of climate change, whether they like to admit it or not. Over the last decade an increased number of countries started to experience shortages of water and more intense periods of droughts during the summer. On the other hand some other countries have also been experiencing floods due to the rising sea level. Chile is no exception for this as can be seen from the evaporation of lakes like the earlier mentioned Laguna Aculeo. Moreover as for now the predictions for Chile are not much better, as can be seen from the image here on the right (figure 2.1). The level of water stress is expected to worsen over the next few decades until reaching critical level by 2030. The image also shows that it is not just a problem for South America but for countries in other continents as well. Where Estonia did not have any water stress back in 2010 they do have so now already (Maddocks, Young, & Reig, 2015). Water stress is a problem going on in all inhabited continents and is not necessarily more critical in arid areas. European countries also score quite high, with San Marino in 11<sup>th</sup> place and Belgium in place 23 (Appendix 3). This shows that



Figure 2.1.: Water Stress from 2010 to 2040 in Botswana, Chile, Estonia & Namibia. Source: World Recources Institute, 2015

climate change is a global problem and since the problem is on such a big scale it is necessary to work together to solve this. One of the reasons why this thesis is socially relevant is because it raises awareness for the seriousness of these consequences of climate change. Besides awareness this thesis also provides knowledge about climate problems, policies and possible solutions. This can help people and also politicians when they have to look at this climate issue, especially pertaining the upcoming climate summit COP25 in Santiago de Chile. The focus on Chile therefore makes it socially relevant since they are chairman of the summit. Therefore Chile will be the core of the summit and will try to convince other nations and politicians to join the agreement.

#### 3.2. Scientific relevance

In the past few decades a lot of research has been done about climate change. Not only the causes have been investigated but also a lot of the consequences and possible solutions. Although these researches come with solutions of what humanity should do to make the situation better, these researches often do not contain ways to implement these solutions in practice. The main problem that the world has besides ignorance and unawareness of the seriousness of climate change is that politics make it sometimes too difficult to legislate these solutions so that they can get executed on a bigger scale. The scientific relevance of this thesis therefore is not so much in the sense of creating new knowledge about climate change and the solutions, since there have already been plenty of other scientists and researchers that investigated that. This thesis is more scientifically relevant in the way that it builds on the work of those researchers and approaches it from a policy view instead and tries to see how the solutions for climate change can be enforced rather than what they are. The focus on Chile is also something that makes this thesis scientifically relevant since research about this topic is still in its infancy and therefore fills in a knowledge gap. Usually researchers focus on either Europe, the United States or China since those countries are bigger polluters than Chile is. Although it is true that those countries are bigger polluters, Chile still is a very interesting country to focus on since it still can be considered as a developing country but still is trying to improve rapidly. They have made tremendous steps in becoming more sustainable in such a short timeframe. Therefore Chile is interesting to focus on because they have shown that it is not necessary to be a rich and developed country but that also developing countries can change. Every country is suitable for at least one renewable energy source, as long as they set their mind to it, Piñera says. They just have to look which source suits their country best. Chile might assist in this well, since all these renewable sources are used in some part of the country. The focus on Chile therefore makes this research unique and both scientifically as socially relevant.

#### 3.3. Research objective

This research tries to explore the different policies regarding environment in the NAFTA region, the European Union and Chile and the pros and cons of the policies these regions have. The objective of this thesis is to provide a guideline for Chile for when they will be chairman of COP25 so that they will be able to overcome the problems that France had during COP21, in order to make COP25 a success where other climate summits failed in the past. Besides that this thesis also tries to show the other countries why it is important and not necessarily bad for economic growth to join.

#### 4. Methodology

By providing answers to the questions back in the introduction I was able to get an answer to the main question of how the current climate mitigation process in Chile can be seen as an example for COP25 and how Chile, as host of COP25, can try to globalise this by making other countries join the treaty in a way that a tragedy of the commons is avoided.

To be able to do this I have triangulated multiple research methods. I started with an extensive literature study to see what others already wrote on this case, which I compared with other documents and statistics provided by organisations and governments. It is also important to get answers to the questions that I did not find during the literature study. Therefore I had to use secondary sources as well. For this I have watched professional interviews with experts and people from the ministries of climate of the countries involved with the COP25. I chose for these interviews by professional interviewers as they have the advantage of getting access to important experts on the issue of climate mitigation and about COP21 and COP25. I on the other hand never would have been able myself to get access to these important people. In addition to the interviews I also looked at press conferences about COP21 and press conferences of President Piñera, especially about the preparation for COP25. One actor I specifically tried to focus on is the Chilean Government, in particular the President and the Chilean Ministery of Climate. By looking at press conferences, publications, statistics and news articles from and about the Chilean Government, I tried to get an insight of what they try to do about the climate issues in their country and how they are preparing for COP25. Besides looking at what Chile does I also looked at what potential some other countries have that they are, as of for now, not utilizing.

#### 5. The Paris Climate Agreement of 2015 (COP21) as foundation for COP25

The 2015 United Nations Climate Change Conference, also called COP21 was a climate conference held from November 30, 2015 to December 12, 2015 in the French city of Paris. On this December 12 when the conference ended 195 countries, out of the 197 countries present, signed the Paris Climate Agreement, which was the last crucial step for the international climate policy process building further upon the 1992 New York Climate Agreement. Only Syria and Nicaragua did not sign in the end. For Syria this was because the United Nations enacted severe sanctions on them, hence they refused to sign the agreement. Nicaragua ended up not signing the agreement because in their opinion the agreement was not binding enough and they wanted a stricter and more binding one. On November 4, 2016 the agreement officially came into force, since then it was one month after the moment that at least 55 of the countries participating in the treaty, with together at least 55% of the global emissions, ratified the agreement (Martens, 2017). Since the old climate conference in New York a lot of things changed in the background. The global mean temperature increased to 1 degree Celsius more than it was in preindustrial times. Costs for sustainable energy technologies dropped and the oil prices fluctuated a lot. Moreover China's economy and CO<sub>2</sub>-emissions grew explosively whereas the emission of greenhouse gasses in the European Union dropped due to a better energyand climate policy and due to economic malaise (De Coninck, 2016). All these things influenced the negotiations during the climate conference in Paris. Also some coincidences sped up the process, like the transition of power of the presidents of Canada, Venezuela and Australia, which before were political opponents of the agreement but since the new presidents cared more about the environment were now proponents. The French chairman and host of this conference did very well leading these negotiations while staying neutral himself. He learned from the debacle of the 2009 Copenhagen conference where the Danish chairman made some mistakes leading to failing negotiations, giving the impression that multilateral climate diplomacy reached a dead end (Falkner, 2016). France managed to mediate between all the parties making sure everybody's voice was heard and that all countries both had at least one point they

considered important and that all countries at least had to give up something they cared about as well.

So how did they manage to do that? In order to make sure that the United States could join they defined the agreement as an attachment to a decision of the conference rather than a treaty. By doing this they were able to avoid it to pass the US senate in order to ratify it because then it probably would not have passed since there was a big division in the senate pertaining the environment. Besides that in order for the US to agree they had to make sure that the agreement did not contain specific goals for specific countries so that the agreement remained general for all countries. Both these things were not part of the Kyoto-protocol of 1997 and because of that the United States did not sign back then (De Coninck, 2016). For the European Union however it was more important that the agreement was legally binding, so with ratification process where national parliaments officially agree with the agreement so that is gets a binding status also in the country itself. Also the European Union requested an evaluation every five years, in which only can be decided to set more ambitious goals rather than simplify them.

In order to make sure that the vulnerable countries, like the pacific island states Tuvalu and Kiribati would agree they reset the goal of a maximum 2 degrees Celsius increase to well below 2 degrees and an investigation on the possibility to set a maximum of a 1,5 degrees Celsius increase. This latter came as a surprise for a lot of climate analysts because they already consider the 2 degrees goal as too ambitious and unfeasible. Another important difference between earlier agreements and this one is the fact that the word decarbonisation was avoided. Decarbonisation would mean the end of the oil industry, so for countries in the Middle East like Saudi Arabia this always was a reason to not sign. By changing the word decarbonisation into: "creating a balance between the source and 'drain' of the greenhouse gasses in the second half of this century", they solved this problem and now the Middle East countries would also sign. Finally for the poorer developing countries the agreement contains a paragraph which states that more than before the richer countries have to provide help pertaining financing and transferring capacity, knowledge and technology (De Coninck, 2016).

However now that the treaty does not contain country specific goals and certain words and terms were avoided in order to make countries sign it also means that certain countries are not held responsible for their actions right now and there is no legal way to make them change since in the end the initiative is still by the countries themselves. So that is why according to De Coninck (2016) the conclusion is that the Paris agreement is going to fail, just as the former agreements did, and will not save the environment. However De Coninck also emphasises that the Paris agreement is not a total disaster since it still offers a necessary start and the opportunity for countries that do want to do something for the environment to do so with each other.

#### 6. Worldwide policies regarding the environment

#### 6.1. North American governmental trade and climate organisations NAFTA & NAAEC

#### 6.1.1. NAFTA

The abbreviation NAFTA stands for the North American Free Trade Agreement and is a trilateral trade bloc between Canada, the United States of America and Mexico. NAFTA is the successor of the Canada – United States Free Trade Agreement. The trade bloc has been in force since January 1, 1994 and is the largest one outside of the European Union (Romalis, 2007). NAFTA was also the first reciprocal free-trade pact between developed

economies and a substantial developing economy (Hufbauer, Schott, Clark, & Dunnigan, 1993). The main focus of this treaty was the liberalisation of trade in agriculture, textiles and car manufacturing. Besides liberalisation of trade the treaty also protected inventions, patents, copyrights and other kinds of intellectual property. After the implementation of NAFTA regional trade increased boomingly and over the years trade between the countries has more than tripled, from about \$290 billion in 1993 to \$1.1 trillion in 2016 (McBride & Sergie, 2018). Mexico and Canada are the US's largest trade partners, more than a third of all US exports go to these two countries.

Since the Second World War people started to consume more, hence more products were needed. In order to supply for this demand production was increased and in many places, especially in the border region between Mexico and the United States, resources were depleted. Especially in this arid border area over-irrigation and overuse of fertilizers was a big problem. Therefore the issue of the environment and resource conservation became more and more important in these border regions and the demand for a cross border policy regarding the environment increased, because when one country over-irrigates or overuses fertilizers the soil on the other side of the border suffers from this as well (Vega-Cánovas, 2001).

So when the idea of NAFTA came around, it provoked a lot of resistance from the environmental community in the United States. Especially since studies at that time showed that in the few decades before the pollution worsened. Although the exponential economic growth created a lot of jobs and made incomes go up, the environmental conditions worsened (Vega-Cánovas, 2001). So that is why a lot of people opposed to this agreement because they believed it would worsen the situation in these border regions even more. Inside the United States congress the environmental community got support from a lot of the democratic congress members. Therefore the democratic congress members pushed the republican administration of the president of that time, George Bush sr., to make NAFTA more environment-friendly. However economic integration through trade and conserving the environment and its natural resources are in the United States considered as independent goals that appear to conflict with one another. Moreover the republican members of the congress threatened that if environmental adjustments to the plans of NAFTA would be made they would vote against. In order to make both sides satisfied the President made the choice to negotiate 2 extra agreements, one for environmental and one for labour concerns, so that it would look like these issues were included in NAFTA as well (Moreno, Rubin, Smith, & Yang, 1998). In reality these two side agreements would not impose any serious costs for the United States and its enterprises, which pleased the republicans. The President also made sure that the government would not send big amounts of federal money to these border regions in order to improve the situations on both sides of the border.

However the side agreement for the environment, the North American Agreement on Environmental Cooperation (NAAEC) led to the foundation of the North American Commission for Environmental Cooperation (CEC), a cooperation that tries to conserve, protect and enhance the environment and helps to resolve environmental disputes through mediation (Vega-Cánovas, 2001).

#### 6.1.2. How successful is/ was the NAAEC?

The parties within the NAAEC do not necessarily have to listen to specific requirements pertaining the protection of the environment. The parties are able to determine and

change their own rules and determine the amount of protection of the environment they consider important. In the NAAEC agreement the rules and obligations for the parties were remained vague on purpose. Besides there is no penalty if they do not do everything by the book and they break the rules (Grant, 1994). It was clear to all the NAFTA participating governments that the United States was not genuinely looking for an agreement that would impose obligations and rules regarding the environment. It was just to make it look like steps were made so that NAFTA would be approved by the congress (Vega-Cánovas, 2001). Moreover the NAAEC did not alter the way environment related decisions are made that much. Political decisions pertaining the environment in all three NAFTA participating countries continued to be made by the same responsible national authorities as before NAFTA and NAAEC. Shortly, the NAAEC policies are an ineffective way of addressing the environmental concerns of the other countries participating in the agreement. First because the administrative procedures may erode environmental protections because of the increased bureaucratic red tape in order to hold a polluter liable (Grant, 1994). Also the result of investigations to find facts and proof is limited to diplomatic negotiations and therefore results in that the polluter does not have to go to court. Finally the enforcement powers of the panel are arbitral and insubstantial. This means the NAAEC was not a good solution for the environmental concerns from trans boundary pollution (Grant, 1994; Vega-Cánovas, 2001). However this does not mean that NAAEC does not have any potential. According to Grant (1994) it only needs some upgrades in the shape of an amendment to the existing NAFTA treaty. To make sure that the goals of the protection of the environment can be attained without the infraction upon national sovereignty where the participating countries are afraid for, the NAAEC just needs some extra power. Then NAFTA and NAAEC can accomplish their aims for the protection of the environment at a minimum cost to national interests (Grant, 1994)

Nevertheless the NAAEC was not entirely a failure since the NAAEC was able to facilitate some interaction between the governments of the NAFTA-countries. Representatives of the three countries (the CEC) meet each other regularly in NAAEC-forums to discuss the issue of the environment. They have successfully established various cooperation programs and researches pertaining the environment in the three countries.

#### 6.1.3. UMCA and the environment

On November 30, 2018, The United States, Mexico and Canada signed a new agreement. The United States – Mexico – Canada – agreement (USMCA), is a modernised version of NAFTA and the idea is that it replaces the former North American Free Trade Agreement (Burfisher, Lambert, & Matheson, 2019). Since the UMSCA agreement is still pretty new it is hard to say if it works better and more efficient than NAFTA did. Especially when it comes to the environment conclusions cannot be drawn yet. This is partly because Donald Trump is the current president of the United States and he is considered to be a climate denier and during the elections he always promised to get the United States out of the Paris Climate Agreement of 2015 (De Pryck & Gemenne, 2017). Although it does appear that the USMCA agreement that Trump signed does have some promising points, like that it is wrong to encourage trade and investments that decrease the conservation of the environment. This however is something that was also a provision in NAFTA and there it had little effect (Vaughan, 2018). Besides that Trump also made sure that in the USMCA agreement there would be no mention of the Climate Agreement of Paris from 2015 nor the United Nations Framework Convention on Climate Change so that he would not have another binding agreement on the environment he does not support. Although the Commission for Environmental Cooperation was not able to contribute according to satisfaction in NAFTA the member states chose to transfer the CEC to the USMCA agreement as well with the acknowledgement that the Commission needs to update to become more focused, relevant and outcome orientated (Vaughan, 2018).

In short USMCA does have potential, it contains the same basic principles as the former agreements as well as a few new things. Together with the modernisation of the Commission this may lead to a good functioning trilateral cooperation, also regarding the environment. This potential however is also influenced by President Trump, so it also depends on what he does since he is a denier of climate change (De Pryck & Gemenne, 2017).

#### 6.2. Environmental policies in the European Union

The European Union is considered to have the most extensive environmental laws of any international organisation (Jordan & Adelle, 2012). The European Union is a politicoeconomic region with 28 member states of which all but Cyprus are located in Europe (Dinan, 2000). It came to life with the Maastricht Treaty, which was signed in 1992 and created a new legislature, the European Parliament. For this the countries needed to give up some of their sovereignty, which they did by signing the treaty of Maastricht. The treaty did not only contain agreements on a political union but also on a monetary union, which meant the foundation of the Euro. The European Union replaced the former political and monetary unions and other treaties between the participating member states (Geursen, 2010).

The first step to an international environmental agreement in European Union was back in 1973 when it was still the European Economic Community and they implemented the first Environmental Action Programme (EAP). The EAP contained many elements that the current European Union environmental programme on sustainable development. The programme stated that prosperity, economic development and protection of the environment are mutually interdependent (Hey, 2005). Keeping an ecological equilibrium within the member states of the European Economic Community and the prevention, reduction and containment of environmental damage were seen as one of the main duties of the EEC. After this a few other EAP's came, the second EAP was an updated version of the first one. The third EAP between 1982 and 1986 was a whole other approach to environmental policies and this third one emphasised the economic benefits of environmental policies. According to this third EAP there could be economic gain due to the positive employment effects that occur because of the environmental policies. The Environmental Action Programme switched from a quality approach to an emissionoriented approach. The aims and goals of the two former EAP's were revised to make the introduction of new filter technologies possible that would reduce the emissions 'at the end of the pipe'. Another new thing the third EAP mentioned was the management of nonrecyclable waste, how to prevent it and that it could lead to economic gain (Lenschow & Zito, 1998). The third EAP also included a clause about the for that time new global strategy for sustainable development created by the International Union for Conservation of Nature in 1980 (Hey, 2005). The reason for these policy changes came mostly because of the pressure of West Germany. In West Germany there was a lot of discussion about

'Waldsterben' (forest dieback) (Hey, 2005). Waldsterben is a condition in trees in which peripheral parts are killed by parasites, acid rain and pathogens (Allen, 2009). Waldsterben is a very serious condition because two of the nine turning points in drastic climate change are directly linked to Waldsterben.

So that is why the German people and the German Green Party were pushing towards a new Environmental Action Programme with harmonised European Emission control policies (Hey, 2005). The fourth EAP was mostly a recognition, addition and correction of earlier shortcomings. The only significantly different part of the fourth EAP was the fact that for the first time ever a sectorial approach was taken and that measures such as taxes, subsidies and tradable emission rights were introduced.

Then in 1992 there was the United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit. Here ambitious goals were set for countries of the United Nations to work together on (sustainable) development issues after the Cold War (Quarrie, 1992). These ambitious goals were also the foundation for the fifth Environment Action Programme of the European Commission. Therefore the fifth EAP had quite some additions and differences compared with the former four EAP's. For the fifth EAP the biggest difference was that it was more of a consensus-oriented approach with a focus on the role of non-governmental actors and more local authorities. A more local level of policies would improve the public awareness. Besides they now focused more on the long-term environmental solutions specifically for the reduction of some pollutants rather than what they could change in the short-run (Hey, 2005). However, the member states were not so satisfied by the new approach of the European Commission, so that is why this new approach got a lot of resistance. Hence the period after the Earth Summit is often seen as a downward spiral in the sense of environmental policies. Several member states announced that they wanted a new agenda focused mostly on the rivalry of industries and decentralizing environmental policies. This for a part contradicted the plans of the fifth EAP, which lead to little progression on the ambitious projects of the fifth EAP (Hey, 2005).

In 2017 the European Union, with the initiative of France, made an agreement that from that moment on the Climate Agreement of Paris would be applied in every new trade agreement and treaty that would be made with other countries. So that is what they did in the new trade treaty with Japan and the CETA agreement with Canada so that these countries would have to ratify the climate agreement before getting a trade agreement with the European Union. Also for the 27 pending trade agreements which were under negotiation at that time the new clause: "No Paris, No Trade Agreement" would also apply (Stone, 2018).

#### **6.3. Environmental policies in Chile**

As said before in the introduction Chile and the rest of South America used to be far behind pertaining environmental policies. Although South America has been the continent with the cleanest energy, due to the many hydro energy plants like the many dams it is also a continent that pollutes a lot. However over the past five years Chile started to get more recognition from the world for its environmental performances (Durán, 2019). Like mentioned in the introduction Chile used to use lots of plastic bags in supermarkets and stores. Piñera however introduced a law where the usage of single-use plastic bags in supermarkets and stores is prohibited, making Chile the first Latin American Country to do so (Montes, 2019). Piñera also introduced a fine when plastic bags would still be used.

He said that when looking at other countries that already introduced policies regarding plastic bags, it was more effective to have a fine so that people would take it seriously. He also saw that it would not be possible to enforce the law immediately and that both the people and the businesses need time to look for other options. In some other countries they did not have a transition period like in Chile but also did not have fines when plastic bags were still given at stores. So in some European countries where they did not have a real transition period and therefore no time to look at other options, like in the United Kingdom, they went around this by making people buy their bags so that it would be seen as a product they bought in the shop, because then they could still use plastic bags. However according to the British Department for Environment, Food and Rural Affairs (Defra) the usage of single-use plastic bags in England dropped about 85% in the first period after the introduction of this law (Smithers, 2016). In Kenya however they took the enforcement to a whole other level. In Kenya they put a huge fine from 19.000 Dollars up to 38.000 Dollars, or a jail time up to 4 years, on the import or production of plastic bags. They already tried a law 10 years ago that prohibited the usage, but put the fines at the users instead of the producers. However, enforcement was too difficult, since there were no alternatives, and therefore the law did not work out back then. This time however, since the Kenyan people and the businesses had a few months to adjust to this new law, a transition is seen and people started to use cloth and paper bags instead (De Freytas -Tamura, 2017). Piñera saw from the Kenyan example that a fine for the people was not as effective as a fine for the businesses and produces so therefore he put the fine on the businesses handing out the plastic bags instead of on the consumer. Moreover he saw that banning plastic immediately would not have the desired effect so he decided to do it differently than England and Kenya and put a transition period. Therefore in Chile businesses had the opportunity to look for long-term more sustainable alternatives and because of that businesses would not try to bypass the law with looking for loopholes they could do on the short run to avoid fines, like they did in England.

Also on other fronts Chile is, as mentioned in the introduction, improving its environmental policies. Especially with the perspective on the Climate Conference that Chile will be organising in December 2019 (COP25), they are trying to be as good of an exemplary country for new environmental policies as possible. In December of 2017 former Chilean president Bachelet received the 'Champions of the Earth' award from the United Nations for her contribution to the creation of protected areas and her assistance towards non-conventional renewable energies (NCRE's) (United Nations Environment Programme, 2017). As mentioned before Chile already had hydro energy plants in the south of the country but there was still a lot to gain in the north so President Bachelet and Piñera pushed towards solar energy plants in the Atacama desert (Durán, 2019). As mentioned in the introduction, another renewable energy source that Piñera is pushing towards is geothermal energy (Londoño, 2017). Geothermal energy is quite effective in Chile due to the different tectonic plates, the many volcanoes and many deserted old mines in the uninhabited parts of the country. Geothermal energy uses the warmth from the inside of the earth to generate electricity (Procesi, 2014).

Besides trying to decrease pollution at the beginning of the chain by improving the way electricity is generated they are also trying to minimalize the pollution at the end of the chain. This not only by prohibiting the most polluting cars but also by making the ones that are still allowed less polluting with better soot filters. Besides polluting vehicles another big contributing factor to the bad air quality were the firewood heaters. In most

cities in Chile firewood heaters were the main heating source (Abastible, 2018). Unfortunately the firewood heater is one of the most polluting kinds of heaters that exist. In some cities, like Osorno in the middle-south, firewood heaters produce over 94 per cent of the fine particular matter in the city (Estado del Medio Ambiente, 2018). Even though these mid-southern cities are over 50 times smaller than Santiago is, and just have a little over 130.000 inhabitants, these mid-southern cities in winter times are even more polluted than Santiago, of which Osorno is the 2<sup>nd</sup> most polluted one in Latin America (figure 1.1). Every year air pollution in Chile costs the Chilean Health Sector over 670 million USD and is the main reason that over 127.000 people have to go a hospital, of which over 4000 die prematurely (United Nations Environment Programme, 2017). The problem however is that changing to less polluting alternatives is very expensive and most people in these cities can't afford to do so. In order to switch to other options to heat the house they often have to rebuild parts of their house, which costs a lot of money. Therefore in 2014 the Chilean Government launched a programme to change these firewood heaters in over 200.000 houses in the mid-south region to more energy-efficient and less polluting heaters. Besides changing the heating source the government also invested in better insolation in the houses of over 100.000 low-income families. These investments of the Chilean Government lead to a big decrease of smog in the urban areas of the country and emission levels dropped with almost 50 per cent (Ministerio del Medio Ambiente, 2017).

#### 7. Tragedy of the commons

The environment can also be seen as a common, since everybody has access to the same air, water and environment. When the common is overused this can lead to a tragedy of the commons and the quality and availability will decrease. Therefore it is necessary to make sure that all countries are participating in order to prevent this decrease in quality to the environment from happening. In case all but one country participate, the one country that still pollutes will still create a decrease in the quality of the environment of the participating countries, since air and water do not know borders. In this case the bad car drive out the good ones. This is something that has to be prevented because when that happens, participating countries might start asking themselves why they have to be the 'good kid in the classroom', whereas others do not care about climate mitigation and do not try to change a thing at all. Then the good cars will eventually also convert into bad cars since they do not see any reason anymore to try their best when the neighbour does the opposite. So how can we make it attractive for countries to join this organisation and how can we make it unattractive to leave? Besides that we need to look at a way to make sure that we won't have to depend on the goodwill of presidents like Sebastián Piñera or the negative goodwill of presidents like Donald Trump. Moreover we need to overcome the problem that countries try to leave as soon as they get a new leader, who does not think the environment is as important as the previous president thought, as we have seen with Trump and Obama.

#### 7.1. What is a Tragedy of the commons?

The concept of 'Tragedy of the commons' was first introduced as an economic and ecologic problem that results in overconsumption and underinvestment of a resource that normally is seen as a common-pool good. A common-pool good or resource is a resource that anybody can get access to when they want. Examples for this are firewood and fish

because it is almost impossible to exclude people from potentially using or acquire it (Ostrom, Gardner, & Walker, 1994). The concept of tragedy of the commons was first used by Garrett Hardin in 1968. Garrett Hardin was an ecologist and environmentalist from Texas, United States (Bajema, 1991). Hardin explained his concept of the tragedy of the commons with imagining a pasture with animals. Everybody could use this pasture and every herder would have a lot of economic benefits from selling the animals he or she owns whereas the costs of overgrazing are relatively low compared to the benefits (Ostrom, 2008). The tragedy in this is that every herder is trapped into a system that urges him or her to increase the amount of animals owned in order to gain more benefits since the costs for adding another animal are lower for the herder than the gains the herder gets. Even when the pasture reached its full capacity every herder will still be tempted to add extra animals because people are always pursuing their own best interests even when it harms society as a whole. As long as the economic gain for the person is higher than the personal harm and costs, herders will still continue to add animals to the already overcrowded field (Hardin, 1968). In the example of the firewood and fish this would mean that instead of adding something to a place that one would extract something, in this case the wood or the fish. Everybody can go to the woods or a lake to cut wood or to fish. But for every fish or tree one person takes the quantity of units available to others decreases, so when people would overuse the resource, it is possible that the world would run out of it.

In the eyes of Hardin it would not be possible for people to arrange, self-organize and maintain institutions to prevent themselves from tragic overuse and running out of certain recourses (Clark, 1976). Escaping from this trapped system is a second-level dilemma. Individuals are already stuck in a dilemma whereby one person his actions inflict a negative externality on another person. Therefore according to Hardin it does not correspond with the initial theory that states that individuals can overcome a second dilemma where the theory already predicts that they would be unable to solve the first theory in the first place (Ostrom, 2008).

#### 7.2. Tragedy of the commons and the environment

The environment in a way can also be seen as a common-pool resource. In the case of the environment, tragedy of the commons can as in the example earlier, either appear by taking recourses out so that the ecolife is affected because of a lack of trees for oxygen and relatively increasing the amounts of greenhouse gasses in the air, but also by adding things to the environment. This can be because of sewage or chemical, radioactive, and heat wastes into the water or noxious dangerous gasses into the air, like pollution through the exhaust of cars, buses and other motorised vehicles (Hardin, 1968). The line of thought is still the same as with the other examples. The rational man discovers that his share of the cost he pollutes into the commons is less than what the costs would be for cleaning the wastes before releasing them into the environment. Unfortunately this is the case for everybody so when everybody only thinks in terms of their own utility then we will get trapped in a system were we will be "fouling our own nest" (Hardin, 1968, p. 1245). Normally tragedy of the commons can be avoided by turning the commons into private property, or something formally like it. However it is not physically possible to put a fence around the air. Therefore tragedy of the commons as a cesspool has to be averted in another way. A way to do this is to implement forceful laws and taxes that make it less expensive to clean his waste than the shared costs of polluting it untreated. The pollution

issue is a result of the increasing population. It did not use to matter much how somebody living in the hinterland used to get rid of his waste. When he dumped it in a river it did not have much influence since water cleans itself over a certain distance, at least as long as the amount of people doing so was not too big (Commoner, Corr, & Stamler, 1971). However when more people came and the density of the population rose, the natural chemical and biological recycling processes got overwhelmed and a reorganisation of property rights was necessary (Hardin, 1968).

The result is the creation of institutions with administrative laws. However, when an institution that watches you behave according to law is created, like a government, it might lead to fear among the citizens, because who shall watch the watchers themselves? A possible way to solve this is to make detailed and strict international agreements, in which it will be possible for one country part of the agreement to rap another misbehaving country on the knuckles. This is something that the Paris Agreement did not have since some countries said that they would not sign if punishments were embedded (De Coninck, 2016). The catch however is how to convince all countries to cooperate because mutual agreed-upon coercion might lead to protests and resistance (De Young & Kaplan, 1988). Another problem in the case of the Paris Agreement was that not all countries that signed the agreement actually ratified it, so it does not have a legal status for them. This means that they do not officially have to follow the agreement and lower their pollution. This leads to a situation where the bad cars drive out the good ones, since some countries try their best to lower pollution and others continue to pollute and therefore ruin it for the countries that do try their best to lower pollution.

#### 7.3. How to overcome an environmental tragedy of the commons?

Already in the late 1980's there was significant evidence that the world population was facing environmental limits. The tragedy of the commons has proved to be an effective method to understand how we reached the current situation where we are at the brink of ecological catastrophe. Mankind is now looking at an alarming situation not because bad outside forces established this, but because of the allegedly appropriate and innocent behaviour of human beings. Therefore it is necessary for humanity to start adopting and upholding ecologically appropriate behaviour (De Young & Kaplan, 1988). According to De Young and Kaplan there are two criteria that have to be met to make sure that the solution works to satisfaction. The first one is that is has to be harmonious with human nature and also it has to be sustainable in a way that it does not endanger the availability of natural resources. These two important criteria came forth from a study of the reason that former solutions to avert or resolve a tragedy of the commons did not get off the ground in the end.

Therefore measures have to be taken to make sure that all countries cooperate with the next Climate Conference in Santiago de Chile (COP25) this year and make sure that they keep their promises. Only when all countries see the urgency of climate change and work together to enforce and maintain these mutual measures, change can be made for real and an ecocatastrophe can be avoided.

#### 8. COP 25 Santiago de Chile

On December 2 of this year the 2019 United Nations Climate Change Conference (COP25) will be opened in Santiago de Chile. In the time after that until the 13th of December the member countries of the United Nations will negotiate terms for a new and improved climate agreement (Velázquez, 2019). Originally Brazil would organize this Climate Conference but upon election Brazilian President Bolsonaro pulled Brazil out of organising the Climate Conference (Gilbert, 2018). Hence they needed a new host, so Piñera did his best to get this event to Chile, in which he succeeded. He wanted to be host of what according to him in his press conference is the most important conference in the world right now since it is such an urgent issue. Piñera says that we are the first generation to really feel the effects of climate change. Moreover he emphasises, that we are also the very last generation that has the possibility to prevent that climate change will end up in a tragedy for the whole humanity (Piñera, 2019). Therefore Piñera started a team, including himself, which would actively discuss strategies to guide this Climate Conference towards success. This team, besides Piñera himself, exists of ex-presidents, people from the ministry of Climate, researchers from universities and other experts on both climate change as well as experts specialised in negotiation, to discuss ways to convince other countries to work along with the new to made treaty during the conference. According to Matías Asun, director of Greenpeace Chile, this is going to be a tough job and Chile therefore has to make sure that it does not make the same mistakes France did. France did a tremendous job mediating between all parties and for the first time where other climate conferences failed to make a clear treaty with clear goals France managed to convince all parties to sign the treaty. However the Paris Agreement was not ambitious enough to really safe the world from severe climate change and to "prevent the world from continuing on a path that could end in tragedy", Piñera said at a press conference (REUTERS, 2019). Therefore Chile has to make sure that this time the treaty does contain more explicit goals for certain countries to reduce their pollution, especially for the biggest polluters like the United States and China (Asun, 2019). As Piñera already said at the Climate Conference in Paris in 2015, it is key that these two countries contribute (Piñera, 2015). Every contribution of every country helps and it is very good that also the countries that are only responsible for a small fraction of the total emission, like Chile with 0,22% of the total global emission, contribute. Even though, their effort does still not influence that much when the biggest two polluters who together pollute over 40% of total global emissions do not change at all. Then you get trapped into the feared system of the tragedy of the commons where the good cars drive out the bad ones. This has to be prevented by all means. The only way to avert this tragedy of the commons is making sure that all nations cooperate at COP25. Therefore Chile has to give everything it has to provide enough arguments so that they can persuade the refusing countries.

### 8.1. How Chile can make sure that the other countries join to avert a tragedy of the commons?

The worry is that the United States will refuse to sign if the new treaty specifically states that they have to cut emission gasses and decrease other ways they are polluting as well. Especially now Donald Trump is the president of the United States and he already wanted to get out of the Paris Agreement is it plausible that they will also refuse entirely to sign a new treaty at all. However there are a few possibilities to convince countries, like the United States, that are sceptical towards a stricter climate treaty that forces countries to decarbonise. Decarbonisation is the main goal where the world eventually has to go to

(Asun, 2019). Key for Chile and the supporting countries is to find a motivation and powerful arguments for every single country that needs to be convinced.

One of the big fronts that Chile is going to have to face will be the oil exporting nations in the Middle East. Last time at COP21 in Paris they were afraid that they would lose their businesses in oil, which is the majority of their income. Although it will be hard to make these countries switch entirely to renewable sources I think there are arguments in favour of Chile to persuade them. Out of the top 10 countries with the most critical level of water stress, all but Eritrea, in 9th place, are located in the Middle East (Appendix 3). In these countries water already used to be scarce but now it became even worse. Especially since for the past few decades the Middle Eastern countries, and especially the United Arab Emirates, have by far been the biggest consumers of water in the world (Das Chaudhury, 2005). Environmentalists warn the United Arab Emirates that they per capita use about four times more water than Europe does and that they soon will not be able at all anymore to get access to water. Due to the lack of water a lot of land suitable for producing food is destroyed by increasing desertification. Water is not the only issue in the Middle East, the air is as well. The World Air Quality Report, which shows the air pollution in cities all over the world, shows bad news for the Middle East. A lot of these Middle Eastern cities are amongst the most polluted ones on the planet. Out of all cities in the Middle East none met the World Health Organisation's target of 2018, whereas 27,3% of European cities does. This is very unhealthy for these Middle Eastern inhabitants and research shows that many people die prematurely due to this pollution (IQAir, 2018). Another point Chile can make to these oil exporting nations is the fact that for every country that does cooperate that the oil nation loses a client, since that country will not import oil no more and national income will fall. Therefore it will be better for the Middle East to cooperate now and slow down the oil industry and invest that money in renewable energy instead. The best option for the Middle East will be investing this oil money in solar and wind energy instead. Especially solar energy has been proved to work very effectively in the Middle East. There already are some wind and solar power plants that were build with the thought that domestic renewable energy use leaves more oil to export (Anderson, 2019). This means the infrastructure is already there so it is relatively easy to expand these power plants since there is space enough for it. Maybe then it even is a possibility to export clean energy to other countries. One of the biggest flaws of solar and wind energy is that it is totally dependent on the weather. In the Middle East this is not that much of a problem since it is the sunniest place on the planet and they have plenty of sun hours, but for some other countries where there is less sun it might be interesting to import solar energy from the Middle East. The advantage of this is that it is not only more sustainable than fossil fuels but on the long run can also be cheaper since it does not involve humans to run the machines but it does not involve any ships or trucks to transport it once the electricity network is there. In this case the Middle East does not lose its income but just switches to another type of energy to export. In this case for the Middle East, climate friendly policies and economic growth still will be able to go together, like Piñera said (Piñera, 2015). So for this group of countries Piñera can probably best throw it on the quality of life and the health of the inhabitants of these countries in combination with the possibility to gain money from the export of solar energy. Of course it is necessary that other nations assist Chile in this to put pressure on these oil nations, since it will be a big risk for them to slow down their primary income source.

Another way to persuade countries that do not want to sign is by using the method the European Union was already using after the Paris Agreement: "No Paris, No trade agreement. Chile can use this as leverage by making this part of the agreement, so that cooperating countries cannot sign other kinds of new agreements with countries that did not sign this one. When all countries that do want to cooperate agree on this, and threaten that they will even decrease existing trade by making this more difficult through trade barriers, maybe it convinces doubting countries to sign the agreement after all. Because when trade with other countries becomes harder or more expensive for them when they haven't signed the treaty it might become more economically attractive to sign after all. This for a businessman as Trump might be a reason to sign.

Moreover for the governments of the United States and China it might be financially interesting to go on the environmental track since the demand for electric vehicles will increase a lot. American company Tesla is the world's most important electric carmaker and Chinese carmaker BYD is the largest electric carmaker in the world (Campbell & Tian, 2019). So when these companies grow due to the big demand for electric cars the governments of these countries will earn a lot of extra money through taxes. Chile has by far the world's largest lithium reserves (Figure 8.1), 48% of the world's lithium Reserves are in Chile (Gobierno de Chile, 2019). Lithium is a key component for batteries in electric cars. Maybe to persuade the United States and China, Chile can make a deal with



Figure 8.1: The world's lithium reserves in2018.Source: Gobierno de Chile, 2019

these countries regarding the trade in lithium for their electric car companies.

Furthermore it is also in the interest of safety for the United States and China themselves to cooperate. A lot of environmental disasters happen in both China and the United States, as can be seen in Figure 8.2. China and the United States are the two countries in the world that by far had the most environmental disasters in the year 2016 alone. This is no exception since this has been the case for many years already (Guha-Sapir, Hoyois, Wallemacq, & Below, 2017). So not only are



Figure 8.2: Top 10 countries in the world by amount of environmental disasters that happened in 2016 alone. Source: Guha Sapir, et al., 2017

the United States and China by far the biggest polluters on the planet, they also are by far the two countries that experience the effects of climate change the most when looking at environmental disasters. Especially in the category meteorological disasters they really stand out from the rest of the world. Meteorological disasters are disasters caused by extreme weather like extreme droughts and floods (Monirul Qader Mirza, 2003). These are exactly the kind of disaster caused by global warming where the pollution of these countries contributes too. So why would they keep shooting themselves in their own foot? If they continue polluting as much as they do they will only worsen their own situation the most. Here instead of a tragedy of the commons where the bad cars drive out the good cars the case is more that the bad cars drive out themselves in the end. Therefore it might be a good argument for China and the United States to become good cars instead, so that their countries do not become unliveable due to the increasing amount of environmental

#### disasters.

As for convincing Europe there is less need as Europe already was a big proponent of a more binding agreement at COP21. Although Europe maybe could use some guidance since switching entirely to renewable sources is still hard. Partly because of the reason that sun hours differ a lot in Europe. The north does not get as much sun hours as in the south and at night there would be a problem since there is no sun then. However solutions are being worked on, be it that they are still in their infancy. Tesla has its Powerwall, which is a battery that empowers your home and has a capacity of 6,4 kWh. BMW however is working on its own kind of home battery that has a capacity of 33 kWh, whereas the average use in the US is about 30 kWh. Cliff Fietzek, manager of Connected eMobility at BMW, reckons that their battery could power a house for 24 hours, this is plenty of time to survive the time that there is no sun or wind (Muoio, 2016). So maybe for Europe Chile can try to cut a deal as well regarding the lithium export since lithium also will be necessary to make those batteries. Furthermore Europe can always still import energy from other countries when a global electricity network, as Europe itself already has, is established.

The hardest actor in Europe to convince might be Germany. Germany is the country that pollutes the most in Europe and has the single worst polluter in Europe, the Niederaußem coal plant. This coal plant is the hotspot in Europe for nitrogen dioxide pollution, even more than the whole city of London's polluted air (Simon, 2018). Moreover the German car industry is still very fossil fuel focused compared to other countries with a car industry. Now Germany has a leading position in the world's car industry but German officials fear that Germany will lose that position in an electric car industry since they are insufficiently prepared (Boston, 2019). Therefore Chile can once again offer a deal with the German industry offering the lithium they have in a special deal so that the German car industry will also push the government to agree.

For the developing poorer countries Chile shows that even without being as developed as some others it is still possible to do something, so this is not an argument for the poorer countries to sign. However just like at COP21, Chile can make sure that the same paragraph as in the Paris Agreement will be added. This paragraph contains that richer countries have to provide support pertaining financing and transferring capacity, knowledge and technology in case poorer countries can prove they lack resources.

Finally another topic Chile needs to pursue during COP25 is the issue that at the conference in Nairobi in 2017, 193 nations announced that they will start reducing and banning plastic bags (Ndiso, 2017). However as it turns out a lot of them did not do so as of July 2018 (figure 8.3). Chile here is still considered a partial ban since at that moment Piñera had only announced the ban but it was only officially implemented on August 3, 2018. Nevertheless Chile needs to ask the other countries why not all of them kept their promise. Moreover Chile needs to make sure that this

#### **Countries with plastic bag bans**



measure comes extra enforced in this treaty and that the countries

Figure 8.3: Countries with plastic bag bans as of July 2018. Source: REUTERS, 2018

that did not sign yet, automatically do so after all by signing this treaty.

From a purely environmental point of view, the best option would be to modify all judicial systems that we have nowadays and change them so that they can provide for the crossborder citizen suit. Research shows that this on national levels has had the desired effect many times. Researchers believe that on an international level this would have the same effect and would lead to similar protections to environmental concerns. In reality this will be impossible since this requires drastic restructuring of old legal systems. Therefore this plan is hopeless (Grant, 1994).

#### 9. Conclusions and recommendations

Climate change is getting more serious and therefore measures have to be taken. As mentioned before Chile meets seven out of nine characteristics of the United Nations Framework Convention on Climate Change and is therefore very vulnerable to the effects of climate change. Over the past decade this has become clearer by increasing smog levels, and the evaporation of rivers, lakes and lagoons due to long and heavy droughts. This is why for Chile it was clear that something had to change and therefore when President Piñera was elected he made sure he started to change this as fast and as soon as possible. Therefore he put a ban on plastic bags, started prohibiting firewood heaters in urban areas, and with help from his predecessor Bachelet, they financially helped the households that could not afford to throw away their firewood heater and get a new more sustainable heating system. Chile has proved to be able to make the change rapidly, drastically and sustainable. It was done by smart usage of local sources and willpower. Hence Chile can be seen as example by the rest of the world.

Also with an eye on the Climate Conference of 2019 that will be held in Chile in December this year they brought together a team of professionals to discuss ways and strategies how to act as a mediator during this conference. To do so they looked at the good things and the mistakes made at former climate conferences to see what strategy works best. Also they discussed ways to coerce and convince countries that probably do not want to sign, to sign after all. However they also emphasise that it is hard to predict how other countries will act during the conference because the climate situation changed all over the world and the effects of it are much clearer to all nations now than they were during the Climate Conference in Paris in 2015.

Since the Paris Agreement was not entirely successful and in order to safe the world has to be more ambitious Chile has to make sure that the Santiago Agreement will contain more explicit goals for certain countries to reduce their pollution. Doing this they risk that the US will not sign, since that was their condition at COP21. However there are other arguments to convince the US and other opponents. One of the reasons might be to use the method the European Union was already using. The cooperating countries agree that they will not sign other agreements with countries that did not sign the Santiago Agreement. They could also take this further and threat to decrease trade with countries that did not sign yet. Also with the world's largest lithium reserves, Chile can make deals with opponents like China and the US. Then signing can become economically interesting for these countries, which might be the way to convince a businessman as Trump. In addition to that these two biggest polluters are also the two countries that suffer most from environmental disasters. Therefore by polluting more they are only shooting themselves most in the foot.

Another front that is going to be hard to convince will be the oil producing Middle Eastern countries. They will be afraid to lose their primary income source. However out of the 10 countries with the most critical level of water stress, 9 are in the Middle East. When the world does not switch to more renewable energy sources the Middle East will become uninhabitable very soon. Moreover when other countries switch to other sources, the oil demand will drop and then they would have to look for another source of income anyway. Since the Middle East has a lot of sun hours compared to other regions solar energy is the best option here. Furthermore they have plenty of space for big solar energy plants, since most of the country is uninhabited already. Therefore they can consider putting these full

of solar cells and start export solar energy, of which transport costs will be way lower than transporting oil. So the Middle East can even earn money by switching to renewable energy.

Europe already was a big proponent of a more binding agreement at COP21, so for Chile Europe might be interesting to discuss some strategies with beforehand. Here Chile can also already cut a deal with Europe and Germany in particular regarding lithium for the European car industry, so that once COP25 starts Chile already has a group of countries to rely on during the negotiations.

The last group of countries that Chile needs to convince are the other developing poorer countries. Chile itself is also considered a developing nation, be it that it is not considered amongst the poorer countries. Chile shows that a developing country still is able to achieve a lot on its own, even in a small timeframe. Every country is suitable for at least one kind of renewable energy. They just have to look which source their country suits best. Therefore even poorer nations can make a start of becoming more environmentally friendly. The Paris Agreement contained a paragraph which says that richer countries have to provide support where the poorer countries lack resources for themselves. This support can be financially but also by transferring knowledge and technology.

For every doubting or refusing country there are arguments to persuade them. However Chile is still going to have an incredibly hard job as chairman since the discussions will be fierce. But in my opinion Chile has the driving force and capacity to achieve this. When they do persuade all the other nations, the Santiago Agreement will be the most successful climate treaty so far and a serious tragedy of the commons which leads to more environmental hazards will be avoided.

Hence it might be a good idea to look at this subject again at the end of the year, both just before, during and after the Santiago Climate Conference (COP25). Then we will know with what exact strategies Chile will enter the conference and if they achieve their goals of persuading the rest. Then we will know what the outcome was of the conference and if other nations cooperated. Also then it might be interesting to look back in a few years to see if it is starting to make any difference regarding at least the air pollution since that is noticeable in the shorter run but also if it makes any difference for climate change in the long run.

Something I was not able to research anymore but that might be interesting for another researcher to look at is the possibility for an empowered international organisation like NAFTA or the EU, but only for climate Change, and if this can be implemented pragmatically. This can either be an organisation within the UN or under supervision of the UN. However this requires focusing more on laws of nations and the UN so this is why I did not focus on this. An organisation like this could then have more power and maybe have the possibility to punish polluters. However, I have no idea if this is possible or not with the current laws that countries have. Therefore this might be something a researcher specialised in Law can look at.

#### **10.** Personal reflection

Chile is an amazing country and it was interesting to see how they have changed so much in such a short time. They really are trying to make the world a better and more sustainable place. Chile made some important steps since I have left the country in early 2018. After writing this thesis and reading so much about the improvements I cannot wait to go back there to see how much they have improved with my own eyes. Looking back on the thesis there are definitely some points that could have gone better. For example I had lots of trouble with finding an interview partner because all the organisations and people I contacted refused to let me interview them. This was because of multiple reasons. Some of them did not have time or as in the case of the Dutch ministries of 'Economy & Climate' and 'Foreign Affairs' said they did not have any budget to talk with students. On the Chilean side however the problem was more that apparently the government has some kind of rule where they don't do interviews over the Internet. So here the Chilean ministry of Environment agreed on an interview under the condition that it would be in person and without recording it. Since I unfortunately was not able to travel to Chile this also was not an option. Nevertheless I was still able to do the research without these interviews by replace these by watching interviews done by professional interviewers on television. However it took me way too long switching from the idea of having interviews myself to watch professional interviews and press conferences. Therefore I am thankful that my supervisor pointed out that doing the interviews myself was not the only option to triangulate research methods and that he allowed me to substitute the interviews done by me for interviews and press conferences of others.

Also it took me long to come to my final main question and theory and therefore I did not know where to start in the beginning. All I knew in the beginning was that I wanted to write about climate problems and climate mitigation in Chile but it took me a while to bend these ideas to the main question as it is now. Especially the idea to write about COP25 came very late in the process, partly because this was not a trending topic in Chilean news and society until recently so it did not come up much earlier. Because of this I had to make a lot of progress in the last couple of weeks where this could have been less stressful if I would have moved on earlier from the problems I experienced in the beginning. Then I could have spread out the work more over the past few months and maybe would not have needed the second opportunity for the finishing touches.

Nevertheless I found it really interesting to write my thesis about this topic and I am looking forward to follow the developments around COP25 and the time afterwards. I hope Chile can do a good job mediating and hosting this big event and that the outcome will lead to a positive change for the environment.

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#### **12. Appendices**

#### **12.1.** Appendix 1: Tables of motorised vehicles in Chile

## Appendix 1.1: Number of motorised vehicles in circulation, according to type of engine and according to region in the year 2017

Número de vehículos motorizad	<u>os en circulación, p</u>	or tipo de mot	or, segun regi	<u>on. Ano 20</u>	17.
Región	Total	Bencinero	Diésel	Gas <sup>/2</sup>	Eléctrico <sup>/3</sup>
TOTAL PAÍS P/	5.079.718	3.756.138	1.313.525	9.518	537
Región de Arica y Parinacota	79.542	46.426	31.541	1.566	g
Región de Tarapacá	127.138	79.100	47.604	433	1
Región de Antofagasta	160.915	114.116	46.773	26	-
Región de Atacama	97.545	64.474	33.050	16	5
Región de Coquimbo	210.623	153.159	57.402	55	7
Región de Valparaíso	532.254	403.916	128.101	160	77
Región Metropolitana de Santiago	2.012.187	1.591.878	415.246	4.727	336
Región del Libertador General Bernardo O'Higgins	289.373	207.986	81.175	191	21
Región del Maule	349.900	242.659	106.939	272	30
Región del Biobío	550.555	403.436	146.982	101	36
Región de La Araucanía	232.911	161.562	71.317	29	3
Región de Los Ríos	94.692	65.716	28.956	17	3
Región de Los Lagos	230.188	153.964	76.180	39	5
Región de Aysén del General Carlos Ibáñez del Campo	40.972	22.314	18.647	8	3
Región de Magallanes y de la Antártica Chilena	70.923	45.432	23.612	1.878	1

Número de vehículos motorizados en circulación, por tipo de motor, según región. Año 2017.

### Appendix 1.2: Number of motorised vehicles in circulation, according to type of engine and according to region in the year 2018

Región	Total	Bencinero	Diésel	Gas <sup>/2</sup>	Eléctrico <sup>/3</sup>
TOTAL PAÍS <sup>P/</sup>	5.382.604	3.972.795	1.398.905	9.444	1.460
Región de Arica y Parinacota	85.250	50.491	33.285	1.466	8
Región de Tarapacá	133.826	82.759	50.635	419	13
Región de Antofagasta	167.406	119.352	48.015	19	20
Región de Atacama	96.892	64.051	32.819	9	13
Región de Coquimbo	225.344	164.162	61.107	55	20
Región de Valparaíso	570.922	431.540	139.070	169	143
Región Metropolitana de Santiago	2.124.481	1.670.798	448.333	4.334	1.016
Región del Libertador General Bernardo O'Higgins	304.993	218.599	86.174	181	39
Región del Maule	380.072	266.036	113.673	286	77
Región de Ñuble	142.027	99.256	42.734	25	12
Región del Biobío	434.336	324.666	109.557	62	51
Región de La Araucanía	250.033	174.332	75.659	29	13
Región de Los Ríos	102.463	70.537	31.900	14	12
Región de Los Lagos	248.528	166.359	82.131	22	16
Región de Aysén del General Carlos Ibáñez del Campo	40.995	22.289	18.697	5	
Región de Magallanes y de la Antártica Chilena	75.036	47.568	25.116	2.349	:

Fuente	P M 1 0	со	NOx	cov	SOx
Fijas					
Procesos industriales	2.8%	0.8%	4.8%	0.1%	12.1%
Calderas industriales	3.9%	1.0%	8.6%	0.2%	75.0%
Calderas de calefacción	0.0%	0.0%	0.0%	0.0%	0.0%
Panaderías	0.0%	0.0%	0.0%	0.0%	0.0%
Otras fuentes*	0.2%	0.0%	0.2%	0.0%	0.5%
Sub-total	7.0%	1.8%	13.6%	0.3%	87.6%
Otras fuentes					
Combustión doméstica	2.7%	0.9%	2.1%	0.4%	1.1%
Emisiones evap. de COV	0.0%	0.0%	0.0%	1.4%	0.0%
Solventes domésticos	0.0%	0.0%	0.0%	34.8%	0.0%
Distribución de combustible	0.0%	0.0%	0.0%	9.5%	0.0%
Emisiones biogénicas	0.0%	0.0%	0.3%	10.4%	0.0%
Incendios forestales	0.0%	0.0%	0.0%	0.0%	0.0%
Fuentes misceláneas	0.0%	0.0%	0.0%	0.0%	0.0%
Quemas autorizadas e ilegales	3.6%	3.3%	0.2%	1.1%	0.0%
Sub-total	6.3%	4.2%	2.7%	57.6%	1.2%
Fuentes móviles					
Automóviles particulares	0.4%	56.3%	20.9%	20.3%	1.3%
Automóviles comerciales	0.7%	18.9%	8.6%	9.9%	1.4%
Taxis	0.1%	13.2%	6.8%	4.6%	0.5%
Camiones	1.9%	1.1%	12.5%	2.3%	2.3%
Autobuses	3.4%	2.4%	33.4%	3.4%	5.7%
Motocicletas	0.0%	1.5%	0.0%	1.5%	0.0%
Off-Road*	0.1%	0.5%	1.4%	0.0%	0.0%
Sub-total	6.6%	94.0%	83.7%	42.0%	11.3%
Polvo resuspendido					
Caminos pavimentados	66.3%	0.0%	0.0%	0.0%	0.0%
Caminos no pavimentados	10.4%	0.0%	0.0%	0.0%	0.0%
Actividades agrícolas*	0.2%	0.0%	0.0%	0.0%	0.0%
Construcción y demolición*	3.3%	0.0%	0.0%	0.0%	0.0%
Sub-total	80.2%	0.0%	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

#### 12.2. Appendix 2: Percentages of emission categories in Santiago de Chile in 1998

\*Estas son las nuevas categorías de fuentes agregadas al inventario de la Universidad de Chile.

In the table above the percentages of emission for each category of emission determined by Universidad de Chile in 1998. Fuentes móviles (= mobile sources) shows the urban transport percentages (O'Ryan & Larraguibel, 2000).

#### 12.3. Appendix 3: Global National Water Stress Rankings

WORLD RESOURCES INSTITUTE National Water Stress Rankings					
EXTREMELY HIGH BASELINE WATER STRESS					
1. Qatar 2. Israel 3. Lebanon 4. Iran 5. Jordan	6. Libya 7. Kuwait 8. Saudi Arabia 9. Eritrea	10. United Arab Emirates 11. San Marino 12. Bahrain 13. India	14. Pakistan 15. Turkmenistan 16. Oman 17. Botswana		
HIGH BASELINE WATER STRESS					
18. Chile 19. Cyprus 20. Yemen 21. Andorra 22. Morocco 23. Belgium 24. Mexico	25. Uzbekistan 26. Greece 27. Afghanistan 28. Spain 29. Algeria 30. Tunisia 31. Syria	32. Turkey 33. Albania 34. Armenia 35. Burkina Faso 36. Djibouti 37. Namibia 38. Kyrgyzstan	39. Niger 40. Nepal 41. Portugal 42. Iraq 43. Egypt 44. Italy		
MEDIUM-HIGH	I BASELINE WAT	ER STRESS			
45. Thailand 46. Azerbaijan 47. Sudan 48. South Africa 49. Luxembourg 50. Australia	51. Tajikistan 52. Macedonia 53. South Korea 54. Bulgaria 55. Mongolia 56. China	57. Guatemala 58. Estonia 59. France 60. Kazakhstan 61. Mauritania 62. Germany	63. Lesotho 64. Denmark 65. Indonesia 66. Peru 67. Venezuela 68. Cuba		
LOW-MEDIUM BASELINE WATER STRESS					
69. North Korea 70. Romania 71. United States 72. Zimbabwe 73. Dominican Republic 74. Haiti 75. Japan 76. Angola	77. Sri Lanka 78. El Salvador 79. Tanzania 80. Netherlands 81. Ecuador 82. Lithuania 83. Philippines 84. South Sudan	85. Ukraine 86. Poland 87. Chad 88. Senegal 89. United Kingdom 90. Georgia 91. Nigeria 92. Argentina	93. Czech Republic 94. Russia 95. Bolivia 96. Ethiopia 97. Bosnia and Herzegovina 98. Swaziland 99. Moldova 100. Somalia		
LOW BASELIN	E WATER STRES	S			
<ul> <li>101. Rwanda</li> <li>102. Liechtenstein</li> <li>103. Guinea-Bissau</li> <li>104. Mozambique</li> <li>105. Vietnam</li> <li>106. Kenya</li> <li>107. Costa Rica</li> <li>108. Canada</li> <li>109. Serbia</li> <li>110. Zambia</li> <li>111. Switzerland</li> <li>112. Brazil</li> <li>113. Hungary</li> <li>114. Ghana</li> <li>115. Belarus</li> <li>116. Modagasear</li> </ul>	118. Colombia 119. Myanmar 120. Belize 121. Montenegro 122. Malawi 123. Mali 124. Finland 125. Slovakia 126. Ireland 127. Sweden 128. Bangladesh 129. Cambodia 130. Burundi 131. Latvia 132. Malaysia 133. Honduras	<ul> <li>135. Uganda</li> <li>136. Panama</li> <li>137. Nicaragua</li> <li>138. Guinea</li> <li>139. Benin</li> <li>140. Croatia</li> <li>141. Papua New Guinea</li> <li>142. New Zealand</li> <li>143. Democratic Republic of the Congo</li> <li>144. Côte d'Ivoire</li> <li>145. Cameroon</li> <li>146. Gambia</li> <li>147. Laos</li> <li>148. Central African Republic</li> <li>149. Siama Laono</li> </ul>	150. Paraguay 151. Uruguay 152. Togo 153. Norway 154. Republic of Congo 155. Bhutan 156. Timor-Leste 157. Brunei 158. Gabon 159. Equatorial Guinea 160. Guyana 161. Iceland 162. Jamaica 163. Liberia 164. Suriname		

Note: This is based on UN member countries. Palestine is a non-member observer and would place between Lebanon and Iran. Some small island nations could not be added to the rankings because of limitations of the model. Scores for these countries are available separately. Source: wriorg/aqueduct