Spring 2018

Tourism in Iceland: Individual Carbon Footprint and the Potential to be Carbon Neutral

Ange-Elise Venet
SIT Study Abroad

Tourism in Iceland: Individual Carbon Footprint and the Potential to be Carbon Neutral

Ange-Elise Venet
(venet002@cougars.csusm.edu)
SIT Study Abroad
Iceland and Greenland: Climate Change and the Arctic

Acknowledgements:

I would first like to thank my parents, Lia and Philippe Venet for providing me with this wonderful experience (SIT Study Abroad: Climate Change and the Arctic). In addition, I would like to thank Dan Govoni and Alex Tyas for their continuous support and efforts in facilitating my experiences and learning here in Iceland. I would like to thank Þröstur Eysteinsson for the inspiration he gave me and the connections he provided. I am grateful to Hrafn Óskarsson and Lucile Delfosse for their endless knowledge and support throughout my research. Mert Kocyigit for his patience and willingness to listen to my never-ending stream of emotions, highs, lows and frustrations. Finally, I would like to thank my big brother Téva Venet, for always showing me what is possible in the world.

Abstract:

World population has increased decade after decade and tourism is following the same trend. Tourism in Iceland is no exception, expanding each year. Most human actions have adverse effects on the planet, including travel. As traveling amongst humans increases so will tourism emissions. It is important to be aware of the impacts our actions have and the options available to make it better. Since carbon emissions for travelers are inevitable, this research has calculated the cost of offsetting those emissions through afforestation in Iceland. Most imagine a heavy financial burden to offset emissions but in reality, most visitors would only require an 8-24 USD contribution. The issue faced is lack of mitigation options. With a minimal financial burden on tourists, Iceland only lacks the resources for carbon neutral tourism.

Table of contents

Abbreviations:

CF - carbon footprint
CO_2 - carbon dioxide
FF - fossil fuels
GHG - greenhouse gas(es)
ha - hectare
ISK - Icelandic Krona
ITB - Icelandic Tourist Board
kg - kilograms
ppm - parts per million
UN - United Nations

Definitions:

Carbon footprint- A measurement that represents the total amount of carbon dioxide emitted as a direct or indirect result of an individual, organization or community.

Pollution- A harmful or poisonous substance(s) added to an environment at a rate which is not able to be handled resulting in the accumulation of the substance(s).

Carbon sequestration- The storage of carbon naturally or artificially and for both long and short periods of time. Plants, soil and the ocean are the main carbon sequesters of the planet.

Afforestation- The effort of transforming an area with no trees into a forest. Simply put, the planting of trees.

Organizations:

Skógræktin- Translates to, Icelandic Forest Service. This is a government agency, responsible for overseeing the environment, natural resources and development of forestry in Iceland.

Skógræktarfélag Íslands - Also known as the Icelandic Forest Association. Founded in 1930, there are now 60 associations all around Iceland, open to the public. There are about 7000 members; associations range from 10 members to 1,500 members.

Landvernd- An association under Skógræktarfélag Íslands; founded in 1969. Their focus is on nature conservation with a concentration on soil and vegetation.

Kolviður- Translates to ICF, Icelandic Carbon Fund. The fund was set up by Landvernd and Skógræktarfélag Íslands. The mission is to reduce the amount of CO_2 in the atmosphere.

Ferðamálastofa- Translates to Icelandic Tourist Board (ITB). Ferðamálastofa is an administrative body that works to uphold the Tourism Act passed in 2005. Everything relating to tourism is under their umbrella. Their website contains all numbers pertaining to tourism in addition to surveys conducted involving tourists in Iceland.

Introduction:

Most humans have a desire to explore and see the world. A desire that has been in our species for as long as humans have roamed the earth. Our history is one of exploration and discovery; first documented on cave walls, now through maps, books and smartphones. Man has explored most places on this planet, and with globalization, places are becoming more accessible. Once explored by few, now explored by many.

In the early 1800's the world population hovered around one billion, now the population exceeds seven billion (United Nations, 2015). According to *World Population Prospects: The 2015 Revision, Key Findings and Advance Tables,* the world population is expected to exceed 11 billion by 2100 (2015). As the world's population grows, tourism grows and is well documented by Ferðamálastofa.

The most common modes of transport are car, plane, train and boat (ITB, 2012). These forms of travel add to the demand for infrastructure and require the addition of roads, railways, fueling stations, bus stops, restaurants, hotels, airports, etc. All these additions also demand maintenance and staff. As population and tourism grow, so will the demand for infrastructure. Both building infrastructure and tourism are fossil fuel heavy, polluting the atmosphere. As these two activities increase so should their mitigation.

With an increased living standard, more tourism traffic and the addition of infrastructure, more GHG are released into the atmosphere each day. These additions only add to the increase in average atmospheric temperature. As the world faces an overall average temperature increase, the addition of GHG will only exacerbate the issue. For centuries, carbon dioxide levels never exceeded 300 ppm however, the current CO_2 level is 410.31 ppm (CO_2 Earth, 2018). Many world leaders have started talking about and taking action in regards to climate change. With the end of the Paris Agreement coming near (2020), the 195 signers will be assessing their current state and progress made on the personal national goals set at the 21st Conference of the Parties of the UNFCCC and since.

It is undeniable that the earth's climate is changing (Huijbens, 2009). Every action we humans take can either advance or hinder our progress in relation to climate. A great way to keep track of our individual impact is through our carbon footprint. Online CF calculators are available and they help bring awareness to the effects our actions have on the environment. This

paper proposes a new way to travel, aware of our personal CF and with the option to offset our emissions. This paper introduces a guilt-free way of traveling to Iceland.

In this paper, the average Iceland tourist carbon footprint will be outlined. In addition, the estimated cost and options for mitigation.

This study will address:

1. What is the average carbon footprint of a tourist visiting Iceland?
2. What are possible mitigation options?
3. How much would it cost for an individual tourist to offset his/her personal carbon footprint from travel emissions?
4. What programs are already in place to help offset tourism carbon emissions?
5. What more can be done?

Literary review:

The primary research referred to in this study is, *Estimated Carbon Footprint of foreign tourists in Iceland - a bottom-up analysis of direct CO_2 emissions* by Viðar Jökull Björnsson. The thesis addresses the importance of calculating the CF of tourists to properly address the issues that will arrive through the growing industry. In addition, this is the first study to address the CF of tourists in Iceland. The goal is to spark a conversation, to educate and inspire individuals and companies to be aware and take action for their emissions.

Most of Viðar's data originated from the ITB 2012 survey conducted in the Summer of 2011. The survey was answered by 2,359 out of the 4,545 people asked (51.9%) (ITB 2012). The survey used was from summer months because that is peak season for tourism in Iceland. The difference in activities participated in throughout the different seasons is briefly addressed. With limited time, the summer season is focused on because it accounts for the majority of Iceland's tourism.

The study attempts to help individual tourists and tourism businesses see the harmful effects they have on the places they are profiting from. Using the survey described above, the average CF of tourist are calculated. The categories first addressed are income and age. People with more income are observed to be older while people with lower income are found to be younger. From there, three hypothetical tourism scenarios are created and calculated focusing on transportation, accommodation and attractions/activities.

A low consumption tourist is assumed to be around 27 years old, traveling with their spouse. They are considered to be a student arriving by ferry from mainland Europe. They take public buses around the country traveling 1,401 km; enjoy museums and whale watching during their 16-night stay.

Transportation - international (694.5 kg CO_2)
Transportation - domestic (82.7 kg CO_2)
Accommodation (3.13 kg CO_2)
Attractions / Activities (4.13 kg CO_2)
Total = 784.46 kg CO_2

A medium consumption tourist is assumed to be around 39 years old traveling with their spouse. They identify as professional or possessing a special skill set. They arrive by plane from the center of mainland Europe and rented a car (Ford Fiesta). They travel 2,007 km and enjoy geothermal swimming pools, museums, and whale watching during their 11-night stay.

Transportation - international (427.8 kg CO_2)
Transportation - domestic (118.7 kg CO_2)
Accommodation (2.06 kg CO_2)
Attractions / Activities (4.18 kg CO_2)
Total = 552.74 kg CO_2

A high consumption tourist is assumed to be 47 years old traveling with their spouse. They identify as a professional or manager. They are assumed to arrive by plane from New York and rented a car (Ford Explorer). Traveling 1,768 km, they enjoy geothermal swimming pools, museums, whale watching and a snowmobiling trip during their 7-night stay.

Transportation - international (723.0 kg CO_2)
Transportation - domestic (393.0 kg CO_2)
Accommodation (1.45 kg CO_2)
Attractions / Activities (22.14 kg CO_2)
Total = 1,139.59 kg CO_2

Viðar concluded that a low consuming tourist emits 39.2 kg of CO_2 per day, medium consuming tourist emits 50.2 kg of CO_2 per day and a high consuming tourist emits 162.8 kg of CO_2 per day. This was the first study to calculate the average individual tourist CF in Iceland.

Paving the way for an upcoming trend and movement, this thesis was found extremely valuable for this study.

Objectives:

The objective of this paper is to understand the carbon footprint of the average tourist in Iceland and how the emissions can be mitigated. This paper explores how travelers can enjoy their travels and not feel guilty for harming the environment. This will be achieved by quantifying the carbon footprint of the average tourist in Iceland, done by Björnsson with the addition of a personal CF of my SIT study abroad experience. Then the focus will shift to forestry, the practices underway and how trees can be purposefully planted with tourist CF in mind. Most importantly, the main objective is to understand the cost of offsetting the individuals CF.

Justification:

Tourism emissions affect not only the countries traveled to but also people who choose not to travel and places not traveled to. GHG add to global temperature increase and will be felt by everyone. Unfortunately, areas and nations that contribute the least will be the first to feel the effects or will suffer more. Myanmar and Haiti are amongst the top three on the long-term climate risk index (Kreft et al, 2012). These countries contribute a fraction of what large countries like the China, US, and Russia emit yet these small nations have already been feeling the burden of climate change.

In a world where we struggle to support one another in terms of refugees from political unrest, I suggest we work toward finding a way to minimize the climate refugees we are destined to see as the effects of climate changes increase; the change in human and natural systems, sea level rise, increase tropical storm intensity and frequency, extreme drought and increased extreme precipitation patterns (IPCC, 2014). If we are able to find ways to mitigate for our individual addition to the issue, I believe it is my personal responsibility to add to the solution. Here I plan to offer an alternative to everyday travel. As a traveler, I am personally addicted to the desire of exploring new countries and their cultures. As an environmentalist, I often struggle with the knowledge that this love for travel is harming that very same love through the degradation of nature and the cultures I wish to experience. This paper will expose the carbon footprint of the average tourist in Iceland, and the option to take personal responsibility for these

emissions through the potential of monetary funding or time and labor to the forestry community here in Iceland. Trees are known to inhale carbon and exhale oxygen, so why not plant them to offset our CF?

Context:

Research on human impacts on the earth is growing. There have been numerous publications on sustainable tourism and carbon footprints. Here in Iceland, experts in the forestry field such as Þröstur Eysteinsson and Arnór Snorrason, have written multiple papers spanning from genetic breeding to the carbon sequestration. This study builds off previous studies while filling in some of the missing gaps. Papers on forestry, carbon sequestration, and tourism are easy to find however, papers that piece them all together do not exist. This is the first paper to address both CF and mitigation in Iceland in-depth on the same pages. I hope this will add to the conversation and create a deeper understanding of the harms we cause in addition to inspiration for solutions easily obtainable. The results can be a starting point for businesses to add an optional carbon charge with an explanation of where the money goes. This paper, if it reaches the individual tourist, will demonstrate the simplicity of offsetting their emissions. Contributing to a fund or planting trees can enrich the overall experience here in Iceland. Thus leaving the country the same if not better than when the individual arrived.

Ethics:

While conducting this study, I was as ethical as possible. When emailing people engaged in forest work, I was respectful and transparent in regards to my intentions. Everyone I emailed or met was over the age of 18 and was aware of the study and its objectives. Time and information were volunteered by individuals willingly, and meetings were informal and mainly used to understand forestry companies, organizations and projects here in Iceland. Some study findings were also shared in meetings and are properly cited in the study.

Methods:

The project was inspired after watching, *Afforesting Iceland - a cause for optimism* (EUFORGEN, 2017). This video, produced by the European Forest Genetic Resources Programme, is narrated by Þröstur Eysteinsson. An email to Þröstur helped solidified the subject of research. Emails were sent to people working in forestry, identified through the government website, www.skogur.is.

Connections were made with:

Kristján Jónsson	Ísafjörður
Bjarki Þorkjartansson	Mógilsá
Björn Traustason	Mógilsá
Arnór Snorrason	Mógilsá
Ragnhildur Freysteinsdóttir	Reykjavík
Hrafn Óskarsson	Tumastaðir
Lucile Delfosse	Tumastaðir
Þröstur Eysteinsson	Laugarvatn

Through connections, people were recommended, articles and papers were sent, ideas and facts were shared. Personal interest sparked several hours of research which had a snowball effect. Many company websites were the starting point; skog.is, kolvidur.is, landvernd.is, and islandsstofa.is. Most websites were originally in Icelandic; the web browser, google chrome version 66.0.3359.181, was used for translation.

After reading, *Tourism in Iceland in Figures, June 2017,* an email was sent to the author Oddný Þóra Óladottir asking for more details or resources (Óladóttir, 2017). Oddný responded with a thesis titled, *Estimated Carbon Footprint of foreign tourists in Iceland* by Viðar Jökull Björnsson (Björnsson, 2014). This thesis is the main data built upon in this study. He created three hypothetical scenarios for average tourists visiting Iceland. Refer back to literary review for more detail on the three scenarios.

Low consumption: 784.46 kg CO_2

Medium consumption: 552.74 kg CO_2 *

High consumption: 1,139.59 kg CO_2

*Overall medium consumption is lower than low consumption tourist because of the duration of their stay. Refer to literary review for further explanation (pg 6)

These figures are used in future calculations to estimate the cost of offsetting these emissions through afforestation. In addition to the three hypothetical tourist CF, a personal CF is calculated for my study abroad experience in Iceland. This CF includes the same four sections as Viðar's thesis outlined in the literature review above.

International transportation includes flights from, Los Angeles to Keflavík, Reykjavík to Nuuk, Nuuk to Reykjavík, Akureyri to Grímsey, Grímsey to Akureyri and Keflavik to San Francisco. To find the kilometers traveled and CO_2 emitted, applications.icao.int/icec was used.

Domestic transportation was found through calculating the kilometers traveled through google maps. The route goes as follows; Keflavík, Reykjavík, Akureyri, Ísafjörður, Reykjavík, Tumastaðir, Reykjavík, and the entire ring road (road 1). This totaled 3,332 km traveled. To find the CO_2 emitted the resulted from Viðar ´s thesis were used. The medium scenario was used to not under or overestimate emissions. The total emissions from the medium domestic travel, 117.4 kg CO_2 was divided by the total distance the medium tourist was assumed to have traveled, 2,007 km. The resulting number 0.0585 was then multiplied by my estimated domestic travel, 3,332 km giving the total emissions of 194.91 kg CO_2.

Accommodations were determined with the calculations from Viðar ´s study. Emissions from hostels and similar accommodations were estimated to be 0.20 kg per night. From the 16th of February until the 28th of May, there are 102 nights. Therefore, 0.20 kg CO_2 $\times$102 nights = 20.4 kg CO_2.

Finally, attractions were added using the CO_2 emissions mentioned in Viðar ´s thesis. Ten visits to geothermal swimming pools, five visits to museums, one snowmobile trip and a round trip to Vestmannaeyjar were added [0.05(10) + 0.08(5) +17.96(1) + 5.75(20 + 5.75(2) = 30.36 CO_2].

Transportation (international) - 1,092.5 kg CO_2
Transportation (domestic) - 194.91 kg CO_2
Accommodation - 20.4 kg CO_2
Attractions/Activities - 30.36 kg CO_2

All the calculations are estimates; it is impossible to be pinpoint accurate when referring to carbon footprint calculations. When given the chance, numbers were rounded up or overestimated for domestic transportation because carbon calculations are most often underestimations. The last example is added to illustrate where my SIT study abroad experience compares to the three hypothetical tourist CF created by Viðar. This is a way to check his work but also understand my personal impact.

I interned at Tumastaðir from the April 25th until May 16th. I helped Hrafn Óskarsson and Lucile Delfosse with whatever was necessary; watering trees, repotting trees, cleaning containers, filling containers with soil, mixing soil, and trimming branches to name a few. On average eight hours were spent a day working, asking questions and learning about Icelandic forestry.

Hrafn being in forestry and speaking the native tongue, volunteered to make calls to tree nurseries around Iceland. Two nurseries were contacted, Sólskógar in Akureyri and Kjarr Efh near Selfoss. Both persons reached were friends of Hrafn from his studies at Landbúnsðarháskóli Íslands, located in Hveragerði. Over the duration of the calls, prices were given for different species of trees; birch, spruce, pine, poplar and larch. For this study, the focus is placed on native birch and spruce, mainly Sitka Spruce. I visited Sólskógar in Akureyri to verify the prices given.

Þröstur shared averages for carbon sequestration, tree species, and quantity of seedlings per hectare of land referred to by the Icelandic forestry community (personal communication, May 9, 2018). Arnór shared specific numbers for carbon sequestration from his research (personal communication, May 18, 2018). This includes the carbon sequestration from an individual tree, surrounding soil and plant litter.

All the data compiled were then used to calculate the average cost for low, medium, high, and personal footprint to be offset. To determine the amount of carbon sequestered $tree^{-1}$ $year^{-1}$, I divided the amount of carbon sequestered ha^{-1} by the number of trees (Equation 1). This equation is used multiple times to find the difference in tree species sequestering abilities. To determine the amount of carbon sequestered $tree^{-1}$ over its lifetime, I multiplied the amount of carbon sequestered $tree^{-1}$ $year^{-1}$ by 50 years to account for the trees assumed lifetime (Equation 2). This equation is used twice to find the difference between tree species lifetime projections. To determine the number of trees needed to offset the estimated emissions of an individual tourist, the total emissions $person^{-1}$ was divided by the amount of carbon sequestered $tree^{-1}$ for its whole lifetime (Equation 3). The equation is used four times per consumer category to compare the difference between birch and spruce sequestration abilities. To determine the price of an individual tree, the price of a birch container containing 40 trees, is divided by 40 (Equation 4) and the price of a spruce container containing 24 trees, is divided by 24 (Equation 4 ½). Tree nurseries do not sell individual seedlings, only containers. To determine the total price of offsetting an individual tourist's CF, the results from equation 3 and 4 are multiplied together (Equation 5).

The number of trees is always rounded up because we cannot plant a portion of a tree. This equation is used two times per consumption category to compare the difference in price depending on the species of tree selected.

Equation 1	$kg\ of\ CO_2\ ha^{-1} \div trees\ ha^{-1}$
Equation 2	$kg\ of\ CO_2\ tree^{-1} year^{-1} \times 50\ years$
Equation 3	$kg\ of\ CO_2\ person^{-1} \div kg\ CO_2\ tree^{-1} 50\ years^{-1}$
Equation 4(B) and 4 (S)	(B) $container\ price\ ISK \div 40$ (S) $container\ price\ ISK \div 24$
Equation 5	$number\ of\ trees \times price\ of\ individual\ tree$

These five equations were used to calculate low, medium, high and personal emission offset cost. The findings are the final result of the study which are expressed numerically in the following section.

Results:

According to Þröstur, there are about 3,500 trees on one hectare of forest (personal communication, May 9, 2018). This number takes seedling mortality into consideration. This is assumed to be a forested area with no one specific species of trees. Native birch sequesters 3.1 tons of CO_2 while Sitka Spruce sequesters 8.3 tons (A. Snorrason, personal communication, May 18, 2018). He also shared that soil sequesters 1.34 tons of CO_2 while plant litter sequesters 0.52 tons of CO_2.

Birch sequesters a total of 4.96 tons $CO_2\ tree^{-1} year^{-1}$ and Sitka Spruce 10.16 tons $CO_2\ tree^{-1} year^{-1}$. Low consuming tourists with emissions of 784.46 kg $CO_2\ person^{-1}$ are found to need 12 birch trees or 6 spruce trees. This would cost 1,320 ISK if birch were selected and 1,440 ISK if spruce were selected. Medium consuming tourists with emissions of 552.74 kg $CO_2\ person^{-1}$ are found to need 8 birch trees or 4 spruce trees. This would cost 880 ISK if birch were selected and 960 ISK if spruce were selected. High consuming tourists with emissions of 1,139.59 kg $CO_2\ person^{-1}$ are found to need 17 birch trees or 8 spruce trees. This would cost 1,870 ISK if birch were selected and 1,920 ISK if spruce were selected. Finally my personal CF, SIT study abroad student, Climate Change and the Arctic Spring semester, with emissions of 1,338.17 kg $CO_2\ person^{-1}$ are found to need 19 birch trees or 10 spruce trees. This would cost 2,090 ISK if birch were selected and 2,400 ISK if spruce were selected

Discussion:

The earth is undeniably warming (IPCC, 2014) and tourism is inescapable increasing (ITB, 2012). Emissions will continue to rise until we as a collective species participate in

lifestyle change or start mitigating and taking action for our emissions. Iceland has the capability to take responsibility for their tourism emissions and start mitigating.

With the maximum calculated carbon offset reaching 2,400 ISK, 25 USD, I see many individuals willing to make a financial sacrifice to preserve what was experienced. The goal is not to create a large financial revenue, it is to start conversation and education around personal impacts on the planet. The end result in some individuals paying to actualize this carbon neutral travel option would be an added bonus.

The results above express a minimal financial burden to offset travel emissions however, the issue of implementation arises. There are currently a few projects underway to offset carbon, Kolviður, Landvernd CARE program, and potentially an agreement signed between Skógræktin and Landskógur. None of these programs have made significant progress in the overall emissions from foreign tourists visiting Iceland.

Kolviður is a carbon fund which seems to mainly be used by local individuals and businesses in Iceland. Landvernd has a pilot program underway to give visitors the opportunity to give back to nature through planning native birch trees (Landvernd Umhverfisverndarsamtök, 2017). Finally, the agreement signed in August 2017 between Skógræktin and Landskógur does not seem to be going anywhere according to Þröstur (personal communication, May 11, 2018).

My calculations show that offsetting a trip is financially reasonable for all financial backgrounds. The maximum price to offset emissions is 2,400 ISK (about 25 USD). This does not seem to be asking too much and would be voluntary based.

Currently, tourist can pay the amounts listed above to Kolviður or participate in the CARE program. These two options are not heavily advertised and are not visible to the majority of tourists in Iceland. I recommend that Kolviður starts advertising or making partnerships with airlines and rental car companies to have the option visible at the time of payment for foreign visitors. This would first make tourists aware that they have a CF and second, give them the opportunity to offset or not.

Iceland has the opportunity to create carbon neutral tourism. There are only a handful of airlines and car rental companies all within reach. If Kolviður or Skógræktin took the first steps to get the program in place, funds would flood in. This would help the mission of afforestation and sparks optimism for forestry in Iceland.

Although my study only demonstrates a hypothetical offset price, I do believe this is very possible for tourism and forestry in Iceland. I hope someone will be inspired enough to be the change needed and make this vision possible for Iceland.

Conclusion:

The main objective of this research was to identify individual tourist CF in Iceland and find the cost of mitigation through afforestation. It is clear that the financial burden is minimal however the feasibility of current individual tourist mitigation is unlikely. There are programs starting to create the mitigation opportunities but nothing at the necessary scale. Tourist first must be aware of our CF, we must have the desire to offset our emissions, and finally, there must be programs in place for the ideas to be actualized. The concept of offsetting emissions was once daunting and unappealing but now seems fathomable. With a green shift in current culture, I believe if given the opportunity some people would choose to contribute to the preservation of what they are going to or just have experienced.

I acknowledge the presence of mistakes are inevitable because I am human. However, I have done my best to avoid their presence. If mistakes are realized I would appreciate criticism and suggestions for improvements. I intend to research more on the subject of neutralizing carbon from travel in the future. I am aware of the limitations of this study; a short time frame (five weeks), a language barrier, and minimal transportation. This study was carried out to the best of my ability.

References:

Björnsson, V. J. (2014). *Estimated Carbon Footprint of foreign tourists in Iceland– A bottom-up analysis of direct CO_2 emissions.* Retrieved from Óladóttir, O. Þ [email].

CO_2 earth. (2018). Earth's CO_2 home page. Retrieved from https://www.co2.earth/.

Gössling S, Peeters P, Ceron J, Dubois G, Patterson T, Richardson R. The eco-efficiency of tourism. *Ecological Economics* [serial online]. September 15, 2005;54(4):417-434. Available from: Academic Search Premier, Ipswich, MA. Accessed May 12, 2018.

Cadarso M, Gómez N, López L, Tobarra M. Calculating tourism's carbon footprint: measuring the impact of investments. *Journal Of Cleaner Production* [serial online]. January 17, 2016;111:529-537. Available from: Academic Search Premier, Ipswich, MA. Accessed May 12, 2018.

Huijbens, E. H. (2009). Book Reviews: Tourism and Climate Change Mitigation, Methods, Greenhouse Gas Reductions and Policies. *Ecological Economics*, *68*(4), 1268-1269. doi:10.1016/j.ecolecon.2008.07.028.

HUDSON, K., & LEE, D. (2010). Biodiversity and Tourism: A valuable relationship. *Social Alternatives*, *29*(3), 39-43.

IPCC, 2014: Summary for policymakers. In: Climate Change 2014: Impacts,Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

ITB (2012). Icelandic Tourism Board. Numbers and Publishings – Surveys and Researchs – Travel Behaviour of foreign Tourists. Survey among foreign tourists in Iceland, summer 2011.

Kreft, S., Eckstein, D., & Melc, I. (2016). Global Climate Risk Index 2017: Who suffers most from extreme weaher events? Weather-relared Loss Evens in 2015 and 1996 to 2015. Germanwatch. Retrieved from https://germanwatch.org/fr/download/16411.pdf.

Landvernd Umhverfisverndarsamtök. [Username]. (2017). *CARE: Græðum Ísland*. [Video File] Retrieved from http://landvernd.is/care.

Óladóttir, O. Þ. (2017). Tourism in Iceland in Figures: June 2017. Icelandic Tourist Board. Retrieved from, https://www.ferdamalastofa.is/en/recearch-and-statistics/tourism-in-iceland-in-figures.

United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP.241.

United Nations Treaty Collection. (2018). Status as at : 10-05-2018 05:00:28 EDT. Retrieved from, https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=_en.

Wiedmann, T. & Minx, J. (2008). A Definition of 'Carbon Footprint'. In: C. C. Pertsova, Ecological Economics Research Trends: Chapter 1, pp. 1-11, Nova Science Publishers, Hauppauge NY, USA.

EUFORGEN. [Username]. (2017). *Afforesting Iceland - a cause for optimism.* [Video File] Retrieved from https://www.youtube.com/watch?v=-hgAf8awLmQ&t=3s.

ICAO Carbon Emissions Calculator. Retrieved from http://applications.icao.int/icec.