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Carbon Can't Buy Happiness: An Analysis of Ecological Footprints and Happiness of University Students in the City of David, Panama

Samantha Burlager
SIT Study Abroad

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Abstract

Global climate change is perhaps the most pressing issue our world faces today. Greenhouse gas emissions reductions are urgently needed, however, there is currently a lack of action due to the fear that a reduction in the ecological footprint will lead to a reduction in GDP and happiness levels of a society. Increasing GDP and economic progress are equivocated with increasing happiness and overall well-being of society. However, based on the literature I discuss in this paper, instead of GDP, an objective measurement of happiness is a better indicator of success. In this paper, I investigate the ecological footprints (in order to quantify consumption) of university students in David, and compare their footprints to happiness level data; through this analysis, I am able to determine if a reduction in consumption (as measured by ecological footprint) equivocates a reduction in happiness. This information is useful because if a reduction is not equal to a reduction in happiness, as the indicator of GDP would suggest, there are important individual and policy implications. I further examine the Happy Planet Index of these subjects, analyzing how well university students in David can produce happy, healthy, sustainable, lives. In this paper, I first briefly review the literature regarding the relationship between ecological footprints and happiness. Next, I describe the methods I use in order to research my question and complete my objectives, and analyze the empirical data I gathered. I explore the ecological footprints of university students in David, as well their happiness levels, and examine the relationship between the two variables. I also examine their Happy Planet Indices, and compare this index to national and international data. I conclude with a discussion of the data, addressing potential strengths and weaknesses of my study, and outline areas for future research.

Sumario Ejecutivo (Español)

El cambio en el clima mundial es el problema más importante a nuestro generación. Los reducciones en los emisiones de carbono son muy importantes y necesarios, sin embargo, ahora hay una falta de acción porque países usan el indicador de GDP para definir éxito. Países tienen miedo que si trabajarían a reducir sus huellas ecológicas, empresas vayan a perder dinero. Sin embargo, en este ensayo, voy a discutir que nosotros podemos usar un indicador objetivo de felicidad para definir éxito. Diferente del indicador tradicional GDP, creo que la felicidad no es corleado en una manera significado a las huellas ecológicas. En este ensayo, investigo la huella ecológica de los estudiantes universitarios en tres universidades in David, Chiriquí, Panamá, y examino el relación entre felicidad y las huellas ecológicas. También, examino el Índice de la Planeta Feliz de estas temas, y analizo sí los estudiantes produce vidas felices,, saludables, y sostenibles.

En este ensayo, primerio, hice una reseña de la literatura sobre el cambio del clima, el indicador de felicidad, huella ecológica, y el relación entre los dos. Luego, yo describo los métodos que uso para descubrir información sobre mi tema, y completar mis objetivos, y analizar los datos empírica que obtuve. Explorar los huellas ecológicas de los estudiantes de David, y sus niveles de felicidades, y examino el relación entre los dos variables. También, examino sus Índices de Planeta Feliz, y comparar este índice a datos nacional e internacional. Concluyo con un discusión de los datos, y explicar cosas Fuertes y problemas con mi estudio, y explicar áreas que necesita más examinación.

Acknowledgements

I would like to give thanks to many people on this project. I would like to thank Ruben, for being there for me to ask questions and bounce ideas off of, and Nicole and Yari for providing great support during my time on this program. I would also like to thank my host family here in David; they were very supportive and helpful throughout my ISP process, and I really enjoyed living with them. I need to thank my family in Minnesota, for supporting me and allowing me to study abroad in Panama. I would also like to thank my friends on the SIT program, for letting me vent about the problems I encountered with my ISP. I would also like to thank my friends from home, especially my roommates, Ronit and Anne Marie, for supporting me through this project, with a special thanks to Ronit for answering my statistics questions. And of course, I need to thank my subjects, the university students, for taking my surveys and bearing with me through this process.

Table of Contents

Introduction

Global climate change is perhaps the most pressing issue our world faces today. With unprecedented greenhouse gas emission levels, the atmosphere is trapping more heat, causing global temperatures to rise. Although a difference of a few degrees does not seem like a great deal, even a small increase can dramatically alter ecosystems and life, as we currently know it. In order to combat climate change, greenhouse gas emissions urgently need to be reduced;

continuing on the same trajectory of emissions is unsustainable, and will have catastrophic impacts for future generations.

Delegates from around the world have come together to discuss this issue, and develop strategies to solve the crisis. However, all of these talks have had limited success, due to rampant fears—especially among the biggest polluters—that a reduction in carbon emissions is equivalent to a reduction in gross domestic product (GDP), consumption, and economic growth. Currently, the measure of a successful economy, and overall well-being of a society is GDP; countries fear that if they work to reduce their ecological footprint, businesses will be negatively impacted, and profits will be reduced. When asked why the United States did not ratify the Kyoto Protocol, in 2005, former president of the United States, George W. Bush, stated, "Kyoto would have wrecked our economy. I couldn't in good faith have signed Kyoto" (NBC). Currently, GDP is equivocated with happiness and well-being: a reduction in consumption equals a reduction in happiness.

GDP is the widely accepted measure of a successful economy, however, as more and more studies are finding, increased levels of consumption and GDP does not reflect increased levels of happiness and wellbeing. This semester, with SIT Panama, I had the opportunity to visit a number of families throughout Panama. Most, if not all, of the families have a lower ecological footprint than my family in the United States; however, these families did not appear to have significantly reduced happiness levels. I decided to follow up on this observational data, and conduct more objective research in David, Chiriquí, to determine the relationship between ecological footprint and perceived levels of happiness. Based on my observations, I think it is reasonable to hypothesize that there is not a positive relationship between a higher level of consumption, as objectively measured by ecological footprint data, and a higher level of

happiness. If, as I suspect, increased happiness is not significantly correlated to a higher ecological footprint, there would be significant implications for the world economy, individual consumer choice, and climate change policy. The findings of this project, as other papers have found in the past, would call into question the benefits of increased global consumption of resources and GDP, and could also encourage individuals with high rates of consumption to reduce their consumption of resources.

To complete this investigation, I will first briefly review the literature regarding the relationship between ecological footprints and happiness. Next, I will describe the methods I use in order to research my question and complete my objectives, and analyze the empirical data I gathered. I've chosen to investigate the demographic of university students in David, because students are the demographic that will have the largest burden of mitigation and adaptation. I will explore the ecological footprints of university students in David, as well their happiness levels, and examine the relationship between the two variables. I will also examine their Happy Planet

Indices, which is a new indicator that measures the ability to live a happy, sustainable lifestyle, and I will compare this index to existing national and international data. I conclude with a discussion of the data, addressing potential strengths and weaknesses of my study, and outline areas for future research.

Research Question

Therefore, through this project, I address the following research question:

> *How do the ecological footprints of university students in David, Chiriquí, relate to students' perceived personal levels of happiness, and how effectively are these students converting ecological resources into happiness, as indicated by the Happy Planet Index?*

Research Objectives

For this project, my objectives are to:

- Determine the ecological footprint of university students in David, Chiriquí, and compare footprints between each university, as well as the average Panamanian and global ecological footprints.
- Investigate the relationship between the perceived happiness of students and their ecological footprints.
- Determine the Happy Planet Index (HPI) for university students of David, and compare this indicator to the national Panamanian and global HPI indicators.

Literature Review

The Problem of a Changing Climate and Economic Growth

Climate change is a serious challenge the world is confronted with today. With the dawn of the Industrial Revolution and an increase in fossil fuel consumption, humans dumped carbon dioxide and greenhouse gases into the atmosphere at unprecedented rates; currently, levels are almost 40 percent greater than they were prior to the Industrial Revolution (New Economics Foundation 26). The natural range of carbon dioxide is approximately 180-300 parts per million, and the Earth's atmosphere currently contains 392.6 parts per million, the highest concentration the Earth has had "during the last 800,000 years, and probably during the last 20 million years" (New Economics Foundation 26). Greenhouse gases trap energy in the atmosphere, keeping the Earth at a temperature warm enough to support life. However, due to the amount of greenhouse

gases expelled, the current level of greenhouse gases are causing more heat to be trapped in the atmosphere than in the past, which in turn is causing the temperature on the planet to increase. According to the Environmental Protection Agency of the United States, Earth's average temperature has already risen 1.4 degrees Fahrenheit in the last 100 years, and is expected to increase another 2 to 11.5 degrees Fahrenheit in the next century (Environmental Protection Agency). Two degrees may not seem like a great deal, however, even this small increase in temperature can have a significant effect on ecosystems around the world. This increase in temperature already has, and will continue to have, monumental effects on Earth's biota.

Melting ice caps, ocean acidification, and sea level rise, are worldwide phenomenon already well underway. Expected changes specific to Panama include changes in rainfall patterns, more frequent, intense, precipitation events, and more intense, frequent, heat waves. Panama is home to a plethora of biodiversity; many species are native only to the forests and ecosystems of Panama. Climate change will have negative effects on Panamanian biodiversity, agriculture, and human health, according to the Intergovernmental Panel on Climate Change (Magrin).

Over 97 percent of scientists agree: climate change is happening, and with the changing climate, wildlife and agriculture throughout the world will be impacted. In order to reduce the effects of climate change, significant action needs to be taken immediately to mitigate and reduce the carbon dioxide levels in the atmosphere (Magrin). However, though there have been a number of international meetings to discuss this issue, there has not been significant, cohesive international action to solve the problem. In order to effectively mitigate the effects of climate change, a reduction in greenhouse gas emissions and consumption of materials such as fossil fuels is necessary; however, a reduction in carbon emissions is often viewed as in conflict with happiness, as measured by economic growth of GDP. The most significant source of carbon

dioxide pollution comes from fossil fuel sources; if the emissions levels were reduced, the cost of power would hypothetically increase, which would in turn increase costs, and as critics argue, hurt the economy and quality of life. If people reduce their consumption and ecological footprints, they will also be reducing their levels of happiness.

However, many studies have suggested GDP is an outdated and inaccurate indicator of overall well-being and happiness. According to an article in *National Geographic*, "findings from a survey of life satisfaction in more than 65 countries indicate that income and happiness tend to track well until about $13,000 of annual income per person (in 1995 dollars). After that, additional income appears to produce only modest increments in self-reported happiness" (Mayell, 2). Increased consumption does not necessarily equate increased levels of happiness, and there is a level of marginal decreasing returns on utility. According to Professor of Economics David Kennett, of Vassar College, "wealthier countries are, on the whole, happier than poorer ones. But most Americans are no happier than they were 60 years ago when their material standard of living was much lower, and some countries with roughly equal standards of living are much happier than others." (Hertz).

When viewed through the lens of economic growth and progress in terms of GDP, mitigating climate change and continuing to live the same lifestyle of consumption seem at odds with one another. However, GDP is not necessarily the best indicator to measure success. GDP attempts to objectively measure the happiness and overall well-being of humans; however, instead of using GDP as a measure of happiness, I am suggesting, as many others have in the past, that instead, the most accurate measure of happiness and overall well-being is to measure it directly (World Happiness Report). Happiness is something universally desired, something that everyone is striving for. I am suggesting a rethinking of the growth paradigm, with a

restructuring of the economic model to make it our goal to maximize happiness instead of material wealth and consumption (Cohen and Vandenbergh). If we use this shifted paradigm, people will no longer need to worry about increasing consumption in order to achieve happiness. In order to explore the feasibility of this theory, through this project, I investigate the relationship between ecological footprint and happiness levels. 7

Many studies have effectively measured happiness levels in the past. Perhaps the most famous and well-supported measure of happiness is the Gallup Poll Ladder of Life Question (See Appendix 1, question 23). The authors of the World Happiness Report, a 265 document detailing how to measure happiness and the current levels of individual happiness throughout the world, found that the Ladder of Life question is a reliable and valid measure of happiness (Sachs, Helliwell and Layard). For this reason, I use this measure in my report. Many studies have also examined the ecological footprint of various populations. In the methods section, I describe in more detail the components of ecological footprint, and its validity as a measure of consumption.

I am also interested in deriving the Happy Planet Index of university students in David, because it measures the "extent to which countries deliver long, happy, sustainable lives to people that live in them" (New Economics Foundation); this indicator measures how well the students are living happy lives now, and how sustainable this happiness is for the future. This indicator will indicate the type of future happiness and prosperity David residents can expect for future generations, and I also plan to compare this data to national and international HPI indicators.

For my project, I chose to sample university students at three universities in David. The students of today are going to have to most actively prepare for and deal with the effects of climate change than any other demographic. The first university, UNACHI, had approximately

2,500 students, and was the largest public university in David. The Universidad Tecnologia de Chiriquí, also a public university, had fewer students—close to 1,800. The final university that I took surveyed was the Universidad La Latina, a private university with approximately 1,250 students. I chose each of these universities because they serve very different demographics, but the majority of the students are from Chiriquí. By collecting data from all three universities, I had a more accurate sample of university students in David. See Appendix 2 for images.

I chose to investigate the role of in the city of David, Chiriquí, for several reasons. David is "a relatively affluent city with a firmly established, dominant middle class and a very low unemployment and poverty index" (Panama Government). David is the third largest city in the country of Panama, with a population of 144,858 as of 2013, and home to 5 universities, and therefore a prime location for sampling students (Panama Government). Finally, I personally like the city of David, and was interested in what the results of would be in that city.

Methods and Materials

Based on the literature discussed, I developed the hypothesis that as the ecological footprint of university students in David increases, there is a negligible increase in happiness levels of the students. Furthermore, I use these variables to investigate the Happy Planet Index of university students in David, and compare this indicator to the national Panamanian HPI, as well as other international HPIs. In my experiment, the independent variable is the ecological footprint, and the dependent variable is level of happiness.

In order to gather data to test my hypothesis, I conducted surveys of individual university students in David. In order to do so, I first crafted my survey, taking several considerations into account. Because this study was limited in terms of time and resources, I used an online

calculator to measure the ecological footprint of students. I do not have access to the complex data and algorithms that make up the equations behind these calculators, and was therefore limited to asking the questions and using the results provided by the online calculators. I researched various online ecological footprint calculators, and though very similar to other calculators, I decided to use the one provided by the Global Footprint Network (Global Footprint Network). I chose this calculator because it asked a wider array of questions than other calculators, and did not ask about income, which is a personal question that as an outsider I did not want to ask. It also asked more questions relevant to the population I wanted to survey, students, and didn't ask questions (for the most part) that I thought students would not know the answer to. The Global Footprint Network Calculator also calculated a percentage breakdown of the components of the ecological footprint, which I thought would be useful in analyzing the components of the footprint. Most importantly, the survey used by the Global Footprint Network was used by the Happy Planet Index group to calculate their national and international data; therefore, to be consistent, I felt I should use the survey provided by this organization. Furthermore, it calculated the footprint in terms of global hectares per individual, which is not only the unit needed to calculate the Happy Planet Index, but also a more visual and visceral measurement than "tones of carbon dioxide equivalent." It is easier to imagine a hectare of land than a ton of gas. Furthermore, the ecological footprint measures all of the resources needed for humans to survive on the planet. This offers a more holistic view, and has had a broader scope and implications than a carbon footprint calculation does. Ecological footprint also better represents consumption, as it is the total amount of land needed to support one's consumption lifestyle, and therefore offers more meaningful results. I used the exact questions from the online calculator from the Global Footprint Network (there was already a Spanish translation so I was

able to cross check the translated copy I created), modified only in that I changed the order of a few of the questions in order to make my survey flow better (see Appendix 1 for a copy of the survey questions). For more information about the methodology of the Global Footprint Network, see their 113-page document on methods (Ewing B.)

However, the online calculator was not perfect. It does not measure all emissions, and most of the answers to the questions are provided in a range (i.e. 1-80 km, or 1-2 times a month). Because the answers are not exact numbers, the results are also not exact. The online calculator also does not cover all possible emission sources, just general emissions. This calculation should not be considered an end all do all analysis calculation, but rather, an accurate estimation of ecological footprint.

I also needed to create survey questions to collect data regarding happiness levels. For measurement of happiness, there were even more considerations to take into account. A carbon or ecological footprint is a number that can be calculated based on empirical, objective data (how many kilometers did you drive in a car with a specific gas mileage? etc.) while happiness is more subjective, and difficult to measure. In order to measure happiness, the Happy Planet Index uses the "Ladder of Life" question the Gallup Poll Foundation provides (Gallup Inc.). I used this exact question (translated into Spanish) in order to have consistent data with the international HPI data. Furthermore, as discussed in the review of the literature, the "Ladder of Life" question has been used by other studies to objectively measure happiness levels in populations.

I had to take into account the number of surveys I wanted to collect, as well as the time each survey would take. As a student, I know that free time is extremely valuable; because I knew I was going to be asking students to give up some of their valuable free time, I wanted to keep the survey short, a maximum length of 5 minutes. Furthermore, while conducting test

surveys, I realized that I could not hold the attention span of students much longer than 5 minutes. Based on these considerations, I only included questions needed to calculate their ecological footprints and happiness levels, as well as a few questions about basic information (including age, major studied in school, residency in David, gender, and knowledge of ecological footprints and climate change) in order to rule out spurious correlations.

After refining my questions and translating them into Spanish, I tested the survey questions in the central square in David. I timed the interviews to know how long I would need for future interviews, and to see if I could maintain the interest of the respondents. I also tested the responses of the interviewees: were they confused after some questions, did others make them feel uncomfortable? Lastly, I used the sample surveys to know which questions I struggled with in Spanish, in order to know which questions to practice more before I completed the real work.

After creating and testing my survey questions, I finally started to collect data. As stated in the review of the literature, I visited Universidad Autonoma de Chiriquí, Universidad Tecnologica de David, and Universidad La Latina, in David. I went to each university and sat in the cafeteria between the hours of 10:30-1:30 pm, and approached students to survey. The cafeterias were small enough that I was able to gather data from almost all of the students in the cafeteria, because I was able to hand out the survey to almost all of the students. This method, though effective in gathering a great amount of data quickly, creates bias in that only students that eat in the cafeteria were surveyed, and these students might have different ecological footprints or levels of happiness than students that bring a lunch from home or eat in surrounding cafes. Furthermore, I only approached students that did not look like they were busy doing homework or writing papers. This also creates an element of bias, because those people could

have a different ecological footprint than those that were socializing with friends or eating lunch. I took care to keep my respondents anonymous by not recording any identifying information. See Appendix 2 for images.

After gathering the data, I analyzed it using Microsoft Excel. First, I entered all of the data into Excel, and then entered my data into the online ecological footprint calculator (see Appendix 2). To eliminate spurious relationships, I controlled for the variables by asking the residents for their age and gender. If the respondent chose to leave a question blank, I entered an "x" into Microsoft Excel, and did not enter any data into the online calculator for that question. If none of the questions are selected, the online calculator has a base footprint of 2.2 global hectares; when response are selected and submitted in the calculator, hectares are either added or removed, depending on the response. Therefore, if a respondent did not answer a question, the base value of that question was used and calculated by the calculator. Furthermore, the vast majority of respondents left the answer blank for the questions about the cost of electricity and natural gas for one year. Those that did respond had a wide range of responses: the cost of electricity varied from 12 dollars for a year, to 4,200 dollars per year. Due to the disparity of responses, I chose to leave all of the responses blank, and let the computer use the base electricity value. Therefore, my data are consistent, though incorrect.

Results

Ecological Footprint of University Students in David

After collecting surveys entering them into the online calculator, I was able to compile the results of the ecological footprints of university students in David. As previously stated, an ecological footprint measures the amount of resources an individual needs, in terms of global hectares, to live their current lifestyle on Earth. The following figure illustrates the average

ecological footprint of individuals in the United States, Panama, and the world, as compared to the university students I sampled from David.

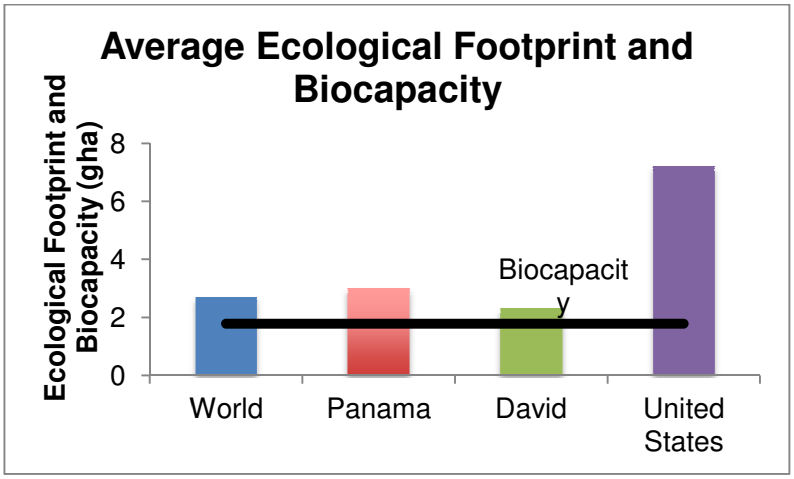


Figure 1

The average ecological footprint of a university student in David was 2.3 global hectares per individual, a total of 0.7 global hectares less than the average Panamanian, 4.9 global hectares less than the average resident of the United States, and 0.4 less than the average global citizen, based on data provided by the Global Footprint Network (Global Footprint Network). However, though students in David have a smaller ecological footprint than these other places, the ecological footprint of the students still exceeds the biocapacity per individual of the Earth, 1.78 global hectares.

The ecological footprint is comprised of six components: energy land, cropland, grazing land, forestland, built land and fishing ground. According to the Global Footprint Calculator, energy land is the area of land needed to store carbon emissions from energy use, including sources like electricity, natural gas, and fossil fuel use. Cropland is the area of land required to grow crop products, including crops for livestock. Grazing land accounts for the amount of grassland (in addition to cropland) needed to support the livestock consumption of an individual. Forestland is the area of forest needed to produce wood products for individual consumption.

Built-up land is the area of land an individual uses that is covered by human infrastructure. The final component, fishing grounds, measures the amount of marine area necessary to support an individual's fish consumption (Global Footprint Network). The following graphic illustrates the breakdown of the ecological footprint of university students in David.

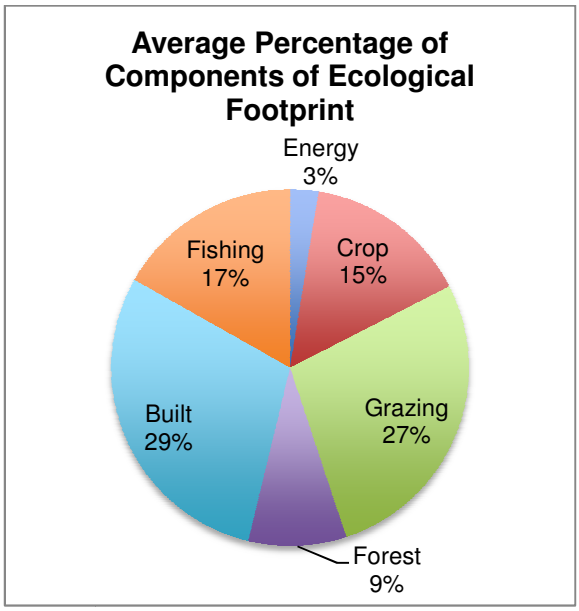
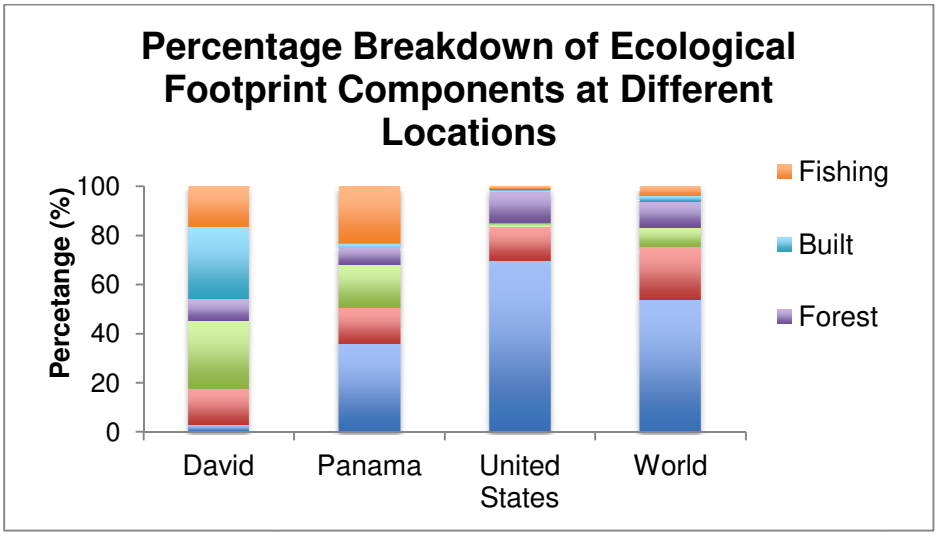


Figure 2

Surprisingly, land needed for energy use is the smallest component, making up just three percent of the total ecological footprint. Forestland was the next smallest component, comprising nine percent of the total ecological footprint. Land needed for crops and fishing grounds were the next largest components. Fifteen percent of the total ecological footprint was devoted to cropland, while seventeen percent was comprised of fishing grounds and marine land. The amount of land needed for grazing and land with built up infrastructure were the largest components of the ecological footprint; twenty-seven percent of the ecological footprint of the average university student from David is devoted to grazing lands for livestock consumption, and twenty-nine percent is devoted to built-up land and infrastructure (Global Footprint Network).

The Global Footprint Network also provides data about the breakdown of the components of ecological footprints for countries around the world. The following figure compares the

breakdown of the components of the ecological footprints in David, Panama, the United States, and the average global breakdown of components.



16

Figure 3

As illustrated by this graph, the percentages of each component are quite different for each location. The amount of forestland used in each location is approximately the same, though individuals in Panama and David use slightly less forestland than individuals in the United States and the general world. In addition, the amount of cropland needed in each location is approximately the same. However, the percentage of fishing grounds and percentage of grazing land is significantly higher in Panama and David than the United States and the world. Surprisingly, built up land comprises a much larger percentage of the overall ecological footprint for students in David than in Panama, the United States, and the world. Also, the amount of land devoted to energy for students in David is much smaller than the energy needed to support by individuals in Panama, the United States, and the world (Global Footprint Network).

In addition, I collected data investigating the relationship between knowledge of what ecological footprints and climate change are, and the size of ecological footprints. The following figure illustrates the knowledge and ecological footprints of the university students in David.

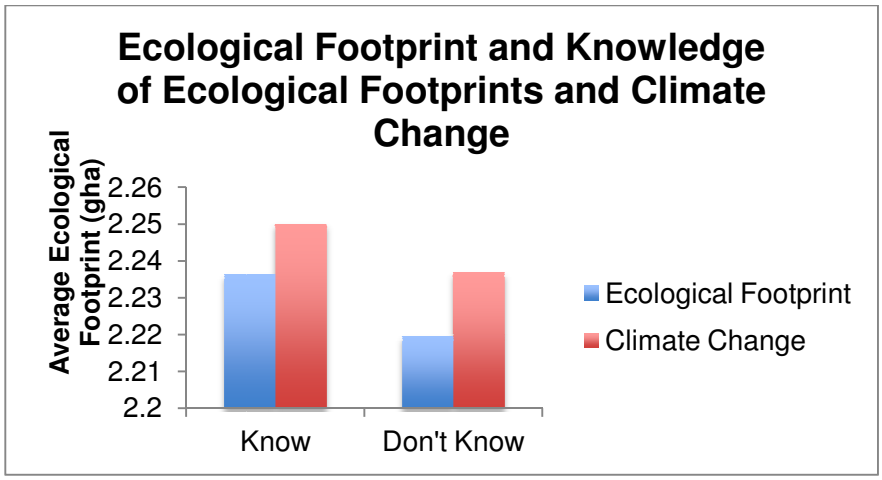


Figure 4

As illustrated, those students that said they knew what climate change and ecological footprints were had larger ecological footprints than students that did not know these definitions. Overall, fewer respondents knew the definition of an ecological footprint than climate change.

Ecological Footprint and Happiness Level for University Students in David

After determining the ecological footprint of university students in David, I compare this indicator to the happiness levels of the same students. I established the hypothesis that there is not a relationship between personal ecological footprint and perception of an individual's current level of personal happiness. I expected individuals with low happiness levels to have both low and high ecological footprints, and vice versa.

In order to determine whether a statistically significant relationship exists between the two variables, the results must reject the null hypothesis. In order to reject the null hypothesis—that there is not a statistically significant relationship—the p-value for regression must be less than .05. In other words, there must be less than a five percent chance of the null hypothesis occurring in order to consider a relationship statistically significant. In my experiment, my hypothesis is the null hypothesis, because I do not expect a statistically significant relationship to

exist; the null hypothesis therefore, is that there is no relationship between personal ecological footprint and perception of an individual's current level of personal happiness. The dependent variable, happiness level, is measured at a nominal level, and the independent variable, an individual's ecological footprint, is measured at a ratio level. To determine whether a relationship exists, and if that relationship has statistical significance, I explored a linear regression of the data, as illustrated in the figure below.

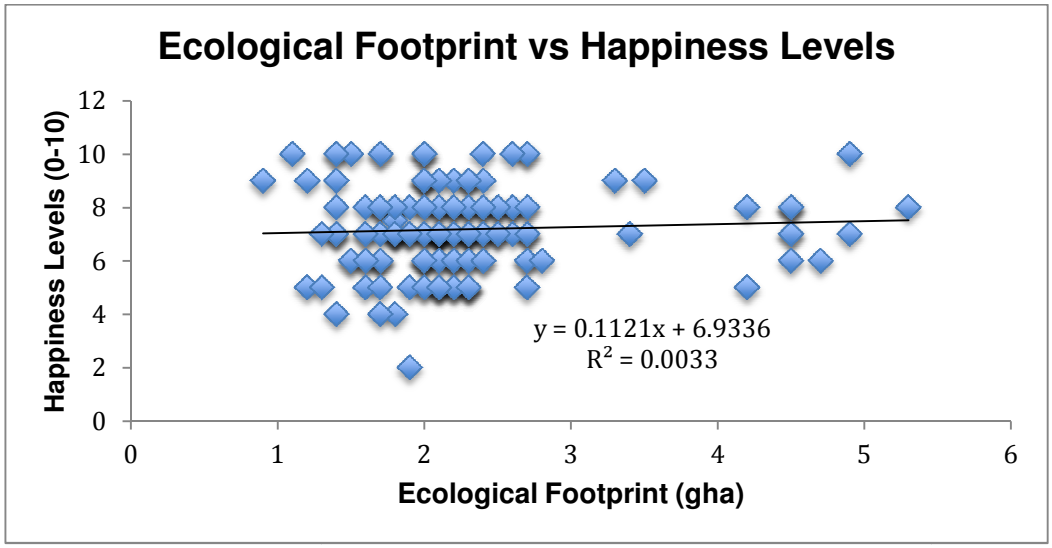


Figure 5

As illustrated by the figure above, there is not a statistically significant relationship between the ecological footprint and happiness levels of university students in David. The closer the R-squared value is to 1, the stronger a relationship between two variables is. In this case, the R-squared value is 0.00335, signaling an essentially non-existent relationship. The p-value for the above regression was 0.33083, and as mentioned, for a statistically significant relationship to exist, the p value has to be less than 0.05. Because the p value is not less than 0.05, the null hypothesis cannot be rejected, and there is not a significant relationship between these two variables.

Happy Planet Index for University Students in David

Combing these two indicators, a new indicator of progress is available: the Happy Planet Index. As described by the creators of the Happy Planet Index, the HPI "is a new measure of progress that focuses on what matters: sustainable well-being for all. It tells us how well nations are doing in terms of supporting their inhabitants to live good lives now, while ensuring that others can do the same in the future" (New Economics Foundation). To calculate the Happy Planet Index, average life expectancy is multiplied by average experienced well-being, or happiness level, in order to obtain the average number of happy life years a university student in David will have. The following figures illustrate average life expectancy and average experienced well-being in David, Panama, the United States, and the world (New Econoimcs Foundation).

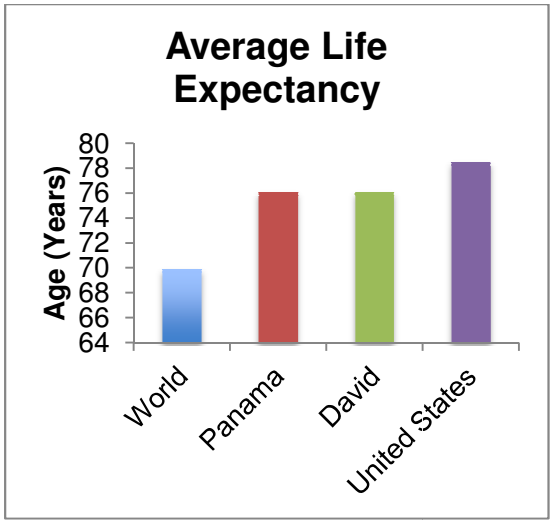


Figure 6

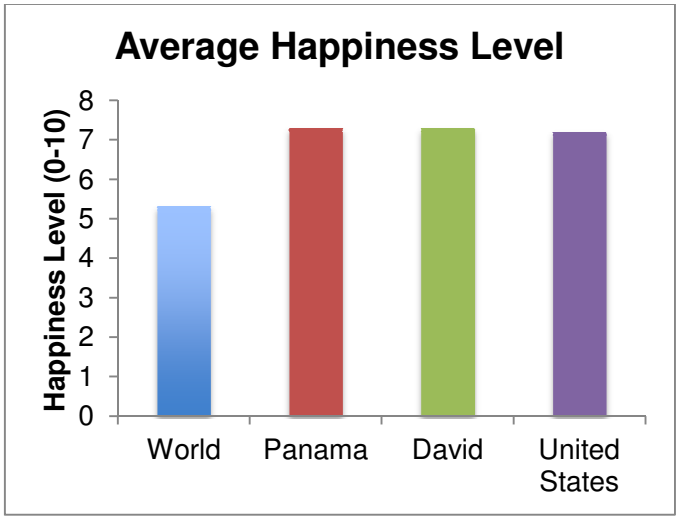


Figure 7

Individuals in Panama and David have the same life expectancies, and similar levels of experienced well-being; although individuals in the United States have a larger life expectancy, they have a slightly smaller level of experienced well-being. Overall, both individuals in Panama (including David) and the United States have greater life expectancies and experienced well-being levels than the average individual in the world. Figure 1 demonstrates the other component

of the HPI: ecological footprint. As illustrated, the United States has a much larger footprint than the average Panamanian resident or university student in David (New Econoimcs Foundation).

Because the United States has a larger ecological footprint, when the number of happy life years is divided by the ecological footprint to determine the HPI, it has a much lower HPI than Panama and David, as illustrated in Figure 8. In other words, individuals in David and Panama are more efficient at living happy lives, creating more sustainable futures for future generations. Overall, Panama has the seventh highest Happy Planet Index score in the world with an index of 57.6; the country with the highest index is Costa Rica, with a score of 64.0. The population of university students in David had an incredibly large Happy Planet Index; with a score of 63.8, university students in David are almost as efficient at producing happy, sustainable lives as the most efficient country in the world (New Econoimcs Foundation).

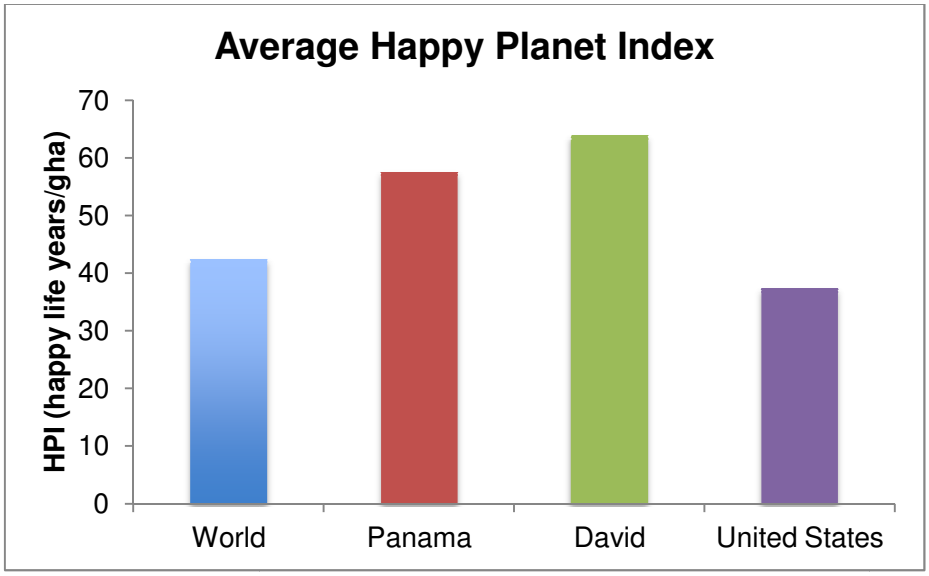


Figure 8

Discussion

Implications of the Results

As illustrated in the results section, students in David have a lower ecological footprint than residents in other parts of Panama and the world. The fact that the students have lower ecological footprints than residents in other parts of Panama is a good sign, in that it could potentially point toward a trend of less consumption of resources in the future. However, because the demographic analyzed was a student population, it is very possible that the students have a lower ecological footprint because they are students, potentially without income, and potentially without as many means to use more resources. For future studies, it would be interesting to further investigate the role being a full time student versus a full time worker plays in the size of an ecological footprint. Furthermore, in this experiment, though adequate samples of students were surveyed in 3 out of the 5 major universities in David, the individuals in this age demographic that do not attend university were not included in the experiment. To gather a more holistic view of the demographic of young adults, further research needs to be completed to investigate the footprint of these individuals.

In addition, the breakdown of the components of the ecological footprint differed significantly from Panama, the United States, and the rest of the world. The built land component, signifying built infrastructure needed to live a lifestyle, comprised a significant portion of the ecological footprint; this could be due to the fact that many of the individuals surveyed stated that they had the largest size home (more than 300 square meters, or approximately 3,200 square feet). Because the average ecological footprint is much larger for individuals in the United States, even if the actual amount of built land was the same in the US and David, the percentage of the component in the overall footprint would be much less in the United States because it is a part of a larger whole. The same theory could also contribute to the amount of grazing land and fishing grounds. Furthermore, the fact that university students in

David had a greater percentage of fishing grounds than the average United States and world footprints is most likely due to David's location near the Pacific Ocean, and students' ease of access to fresh fish.

The data regarding how knowledge about ecological footprints and climate change affects ecological footprint yielded interesting results about the ecological footprints of university students in David. The students that knew what ecological footprints and climate change are had greater ecological footprints than those that did not know definitions of these concepts. This result is surprising, because if one knows the problems associated with climate change, logically, one would have a lower ecological footprint as an effort to try and solve the problem. However, this expectation is clearly far from correct; based on the results of my survey, just because someone knows about the problem of climate change does not mean they will actively attempt to solve the issue and reduce their impact. In addition, a few sources of error need to be taken into account in terms of this analysis. I simply asked whether or not students knew what the concepts were; I did not ask them to prove their knowledge by providing a definition. Therefore, it is likely that many either lied and said they knew what it meant and didn't or vice versa. Furthermore, it is likely that the respondents have varying degrees of knowledge on the subject; some may have extensive knowledge, while others have merely heard of the topic. Due to these sources of error, it is likely that the results do not tell much about the actual influence of knowledge of climate change and ecological footprints on the ecological footprint of students.

The relationship between ecological footprint and happiness level is perhaps the most interesting finding. Based on my data, which agrees with the results of past studies, there is no statistically significant relationship between a university student's ecological footprint and level

of happiness. As the data illustrates, there were students with both high and low happiness levels that had both large and small ecological footprints. This finding has important implications for future consumption patterns and action against climate change. If increased consumption doesn't equivocate increased happiness levels, people can take this knowledge into account when making choses about consumption. Furthermore, policy makers can take this knowledge into account when creating laws and regulations regarding climate change, and business owners can take this knowledge into account when making choices about what types and how many products to sell.

In addition, the results regarding the Happy Planet Index were very informative. Overall, according to my analysis, students in David are sustainably living long, happy lives. Though their average carbon footprint is greater than the biocapacity of the planet, overall, the ecological footprint of university students in David is lower than the ecological footprint of others worldwide, and students in David reported greater levels of happiness than individuals worldwide. However, because there is not data available regarding the ecological footprint and happiness levels of students worldwide, age or occupation could be confounding variables in the comparison. For future studies, it is essential that more data is gathered for the young adult demographic. This demographic is important to analyze because this age group will have to adapt the most to mitigate and adapt to climate change.

Sources of Potential Bias

In this experiment, there are several sources of potential bias. First, as a white, American woman, there is bias in the fact that I was the interviewer. I am an outsider, and it is likely that some Panamanians did not trust me or want to be completely honest with me. Often when I

approached people in the cafeteria, they were sitting with other friends. Because both friends would complete the survey, usually at the same time, there was potential for bias if they discussed the questions or their results. Knowing that a friend was sitting next to them, it is possible that they lied, saying they consumed more or less of certain commodities, or were happier or more unhappy than they actually are. It is entirely possible that some people lied in the surveys because of my influence, or the influence of their friends sitting nearby.

In addition, when entering the data, it was clear that some of the respondents did not read the questions carefully, or did not understand them. For example, when asked what the gas mileage of their car (if they had one) was, many put numbers that far surpass the gas mileage of any cars that I know of currently in existence: 117,000 km/L of gasoline, for example. Also, instead of answering the question "what do you study at this university," as the question was written, some respondents answered the question "do you study at this university," and simply wrote "yes." It is possible that respondents did not carefully read other questions as well, but it was less obvious and included as real data. Furthermore, because for the most part the demographic surveyed still lives at home, most students did not know the answers to questions about the cost of electricity or natural gas per month. Many students do not have to pay for these bills directly, and therefore do not have the knowledge to accurately complete my survey, creating another level of bias.

In addition, the process of choosing my subjects was not completely random. I did not approach students that looked busy, were doing homework, or looked like they were in a hurry. I did not approach these people because there were many other subjects, and in the beginning when I attempted to approach them the majority refused to take my survey. There was also some bias because some people refused to take the survey. I do not have their data, and did not record

the number of people that refused to be surveyed, which creates another level of bias. However, overall, bias was limited as much as possible, and therefore, my results still have merit.

Conclusion

The field of happiness and ecological footprint measurement are still continuing to develop, and more research is definitely needed. My experiment only took into account three of the five universities in David; future research could focus on expanding the sample size of the data at the universities I sampled, as well as collecting data from the other universities. Furthermore, as the students of today become the leaders of tomorrow, it is likely that the ecological footprints of future students, as well as happiness levels, could shift; it would be interesting to track these changes in a study that took place over several years.

In addition, the national and international data that I compared my data to was not data from a student demographic, but rather an overall adult demographic. More research is needed on the student demographic, both in Panama and around the world.

In conclusion, based on the results of my experiment, the ecological footprint of university students in David and their levels of happiness are not significantly related. The average ecological footprint of students in David was smaller than that of Panamanian and international averages, and the average happiness level was greater, creating a large Happy Planet Index. More goods, and more consumption does not necessarily equate more happiness, and students in David, and in general world citizens, can take this knowledge into consideration when making choices about consumption habits.

Appendix 1

Por favor, escribe la letra de su respuesta en la línea a lado de la pregunta. Sí tiene preguntas sobre este encuesta, por favor preguntarme. Sus respuestas va a ser anónimas. Muchas gracias para su ayuda.

1. ¿Cuántas de tus comidas están basadas en frutas y vegetales?_____
a. Ninguna (0%)
b. Poco (25%)
c. Alguno (50%
d. Mucho (75%)
e. Todas (100%)

2. ¿ Cuál porcentaje de las comidas que usted come son procesadas, empacados, o producidas más de 640 km de donde vive? _____
a. Ninguno (0%)
b. Poco (25%)
c. Alguno (50%
d. Mucho (75%)
e. Todo (100%)

3. ¿Con qué frecuencia consumes la comida siguiente? Ponga la letra que corresponde con su vida a lado de cada tipo de comida.
a. Nunca
b. Pocas veces (una vez cada mes o dos meses)
c. Ocasionalmente (una o dos veces a la semana)
d. Con frecuencia (casi todos los días)
e. Con mucha frecuencia (casi en todas las comidas)

_____ puerco
_____ vaca o cordero
_____ huevos, leche, queso, etc.
_____ pescado
_____ pollo o otros aves
_____ comida orgánica (sin químicos o insecticidas)

4. ¿Cuántas veces compra las cosas siguientes? Ponga su respuesta a lado de las cosas.
a. Nunca
b. Pocas veces (casi cada 2 años)
c. Ocasionalmente (casi cada año)
d. Con frecuencia (casi cada mes, o tres meses)
e. Con mucha frecuencia (casi cada semana)

_____ nuevos electrónicos como televisiones, esteros, computadoras
_____ nuevos electrodomésticos
_____ nuevos libros, revistas, periódicos
_____ nuevos muebles o decoraciones para su casa
_____ nuevas ropas

5. ¿Cuántas bolsas de basura produce cada semana? ____
a. 1-2
b. 2-5
c. 5-10
d. Más de 10

6. ¿Cuántos papeles y plásticos recicla? _____
a. No recicla
b. Algunos
c. Muchos
d. Todo

7. ¿De qué materiales es su casa? _____
a. Adobe o tapial
b. Ladrillos y cemento, bloque
c. Madera
d. Otro

8. ¿Qué tipo de casa tiene? _____
a. Casa
b. Apartamento
c. Cuarto
d. Finca
e. Otra

11. ¿Qué es el tamaño de su casa? _____
a. 0-30 metros cuadrados
b. 30-50 metros cuadrados
c. 50-100 metros cuadrados
d. 100-200 metros cuadrados
e. 200-300 metros cuadrados
f. más de 300 metros cuadrados

10. ¿Cuántas personas viven en su casa? _____

11. ¿Cuánto dinero paga para…
_____ electricidad para un ano?
_____ gasolina natural para un ano?

12. ¿Qué tipo de transporte usa más? _____
a. coche
b. taxi
c. bus
d. bicicleta
e. caminar

13. ¿Cuántos km o horas viaja en…
_____ bus cada semana?
_____ coche cada semana?
_____ motocicleta cada semana?

14. ¿Sí usa un coche, cuántos km/L tiene su coche? _____

15. ¿Sí usa un coche, cuántas veces maneja en un coche con otras personas cada semana? _____

16. ¿Cuántas horas vuela cada año en avión? _____

17. Por favor imagina que hay una escalera con escalones numerados del cero en la parte inferior a 10 en la parte superior. La parte superior de la escalera representa la mejor vida posible para usted y la parte inferior de la escalera representa la peor vida posible para usted. ¿En que escalón de la escalera le diría usted personalmente siente que esta parado en este momento, 0-10?
_____

18. ¿Cómo satisface toda su vida estos días, usando una escala 0 a 10? _____

19. ¿Sabe qué es una huella de ecológica? (Sí/No) _____

20. ¿Sabe qué es la procesa de cambio climático? (Sí/No) _____

21. ¿Qué año nació? (Ponga el año el la línea.) _____

22. ¿Es usted un residente de David? (Sí/No) _____

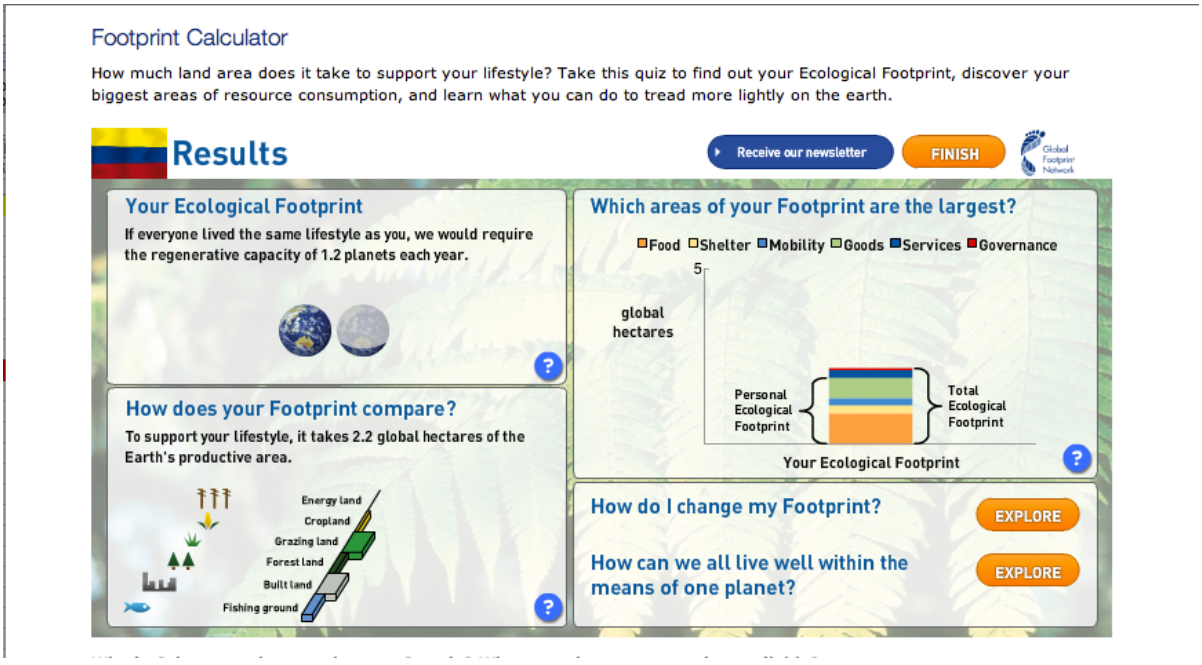
23. ¿Qué está estudiando en universidad? _____

Appendix 2: Images

Universidad La Latina

Universidad Tecnologica Chiriquí Panama

Universidad Autonoma Chiriquí



Sample Results

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