Extended essay cover

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Candidate session number	
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Examination session (May or November)	May Year 2015

Diploma Programme subject in which this extended essay is registered: ESS

(For an extended essay in the area of languages, state the language and whether it is group 1 or group 2.)

Title of the extended essay: The Impact of my household on the environment

Candidate's declaration

This declaration must be signed by the candidate; otherwise a mark of zero will be issued.

The extended essay I am submitting is my own work (apart from guidance allowed by the International Baccalaureate).

I have acknowledged each use of the words, graphics or ideas of another person, whether written, oral or visual.

I am aware that the word limit for all extended essays is 4000 words and that examiners are not required to read beyond this limit.

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Please comment, as appropriate, on the candidate's performance, the context in which the candidate undertook the research for the extended essay, any difficulties encountered and how these were overcome (see page 13 of the extended essay guide). The concluding interview (viva voce) may provide useful information. These comments can help the examiner award a level for criterion K (holistic judgment). Do not comment on any adverse personal circumstances that may have affected the candidate. If the amount of time spent with the candidate was zero, you must explain this, in particular how it was then possible to authenticate the essay as the candidate's own work. You may attach an additional sheet if there is insufficient space here.

has shown a lot of initiative and genuine interest in the topic. She worked for a long period of time gathering her data and devised her methodology on her own, after getting feedback from me. She was very cooperative, diligent and punctual. In the viva voce she showed that she master the subject and presented her work fluently and with confidence.

This declaration must be signed by the supervisor; otherwise a mark of zero will be issued.

I have read the final version of the extended essay that will be submitted to the examiner.

To the best of my knowledge, the extended essay is the authentic work of the candidate.

As per the section entitled "Responsibilities of the Supervisor" in the EE guide, the recommended number of hours spent with candidates is between 3 and 5 hours. Schools will be contacted when the number of hours is left blank, or where O hours are stated and there lacks an explanation. Schools will also be contacted in the event that number of hours spent is significantly excessive compared to the recommendation.

I spent [4] hours with the candidate discussing the progress of the extended essay.

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Assessment form (for examiner use only)

Candidate session number		

Achievement level

Criteria	Examiner 1	maximum	Examiner 2	maximum	Examiner 3
A research question	2	2		2	
B introduction	2	2		2	
C investigation	3	4		4	
D knowledge and understanding	4	4		4	
E reasoned argument	4	4		4	
F analysis and evaluation	3	4		4	
G use of subject language	4	4		4	
H conclusion	1	2		2	
I formal presentation	3	4		4	
J abstract	2	2		2	
K holistic judgment	3	4		4	
Total out of 36	31				

Name of examiner 1: _____ Examiner number: _____
(CAPITAL letters)

Name of examiner 2: _____ Examiner number: _____
(CAPITAL letters)

Name of examiner 3: _____ Examiner number: _____
(CAPITAL letters)

IB Assessment Centre use only: B: _____

IB Assessment Centre use only: A: _____

EXTENDED ESSAY

TOPIC: The impact of my household on the environment.

RESEARCH QUESTION: Does my household's impact on the environment (ecological, carbon and water footprint) imply a sustainable lifestyle and how can it be improved?

Word Count: 3982

ABSTRACT

The way people live has an impact on the planet, which can be either favourable when they live sustainably or negative when there is increased product consumption and waste production. There are many ways to assess one's impact on earth. Such as the ecological, the food and the carbon footprint that calculate the impact by inserting data of an individual's lifestyle. It was very interesting to find my home's impact on earth and how it can be reduced. Therefore, the research question of this investigation was: **"Does my household's impact on the environment (ecological, carbon and water footprint) imply a sustainable lifestyle and how can it be improved?"**

In order to answer this question, an investigation was conducted in my house. Products consumed and wastes produced were weighed but also energy consumption was calculated for a month. Then this data was calculated for the duration of a year. Moreover, online tests of carbon, water and ecological footprint were performed by inserting the raw data. After conducting this investigation my household's impact was determined. My home had an ecological footprint of 1.70 earths, a carbon footprint of 11.41 tons and a water footprint of 3370 tons. The global average ecological footprint is 1.40 earths and the Greek average is 2.50 earths. However, in order for our planet to be sustainable we should not exceed 1 earth.

Concluding, it was observed that our household's ecological footprint is lower compared to the Greek average but slightly higher than the global average. Therefore the impact of our household on earth is rather small suggesting an almost sustainable living. However, if everyone lived in the same way then 1.70 earths would be needed which is not eco-friendly. Therefore our impact should be further reduced so that we live a more sustainable way.

Word Count: 297

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1. INTRODUCTION

We live in a world that is constantly changing, since technology is advancing and major breakthroughs are achieved in different fields. However, instead of using the technology to improve our world, we often damage it. Even though the phenomenon of the enhanced global warming is evident, people keep polluting the air, the water and the soil in the environment they live. At the same time, consumption of large amounts of products results in large amounts of garbage, which then end up in landfills littering all the minerals and the underground water.

An average family consumes numerous products each month that require big amounts of energy and water for their production. As a result, one Earth is not enough for the humanity, but instead the average person needs 1.4 Earths to continue living.

As a citizen myself, I believe that the impact of each individual on the environment is a very important issue and is intriguing to determine. It is a contemporary issue since now the mankind is facing the consequences of the environmental destruction caused by the previous generations. Therefore, I decided to conduct an investigation on my family's impact on the environment and to determine our ecological, carbon and water footprint.

1.1. ECOLOGICAL FOOTPRINT

The ecological footprint of a population is defined as the area of land that would be required to sustainably provide all the resources of a particular population and to assimilate all its wastes. It is the inverse of carrying capacity. It should be stated that we only have one Earth[1].

Rees and Wackernagel were the first to publish in 1996 the book: "Our ecological footprint: reducing human impact on the Earth" on the calculation of the impact of ecological footprint and how to reduce it. Their concept was globally accepted. Thereafter many tests were created in order to measure one's ecological footprint. As mentioned before, the average global ecological footprint is 1.4 Earths which exceeds the 1 Earth available. Therefore, countries with a high ecological footprint are trying to reduce it by applying different methods. However, there are counties (e.g. Africa) which continuously have a big increase in their ecological footprint (240%) that it keeps augmenting throughout the years.

The ecological footprint of an individual can be estimated by the following formula:

$$\frac{\text{Per capita food consumption (kg yr}-1)}{\text{Mean food production of local arable land (kg ha}-1 \text{ yr}-1)} + \frac{\text{Per capita carbon dioxide emission (kg C yr}-1)}{\text{net carbon fixation of local natural vegetation (kg Cha}-1 \text{ yr}-1) \text{ land(kg ha}-1 \text{ yr}-1)}$$

(The measurement unit of the result is given to global hectares or earths.)[2]

More developed countries tend to have a higher ecological footprint since they are more economically developed and consume lots of products every day, resulting in the production of many wastes. Such examples are Qatar, Kuwait, United States, United Arab Emirates, the

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[1] Davis, A. J., & Nagle, G. E. (2010). *Environmental Systems and Societies.* Page Number 160-161. UK: Pearson Education Limited

[2] Rutherford, J. (2009). *Environmental Systems and Societies: Course Companion.* Page Number 196-197. Oxford: Oxford University.

1

Netherlands, Denmark, Canada, Belgium, Australia and Ireland[3]. Below there is a map showing the ecological footprint of different countries.

This map depicts: "The ecological footprint of nations"[4]
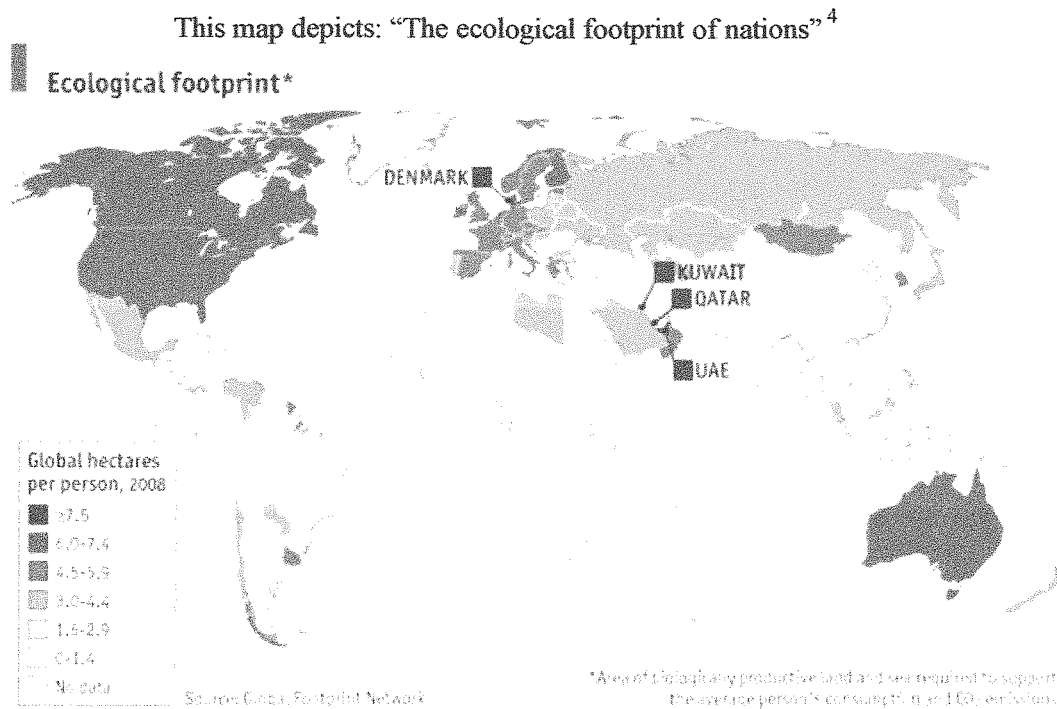
There are many factors that can affect and increase the ecological footprint. First of all, one main reason that our ecological footprint increases is the enormous usage of fossil fuels and energy due to the development of technology. This happens because the energy and the fossil fuels we use are more than the world can sustain. Since they are not renewable, a point in time will arrive when they will disappear. Equally important factors that largely affect the ecological footprint are the great amount of food consumed. Meat-rich diet is also causing an increase since animals are in a higher trophic level and only 10% of their energy is transferred to humans. Also, high rates of imports in a country suggest that there is an increased ecological footprint because transportation of goods takes place and energy and resources were consumed. In other words, more energy is needed. Finally, deposition of wastes increases the ecological footprint since people produce increased wastes every day.

1.2. DIFFERENCE AMONG CARBON, ECOLOGICAL AND WATER FOOTRPINT

The ecological footprint takes into account all the resources that people consume and the wastes that people produce. The carbon footprint takes also into consideration the resource usage, but the main focus is on greenhouse gases and especially on carbon dioxide. On the other hand the water footprint only concerns water and focuses on the amount of water that is consumed per person. All of the three footprints calculate and measure the

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[3] Joe Spring. (2012). *The countries with the 10 biggest ecological footprints per person.* Retrieved July 20,2014, from http://www.outsideonline.com/blog/outdoor-adventure/nature/the-countries-with-the-10-biggest-ecological-footprints-per-person.html
[4] Big foot. (2012, May 16). Retrieved July 22, 2014, from http://www.economist.com/blogs/graphicdetail/2012/05/daily-chart-10

impact of human activity on the environment. The larger the carbon and water footprint is, the larger the ecological footprint is likely to be[5].

1.3. BIOCAPACITY

Biocapacity is an abbreviation for biological capacity, which is the ability of an ecosystem to produce useful biological materials and to absorb carbon dioxide emissions.

Biocapacity is what is limiting the ecological footprint since no more resources can be used or no more waste production can be sustained. It is divided into six main land types that are cropland, pasture, forestry, fisheries, carbon and build-up land. The biocapacity in 2008 was 12 billion hectares of biologically productive land and water on this planet. Also Greece's total biocapacity is 1.689 billion hectares. If we compare the biocapacity of most of the countries with their ecological footprint, we will find that biocapacity is much lower. This means that people have exceeded their limits.[6]

1.4. PRODUCTS AND WASTES

In every open system there are inputs and outputs. The household, as the centre of this investigation, is displayed as a system with its inputs and its outputs. In the specific case of a house, one of the inputs are the products and one of the outputs are the wastes of the house.

A product is an item bought by the consumers. The title "products" is referring to all the items that are obtained for a household. The goods are meat/fish, cereal, vegetables/fruits, dairy, chocolate, beverages, sauces, eggs, oil and vinegar. Also other materials are included such as clothes, papers, floor cleaning products and dishwasher detergents. On the other hand, wastes are substances that are no longer useful or wanted and are thrown away. These are the outputs. They can be disposed in ordinary garbage, recycled or composted.

1.4.1 Recycling

Recycling is the process of collecting materials that would otherwise be thrown away as trash in order to turn them into new products[7]. Paper, plastics, aluminium and other materials may be recycled. There are many advantages in recycling products such as conservation of energy and raw materials saving, since old ones are being reused. Also less amount of waste is being thrown in the landfills, so there is less soil pollution. Finally, the most important aspect is that greenhouse emissions are reduced, since less methane is produced from garbage, hence less harm to the environment is caused. However, there are some disadvantages as well, such as that it is not cost-effective and it is very expensive to make recycling premises.

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[5] Williams M. (n.d.) Business Home Guides: *Difference between a Carbon Footprint and an Ecological Footprint.* Retrieved August 20, 2014, from http://homeguides.sfgate.com/difference-between-carbon-footprint-ecological-footprint-78732.html

[6] Global Footprint Network. (August 9, 2011). *Footprint Calculator Frequently Asked Questions.* Retrieved August 2, 2014, from http://www.footprintnetwork.org/ar/index.php/GFN/page/footprint_calculator_frequently_asked_questions/#gen13

[7] EPA. (November12, 2014). *Recyling Basics.* Retrieved July 15, 2014, from http://www2.epa.gov/recycle/recycling-basics

3

1.4.2 Composting

During composting, waste products break down to produce humus that contains different nutrients. Addition of humus improves the composition of soil. The formation of humus by composting takes one to four months, depending on the size and the material of waste products. Since there is lack of exposure to air, sun and moisture in landfills, waste products thrown at landfills are not easily broken down and it takes more than one year to biodegrade.

1.4.3 Ordinary garbage

Garbage production of the world is augmenting in volume and toxicity day by day. People consume a lot of products so they also produce a lot of waste, which is causing health problems to the communities and largely affecting the environment. The United States is having a great impact on the environment by producing 30% of the total wastes in the planet. Even though big corporations are trying to satisfy us by creating the most intelligent machine with a very specific objective, they don't help the environment but instead they burden it even more. Furthermore, these products contain lots of dangerous toxic chemicals which are then transmitted in the soil. The 40% of the packaging waste is plastic. This fact is alarming since not only a huge amount of our waste is plastic but also that it cannot be biodegraded and takes centuries to break down. As the garbage accumulates in the landfills our health is even more threatened. The leachate of garbage leaks in the soil and pollutes all the plants and the groundwater as well. Not only they leak but they also produce harmful gases which are then released in the atmosphere. On the optimist side, there have been many improvements since sanitary landfills have been discovered which create much more space for future garbage. These kind of landfills not only prevent from the smell but also the leachate from leaking into the soil and polluting the underground water[8].

1.5. SUSTAINABLE LIFESTYLE

Sustainability means using resources at a rate that allows natural regeneration and minimizes damage to the environment. Someone who lives sustainably is not exceeding the biocapacity of the place he lives[9].
Generally, by sustainable living they mean not harming the environment by exceeding its limits and save the earth for future generations. There are many ways for one to become "greener" since this concept applies to our everyday life.

Beginning from the house of a person, it should be build by environmentally friendly materials. For example, straw bales, adobe, or reclaimed stone or brick. Another possible way is by using not as much energy as others consume or by using renewable sources (such as solar, wind, water, or geothermal energy) of energy since the non-renewable (fossil fuels) are limited in quantity. A person must have as little impact on the environment as possible in order to be considered sustainable.

Furthermore, a sustainable lifestyle requires a diet that is based on the first trophic level of the food chain. Vegetarians live sustainably since they do not cause an environmental

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[8] Toxics Action Center. (2012). *The problems with waste*. Retrieved July 15, 2014, from http://www.toxicsaction.org/problems-and-solutions/waste

[9] Davis, A. J., & Nagle, G. E. (2010). *Environmental Systems and Societies*. UK: Pearson Education Limited

damage by their diet. The first trophic level of the food chains is very important. Although pesticides and other chemicals are used in crops in order to increase their growth, they also cause many deaths to animals and people every year. That's why a sustainable homeowner should prefer and buy organic food even though it is more expensive. Also homeowners must prefer locally grown food rather than other countries production to avoid transportation of the food all over the world (since transportation uses a lot of energy).

Finally, a person who is indeed living sustainably has the goal of providing a better life to the future generations without harming the environment and there are many ways to do so. They should embrace the idea that "Sustainability is not a lifestyle but an attitude".

1.6. SYSTEM OF AN AVERAGE HOUSEHOLD

Diagram 1: The diagram below represents a general system of inputs and outputs of an average household.
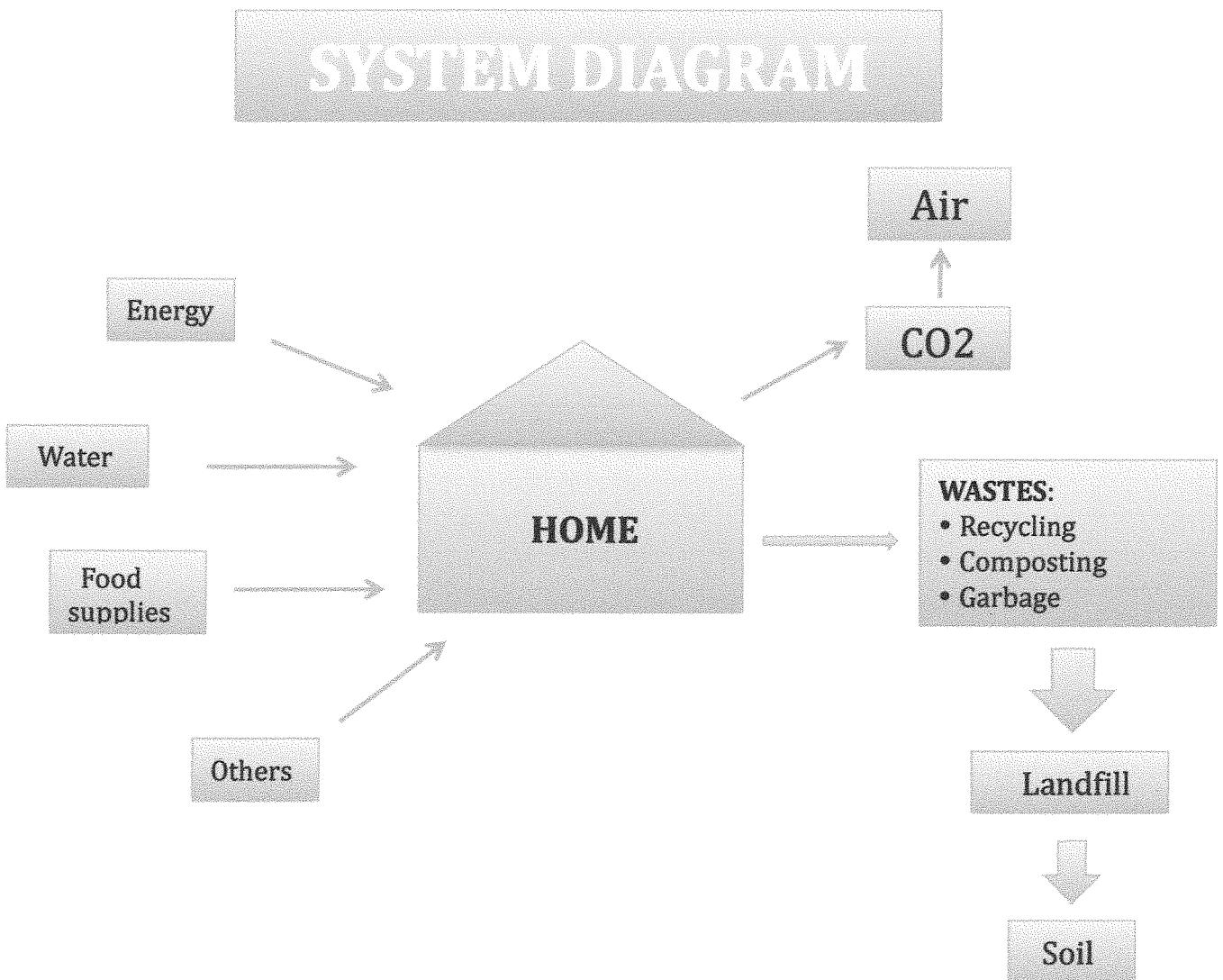
1.7. RESEARCH QUESTION

Therefore after considering all of the information above I decided to conduct an experiment about my home. Taking into consideration the ecological footprint of the people around the world and all the impact that one can have on the planet, I was very curious to find out what is my home's ecological footprint and our impact on earth. Finally after calculating our ecological, carbon and water footprint I wanted to find the ways to reduce our impact.

"Does my household's impact on the environment (ecological, carbon and water footprint) imply a sustainable lifestyle and how can it be improved?"

2. METHODOLOGY

My household was studied in this investigation. My family is composed of 5 individuals, aged between 13 – 60 years old. It is an individual house with a garden. We also own two medium sized cars.

The ecological, the carbon and the water footprint of my household were calculated in order to find its impact on the environment.

The household inputs and outputs were measured for a period of one month (June 2014) using the following steps:

1. Food supplies (meat, fruit, vegetables, dairy products etc.) and other items that were purchased for the household were weighed on a scale (± 0.1 kilos of a range from 0.1-5.0 kilos) every day.

2. Also the energy used (petrol, electricity and natural gas) and the water that was consumed by my family were retrieved from the receipts of electricity, water and the natural gas company for a period of one month. Petrol in litres was recorded each time each of the cars of the household was refilled, and then added together to find the total amount of litres for the month.

3. During this month, different kinds of wastes that were being produced were also weighed on a scale after each day.

4. After collecting all of the above data, the recorded values of the specific month were multiplied by 12 in order to calculate the value per year. However, sine June is a summer season and natural gas wasn't used, an average of the winter months was taken.

5. To estimate the ecological, water and carbon footprint, five online tests used:

   For the ecological footprint:
   http://www.earthday.org/footprint-calculator and
   http://ecoguru.panda.org/#/lifestyle/green/holidays,

   For carbon footprint:
   http://calculator.carbonfootprint.com/calculator.aspx and
   http://www.epa.gov/climatechange/ghgemissions/ind-calculator.html#c=waste&p=reduceOnTheRoad&m=calc_currentEmissions

   For water footprint:
   http://www.waterfootprint.org/?page=files/YourWaterFootprint

6. After completing the above tests with the data collected, the values of the respective footprints were recorded and used in order to assess the household's impact on the environment.

7. In order to use the same units for the different types of energy consumption, we should convert them. There are many online converters but some conversions can be made by hand. Many conversions were made in order to have all of the data in the same units but also be able to process them.

8. Finally, after getting the data from the test, almost all of the data were converted into percentages and pie charts were made.

3. DATA

3.1. Food

Table 1: All the food supplies purchased for the household during June, were weighed in kg and recorded. They were divided into five categories.

Food Categories	Mass of Food Supplies (kg/month)
Meat / Seafood	14.3
Cereal	30.9
Fruits/vegetables	50.5
Dairy	41.4
Others (sweets, beverages, sauce, eggs, oil, vinegar)	19.0

After having collected all of the data, each recorded value was multiplied by 12 in order to find the yearly food consumption.

Table 2: The mass of the different household food supplies as calculated per year purchase.

FOOD SUPPLIES (kg/year)		Percentages of food supplies
Meat/seafood	342.7	10%
Cereal	740.5	21%
Fruits/vegetables	1211.8	34%
Dairy	993.5	28%
Others (sweets, beverages, sauce, eggs, oil, vinegar)	228.4	7%

Graph 1: Pie chart depicting the percentages of food consumption divided in five categories.

Pie chart of Food Consumption

7% 10% 21% 34% 28%

Meat/seafood
Cereal
Fruits/vegetables
Dairy
Others
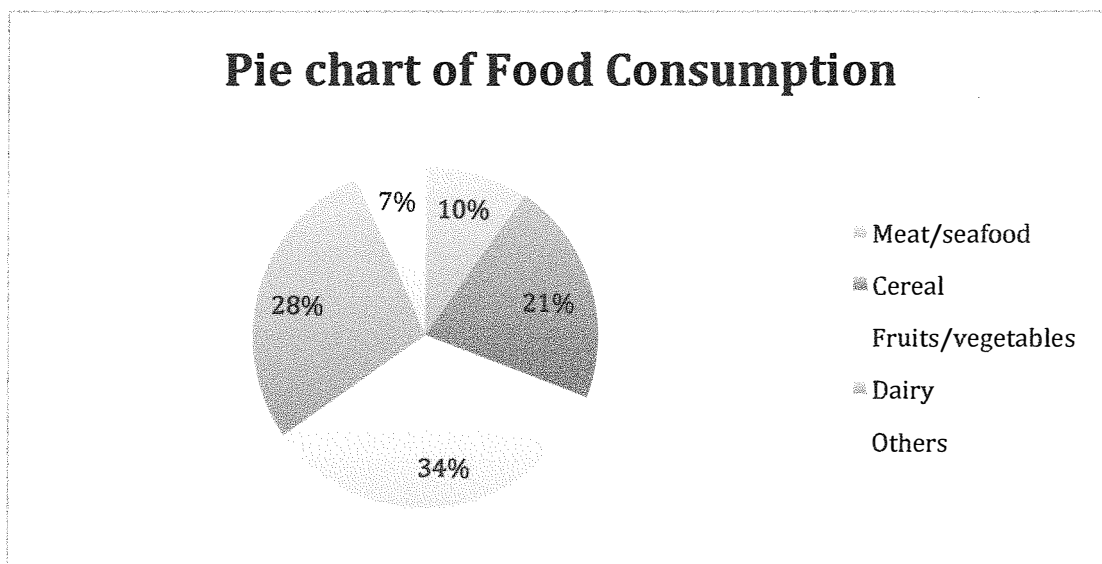
3.2 Items

The items that were bought are listed below, however, there were no big purchases made i.e. furniture, or other electronic devices at the specific month.

Table 3: All other items purchased during June were numbered or weighed.

ITEMS	Amount/month
Clothes	5 pieces
Paper	3.60 kg
Dish detergent	0.25kg
Floor cleaner	0.50 dm^3

3.3 Energy

We use electricity for general appliances and all of this energy consists of coal. I collected this data from our electricity bill. Petrol is used in mobility, so the two cars used need to be refilled on a regular basis. Natural gas is used for heating in our house.

Table 4: The different kinds of energy that were consumed in June.

Energy Types	Energy consumption /month
Petrol	137.50 dm^3
Electricity	1800 kWh
Natural gas	182.08 m^3

After having collected all of the data, each recorded value was multiplied by 12 to find the yearly energy consumption. All of the data was converted in dm^3. According to the online converter (http://rekauk.com/kwh-converter) 11.69 kWh are equal to 1dm^3 of energy. Therefore all the values below were converted accordingly either online or by hand in order to have the same units.

Table 5: The different kinds of energy that were consumed and recorded in June multiplied by 12.

ENERGY /year		Converted to dm^3
Petrol	1650 dm^3	1650
Coal (electricity)	10800 kWh	924
Natural gas	2185 m^3	2185000

3.4 Water

Table 6: Water tonnes consumed in June.

Water consumption	2.17 tons/month

After having collected all of the data, the tons of water value was multiplied by 12 in order to find the yearly water consumption.

Table 7: Water tons consumed in June multiplied by 12.

Water consumption	350 tons/year

3.5 Wastes

**Table 8**: Different types of waste that were produced during June were weighed and recorded.

WASTE TYPES	MASS (kg/month)
Garbage	7.11
Recycling	16.50
Composting	16.35

After having collected all of the data, each recorded value was multiplied by 12 in order to find the yearly waste production.

Table 9: Different kinds of waste that were produced, weighed and recorded in June multiplied by 12.

Type of wastes	Amount of wastes (kg/year)
Garbage	170.64
Recycling	396.00
Composting	392.40

Graph 2: Pie chart depicting the percentages of our waste production.

Pie chart for Waste Production

18%
41%
41%

- Garbage
- Recycling
- Composting
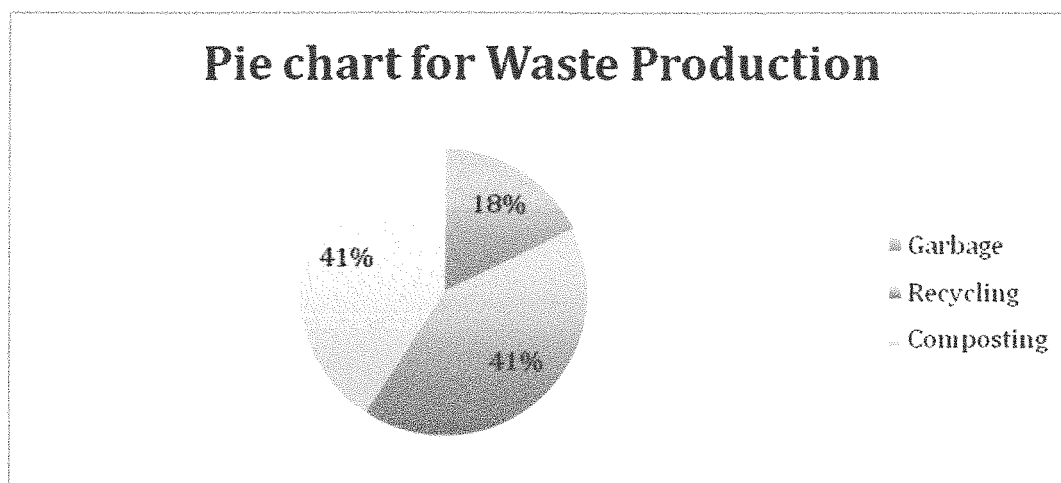
3.6 Ecological Footprint

Table 10: Ecological footprint results of our household in planets after completing the two online tests.

Online tests for ecological footprint	Results
1. http://ecoguru.panda.org/#/calculator/result[10]	2.0 planets
2. http://www.earthday.org/footprint-calculator[11]	1.4 planets or 2.6 global hectares

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[10] WWF. (n.d.) *Calculate your Footprint.* Retrieved August 18,2014, from http://ecoguru.panda.org/#/lifestyle/green/holidays

[11] Earth Day Network. (n.d.) *Ecological Footprint Quiz.* Retrieved August 18, 2014, from http://www.earthday.org/footprint-calculator

After completing two online tests for ecological footprint we find the average value.

Table 11: Average values for two different online tests in ecological footprint.

Average ecological footprint	1.7 earths

According to the inserted data, the second test produced some extra data. A graph was given with different components being responsible for our impact on the environment and to what extent. This graph was analysed as follows by using a ruler and the numbers given in order to find the exact value of each component.

Table 12: Ecological Footprint Components of our household in global hectares.

Components of our ecological footprint	Global hectares
Food	1.2
Shelter	0.4
Mobility	0.1
Goods	0.4
Services	0.4
Governance	0.1
Total	2.6

Table 13: Percentages of the components of the ecological footprint used by our household.

Components of ecological footprint	Percentages (%)
Food	46.15
Shelter	15.38
Mobility	3.85
Goods	15.38
Services	15.38
Governance	3.85

Graph 3: Pie chart depicting the percentages of components of ecological footprint.
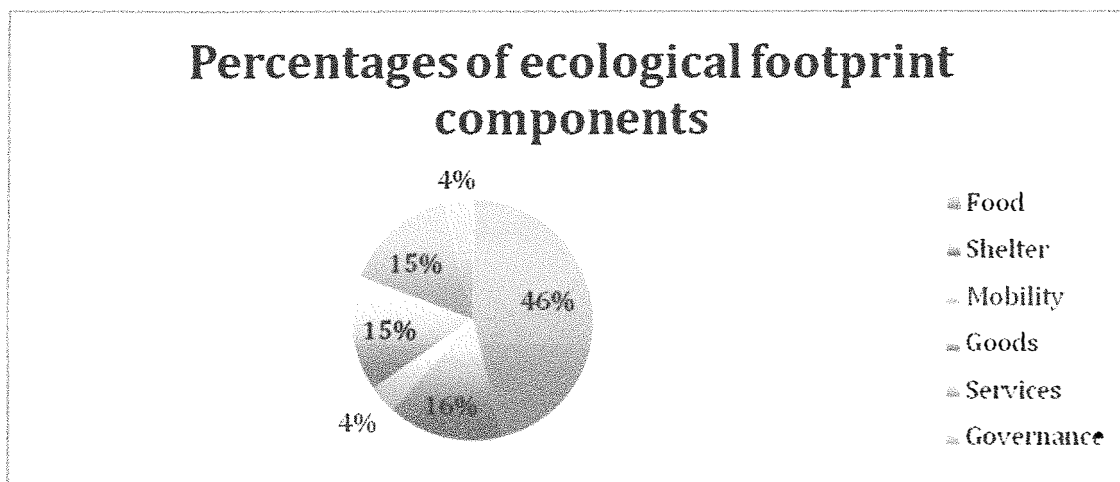
3.7 Carbon Footprint

Table 14: Carbon footprint results in metric tons of CO2 after completing the two online tests.

Online tests for carbon footprint	Results in metric tons of CO_2
http://calculator.carbonfootprint.com/calculator.aspx[12]	10.82
http://www.epa.gov/climatechange/ghgemissions/ind-calculator.html#c=theBasics&p=reduceOnTheRoad&m=calc_instructions[13]	12.00

After completing two online tests for carbon footprint we find the average in order to have one more accurate value.

Table 15: Average values for two different online tests in ecological and carbon footprint.

Average carbon footprint	11.4 tons

3.8 Water Footprint

Table 16: Water footprint results in m^3 of water per year after completing the online test.

Online test for water footprint	Water in m^3/year
http://www.waterfootprint.org/?page=files/YourWaterFootprint[14]	3370

The results for this test were further analyzed to give quantitative data for the different components and the contribution of different food categories to our total water footprint.

Table 17: Water footprint components of our total water consumption in tons.

Components	Tons of water
Food	3135
Domestic	235
Industrial	0
Total	3370

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[12] (n.d.) *Carbon Footprint Calculator*. Retrieved September 20, 2014, from http://calculator.carbonfootprint.com/calculator.aspx

[13] United States Environmental Protection Agency (EPA). (n.d.) *Climate Change: Individual Calculator.* Retrieved September 20, 2014, from http://www.epa.gov/climatechange/ghgemissions/ind-calculator.html#c=theBasics&p=reduceOnTheRoad&m=calc_instructions

[14] Water Footprint Network. (2014). *Water Footprint*. Retrieved September 18, 2014, from http://www.waterfootprint.org/?page=files/YourWaterFootprint

Table 18: Contribution in tons of water of the different food categories, to our total water footprint.

FOOD CATEGORIES	Tons of water
Cereal	407
Meat	1444
Vegetable	51
Fruit	169
Dairy	734
Stimulant	51
Fat	9
Sugar	2
Egg	58
Others	210
TOTAL	**3135**

Table 19: Percentages of the components of our total water footprint.

COMPONENTS	Percentages of total water consumption (corrected to 3 significant figures)
Food	93.00 %
Domestic	6.97%
Industrial	0.00%

Graph 4: Pie chart depicting the percentages of components of water consumption.

Components of water consumption

7%
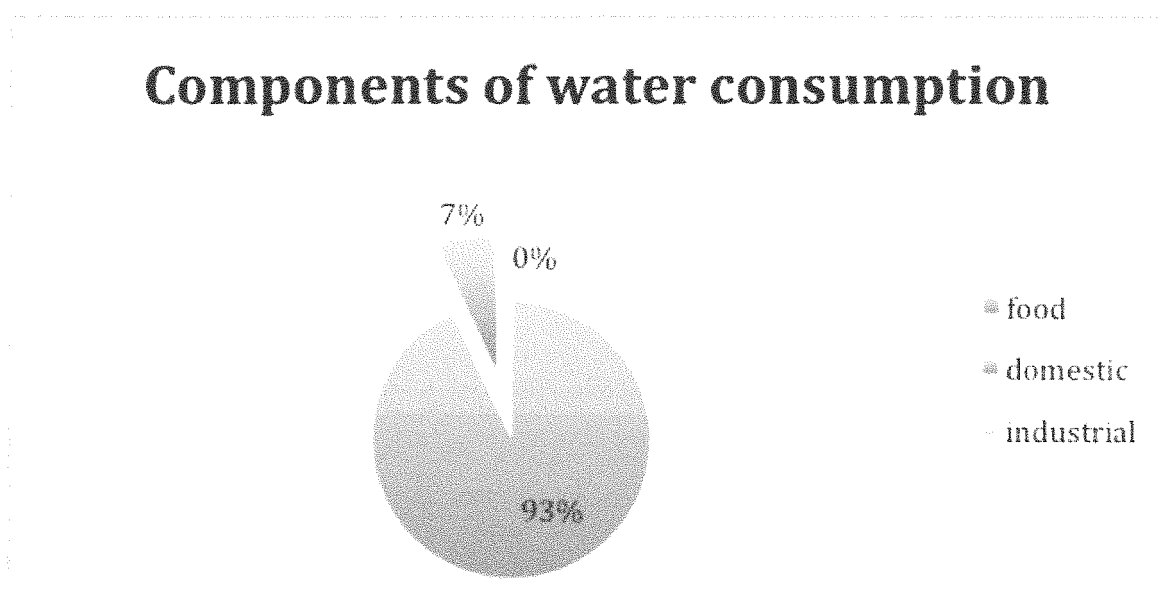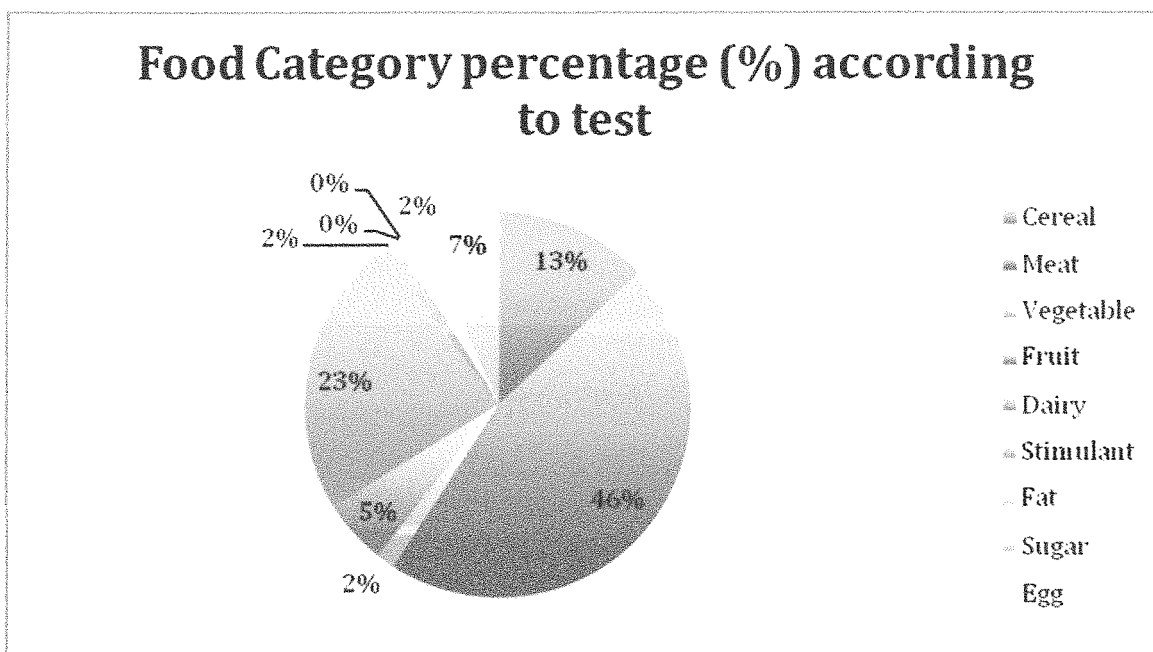
0%

food

domestic

industrial

93%

Table 20: Percentages of contribution of different food categories to our total water footprint.

FOOD CATEGORIES	Percentages of tons of water (corrected to 3 significant figures)
Cereal	13.00%
Meat	46.10%
Vegetable	1.63%
Fruit	5.39%
Dairy	23.41%
Stimulant	1.60%
Fat	0.29%
Sugar	0.06%
Egg	1.85%
●thers	6.70%

Graph 5: Pie chart depicting the percentages of food categories components to our water consumption.

Food Category percentage (%) according to test

Legend: Cereal, Meat, Vegetable, Fruit, Dairy, Stimulant, Fat, Sugar, Egg

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3.9 System Diagram of my Home

Diagram 2: The diagram below represents a system of inputs and outputs of my home yearly.

SYSTEM DIAGRAM OF MY HOME

Energy:
- Petrol 1650 dm^3
- Electric 924 dm^3
- Natural Gas 2,185,000 dm^3

Water: 350 tons

Food supplies: 3,516.888 kg

HOME

Air

CO_2: 11.41 tons

WASTES:
- Recycling 396.00 kg
- Composting 392.40 kg
- Garbage 170.64 kg

Landfill

Soil
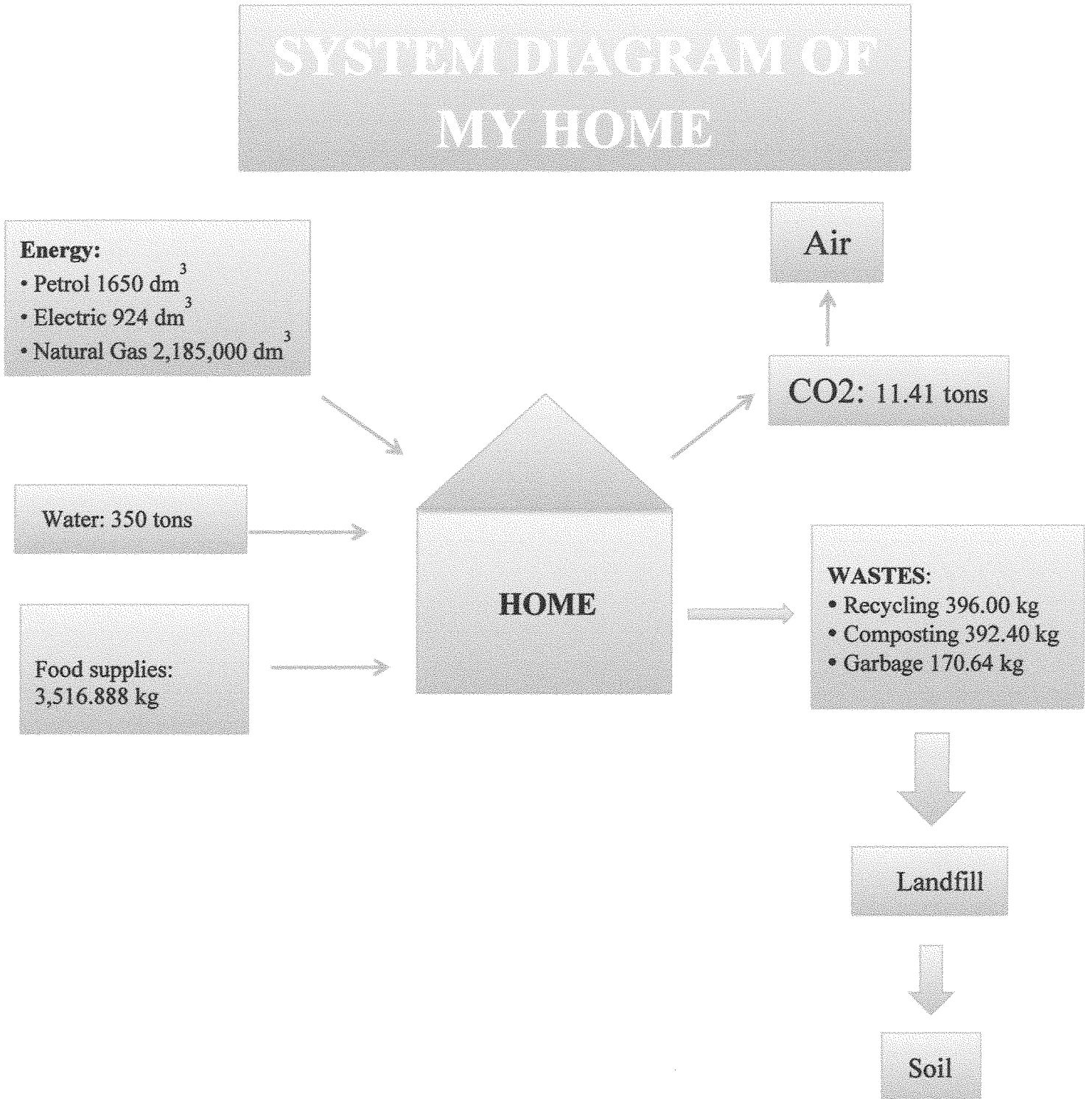
4. DISCUSSION

Performing the two online tests related to the ecological footprint of our household, it was found that the average ecological footprint is 1.7 earths. Therefore, if everyone lived like my family does it would require 1.7 earths for the human population. Comparing this number to the global average, which is 1.4 earths[15], our household has a slightly bigger impact on the planet. Although my family lives in a rather sustainable way, we would need to reduce our ecological footprint by 41,18% in order to reach the value of 1 earth, since we actually only have one Earth. On the other hand, our household average is very low if we compare it with the average number in Greece, which is 5.7 earths. Apparently people in Greece are neither environmentally conscious nor aware of the enormous impact that they have on the environment.

Furthermore, our water footprint is 3370 cubic meter per year, which is 674 cubic meters per year per person in our household. In comparison to the world's average, which is 1385 m^3 per year per person, and in comparison to Greece's average consumption of water, which is 2338 m^3 per year per person, our water consumption is still pretty low.

The calculation of our carbon footprint is equivalent to 11.41 tons of CO_2 per year, therefore approximately 2.282 per person in our household. In comparison to the global average carbon footprint, which is about 4 tons of CO2-eq per year and with 9.5 tons on average in Greece, the carbon footprint of our household is again very low.

Also concerning energy consumption, the use of natural gas is much bigger in comparison to petrol and coal. Since natural gas pollutes the environment less than the other energy sources it is preferable for preventing atmospheric smog but it still has an impact on the environment since through combustion it releases carbon dioxide. Therefore we need to reduce our natural gas consumption in order to become more sustainable.

More specifically, referring to our food supplies we have a diet that is centered in the lower trophic levels since we consume a lot of fruits/vegetables and cereal. This is an indicator that my family has a low impact on the environment by consuming more food with less water requirement in order to be produced.

Our waste production is not very high, since we have a high percentage of composting and recycling but only 18% of garbage. Furthermore, it can be observed that food consumption is the biggest component in both the ecological footprint (46%) and the water footprint (93%). This indicates that we should not consume more food than what we really need. Finally, as it is shown in Graph 5, meat is a major component in our water footprint, which has a negative effect on the environment.

Even though the impact of our household on the environment is relatively small it could still be further reduced. First of all, we can reduce the amount of meat and the dairy products we consume since these are the prevailing food categories that we consume. In addition, the energy consumed should also be reduced or be replaced by renewable energy. Even though we have two cars, only one of them could be used in most cases. However this is not easily achieved, since we live in a suburban area where public transportation is not well developed. Besides, it is very difficult to use a bicycle since there are not many designated bicycle lanes in the center of our city, so we can only use bicycles for short distances. Consequently we cannot easily reduce our carbon emissions to a great extend.
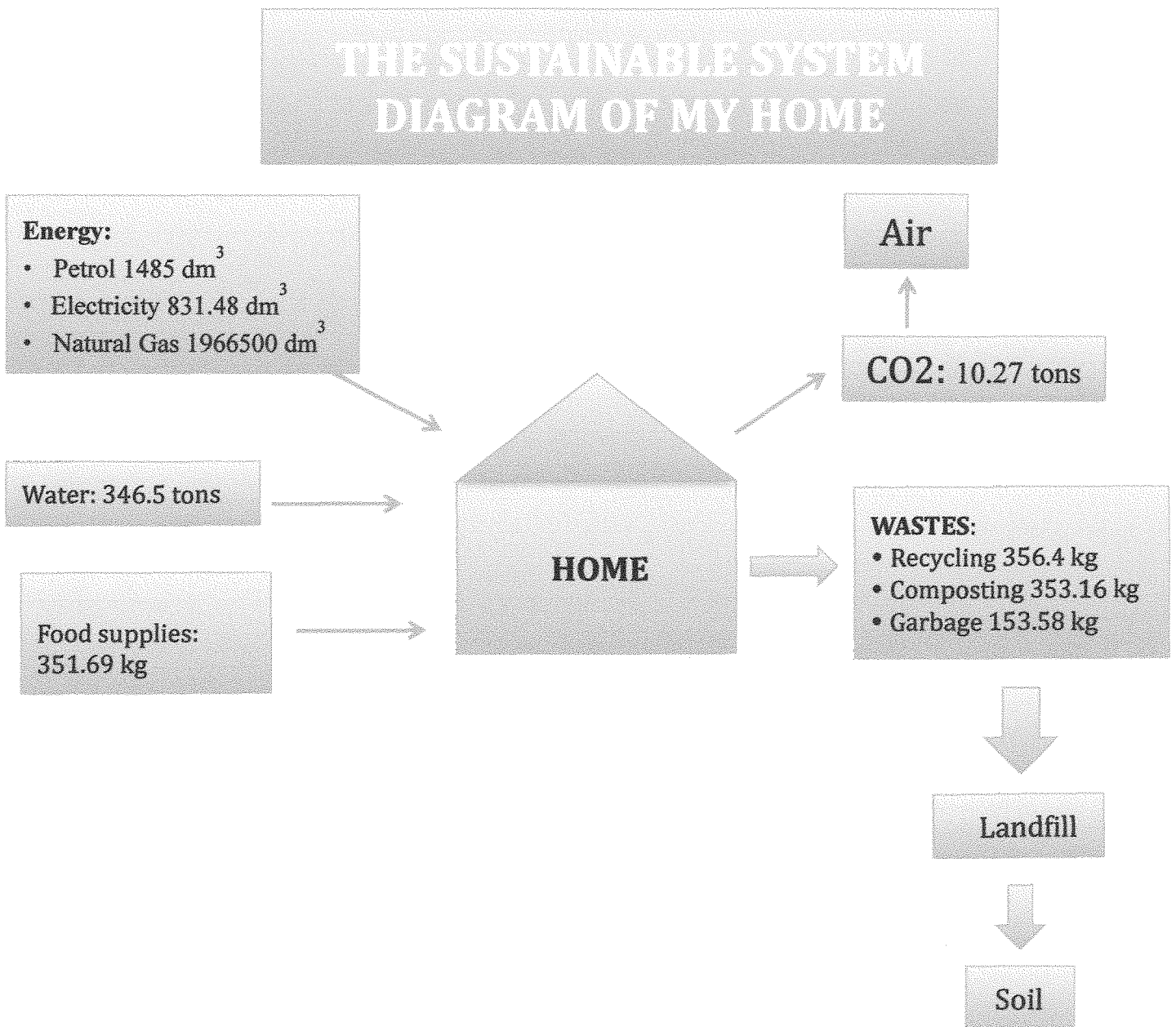
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[15] Global Footprint Network.(n.d). Footprint Network News-Humanity now demanding 1.4 earths. Retrieved August 10, 2014, from
http://www.footprintnetwork.org/en/index.php/newsletter/bv/humanity_now_demanding_1.4_earths

Moreover, we can reduce our water consumption by not wasting water for different tasks. For example, taking shorter showers. Three minutes instead of five is the ideal time to take a shower and by this way you save 5 gallons of water every time. Also it is better not to allow water running while brushing your teeth. In addition, we should avoid flushing the toilet every time we visit it. In this way one can save up to 3-7 gallons of water per day.

The diagram below shows a feasible 10% decrease in each category so that my household can become more sustainable.

4.1 Sustainable System Diagram of my Home

Diagram 3: The diagram below represents a system of inputs and outputs of my home reduced by 10% in order to become more sustainable.

THE SUSTAINABLE SYSTEM DIAGRAM OF MY HOME

Energy:
- Petrol 1485 dm^3
- Electricity 831.48 dm^3
- Natural Gas 1966500 dm^3

Water: 346.5 tons

Food supplies: 351.69 kg

HOME

Air

CO_2: 10.27 tons

WASTES:
- Recycling 356.4 kg
- Composting 353.16 kg
- Garbage 153.58 kg

Landfill

Soil

4.2 Limitations of ecological footprint assessment

In this investigation the ecological footprint of our house was calculated. The ecological footprint measures the "unsustainability" of an individual, but it cannot measure to what extend someone is sustainable. When inserting data in a test it measures one's impact on the planet but it cannot determine the extent of sustainability that an individual is achieving. Besides, many different tests are required in order to find the average and obtain a more accurate estimate, since these tests have many limitations. Firstly, they do not take into account various social factors such as the culture, the religion, the economy and the political situation of a country in which an individual lives. In addition, only carbon dioxide emission is assessed in the carbon and ecological footprint. Other greenhouse gases, which are not assessed, might even have a major effect on the planet. In addition, even though the ecological footprint of an individual is calculated, there might not be any available data for the particular country, like in the case of Greece. Greece has no records for the mean food production of arable land and the net carbon fixation of local vegetation so it was impossible to make accurate calculations of the ecological footprint. Furthermore, there aren't any tests that calculate the ecological footprint specifically for Greece. Therefore I had to choose Turkey (a country similar to Greece in terms of climate and resources) in order to determine our ecological footprint. Moreover, the outcome of the tests might not be as accurate since in some cases, the data that was inserted in these tests was an approximation of the real value. It was very difficult to have an exact measurement of all the inputs and outputs of our household. In general, footprint tests have on average a 20-30% margin error[16]. It is also known that most tests do not ask for quantitative data but instead they use multiple-choice questions with a rather big range of values in their answers. This makes the results more subjective and inaccurate. Finally and most importantly, ecological footprint tests don't calculate water consumption and wastes produced. Therefore carbon and water footprint tests should be also used in order to calculate all the components that are included in one's impact on the environment.

4.3 Limitations of the investigation

There were also some limitations in the way the investigation was conducted. The collected data might not be as representative since it was recorded only during one specific month (June) of the year and the needs of a household change according to the seasons. So the estimated footprint for the whole year might not be very accurate due to seasonal variations. Therefore it would have been better to record data for the duration of a whole year and then take the average of these values. In addition, some data was not included. For instance, some products consumed during June were already stored in our storeroom or in the freezer from previous months. These products were not recorded since they were purchased before the investigation started. Moreover, the food that my family consumed outside of the house, like in restaurants or canteens, was not included. Furthermore, the balance has an uncertainty of ± 0.1Kg; therefore the products might not have been weighed accurately. Finally, conversions of units in many cases may have resulted in a final value that was not as accurate as the initial one.

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[16] (n.d.). *Ecological Footprint-Methods and Limitations.* Retrieved July 17,2014, from
http://www.acrewoods.net/environment/ecological-footprinting

5. CONCLUSION

Although it may vary between individuals, all people have an impact on this planet. Through this investigation an estimation of my household's ecological, carbon and water footprint was made. It was found that the ecological footprint is higher than the global average but lower than the Greek average. However, the carbon and the water footprints were pretty low compared to both the global and the Greek average. This indicates that we do not harm the environment to a great extend. Eventually, through this investigation it is evident that the ecological, but not the carbon and the water footprints, should be reduced in order to acquire a more sustainable way of living and to reduce our impact on the environment, saving it for future generations.

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