THE UNIVERSITY OF THE SOUTH PACIFIC
LIBRARY

Author Statement of Accessibility- Part 2- Permission for Internet Access

Name of Candidate: POONAM PRITIKA DEVI

Degree: MASTER OF ARTS IN GEOGRAPHY

Department/School: SCHOOL OF GEOGRAPHY, EARTH SCIENCE & ENVIRONMENT

Institution/University: THE UNIVERSITY OF THE SOUTH PACIFIC

Thesis Title: COMPARISON OF CONSUMPTION PATTERNS & ENVIRONMENTAL AWARENESS IN FORMAL & INFORMAL COMMUNITIES IN SUVA, FIJI ISLANDS.

Date of completion of requirements for award: DECEMBER

1. I authorise the University to make this thesis available on the Internet for access by USP authorised users. [Yes/No]

2. I authorise the University to make this thesis available on the Internet under the International digital theses project [Yes/No]

Signed: [signature]

Date: 20/05/16

Contact Address

PH: 9966055
email: poonamdevi886@gmail.com

Permanent Address

P.O. BOX 3749
Labasa.
LIBRARY
Author Statement of Accessibility

Name of Candidate: Poonam Pratika Devi

Degree: Master of Arts in Geography

Department/School: School of Geography, Earth Science & Environment

Institution/University: The University of the South Pacific

Thesis Title: Comparison of Consumption Patterns & Environmental Awareness in Formal & Informal Communities in Suva, Fiji Islands

Date of completion of requirements for award: December, 2015

1. This thesis may be consulted in the Library without the author’s permission

Yes/No

2. This thesis may be cited without the author’s permission providing it is suitably acknowledged.

Yes/No

3. This thesis may be photocopied in whole without the author’s written permission.

Yes/No

4. This thesis may be photocopied in proportion without the author’s written permission

Part that may be copied

Under 10% __________ 40-60% __________ 10-20% __________ 60-80% __________ 20-40% __________ Over 80% __________

Yes/No

5. I authorise the University to produce a microfilm or microfiche copy for retention and use in the Library according to rules 1-4 above (for security and preservation purposes mainly)

Yes/No

6. I authorise the Library to retain a copy of this thesis in e-format for archival and preservation purposes.

Yes/No

7. After a period of 5 years from the date of publication, the USP Library may issue the thesis in whole or in part, in photostat or microfilm or e-format or other copying medium, without first seeking the author’s written permission

Yes/No

8. I authorise the University to make this thesis available on the Internet for access by authorised users.

Yes/No

Signed: [Signature]

Date: 30/05/16

Contact Address

Ph: 9966055
email: poonamdevi806@gmail.com

Permanent Address

P.O. Box 3749
Labasa.
COMPARISON OF CONSUMPTION PATTERNS AND ENVIRONMENTAL AWARENESS IN FORMAL AND INFORMAL COMMUNITIES IN SUVA, FIJI ISLANDS

By

Poonam Pritika Devi

A thesis submitted in fulfillment of the requirements for the Degree of Master of Arts in Geography

Copyright © 2015 by Poonam Pritika Devi

School of Geography, Earth Science & Environment
Faculty of Science, Technology and Environment
The University of the South Pacific

December 2015
Declaration

A statement by the Author

I, Poonam Pritika Devi, hereby declare that this thesis is my own work and produced to the best of my knowledge. It contains no material previously published, or overlaps with material substantially submitted for the award of any degree at any institution, except where duly acknowledgement is made in the manuscript and in the reference list.

Poonam Pritika Devi
S11075357
Date: 14/12/15

A Statement by the Supervisors

This research work was performed under my supervision and according to my knowledge is the sole work of Miss Poonam Pritika Devi.

Dr. Eberhard Weber
Supervisor
Date: 14/12/15

Dr. John Lowry
Co-Supervisor
Date: 14/12/15
Acknowledgements

I would like to forward my sincere gratitude to the Research Office at the University of the South Pacific for awarding me the Graduate Assistant for Research Scholarship to pursue Masters of Arts in Geography. This project would not have been possible without the scholarship and funding.

I would like to extend heartfelt gratitude to my supervisors, for their continuous support and guidance throughout the research. Dr. Eberhard Weber and Dr. John Lowry, I feel really privileged to do research under your guidance. Without your support, I would not have been able to produce a quality work. I am grateful for the valuable time you have spent in reviewing and providing valuable comments on my progress. I would also like to thank you for your advice on selecting the topic, to carrying out the research, analyzing the data, and writing the thesis. I also wish to thank Dr. Naohiro Nakamura for his advice and discussion on my research.

I would also like to thank the School of Geography, Earth Science and Environment for providing me a work space. I am grateful to the Secretary (Ms. Sue Naco), for printing out documents for me and promptly adhering to any issue I had with the school during the research. I also wish to thank my translator, Resina Divuniwaqa for accompanying me during the fieldwork and assisting me with Fijian – English translation during household survey, without her assistance I would not have been successful in the survey. I would like to acknowledge the Department of Town and Country Planning, and Department of Housing for providing statistical data; in particular, Anuragh Narayan and Fesaitu Mesulame. I also like to thank the secretary of Bhindi Bros Industries (Ms. Premila) for providing valuable information of the study area.

I am grateful to my family for believing in me and supporting me in all possible ways during the research. I wish to sincerely forward gratitude to my parents, Mr. & Mrs. Ami Chand for their unremitting support and encouragement. I would also like to thank my friends and other family members for their reassurance.

Above all, I am extremely grateful to the Lord Almighty for his blessings.
Abstract

Urbanization is observed in Fiji in many aspects. A paramount significance of it is depicted in the growth of informal settlements particularly in the Capital City, Suva. Increase in demand for housing in urban areas has led to increase in housing cost and land prices; especially where close to 90 percent of the land is under native Fijians and not available to the land market. This leaves low income earning migrants with no other choice than to move to informal settlements. It is observed that households who are poor in one measure tend to be poor in others as well.

This study was carried out to measure consumption patterns and the degree of environmental awareness on communities located on or near fragile environments. Two informal settlements and a formal neighborhood were selected for the study. The three communities (Veidogo and Wailea informal settlements and Vatuwaqa formal neighborhood) are all located in Vatuwaqa, a densely populated urban neighborhood of Suva, enclosed by mangrove swamps in the vicinity. The study includes an ecological footprint survey through which data on consumption patterns of the three communities in the study area was collected. The data collection included both qualitative and quantitative approaches and was done using a structured and a semi-structured questionnaire survey with households in the study area.

The study revealed that consumption patterns significantly differ between the three communities. In particular the two informal settlements showed contradictory results; one settlement has results that are more similar to the formal neighborhood. On one hand, residents of the formal neighborhood appear to be more considerate about their physical environment; however, their higher consumption explains that their actions are degrading the environment in the long term. On the other, residents of informal settlements are least concerned of the environment and more apprehensive to survive in a degrading environment. They have lower consumption than the formal neighborhood. A bigger ecological footprint is correlated to a bigger impact on the environment, which is apparent by the consumption pattern of the Vatuwaqa formal neighborhood and Wailea informal settlement.
List of Abbreviations

ADB – Asian Development Bank
FAO – Food and Agriculture Organization
GHA – Global hectare
PIC – Pacific Island Country
TFR – Traditional Fishing Rights
WHO – World Health Organization
Table of Contents

Declaration .............................................................................................................................. i
Acknowledgements ................................................................................................................ ii
Abstract ................................................................................................................................. iii
List of Abbreviations ............................................................................................................. iv
List of Figures ......................................................................................................................... x
List of Tables ........................................................................................................................ xii
Chapter 1: Introduction ........................................................................................................... 1
  1.1. Introduction ....................................................................................................................... 1
  1.2. The Conceptual Framework .............................................................................................. 3
  1.3. Informal settlements in Fiji: A brief overview ................................................................. 4
  1.4. Justification of research ..................................................................................................... 5
  1.5. Background and context of the Study Area ...................................................................... 6
  1.5.1. Topography ........................................................................................................................... 7
  1.5.2. Demography ......................................................................................................................... 8
  1.5.3. Education and employment ................................................................................................. 8
  1.6. Research Questions ........................................................................................................... 9
  1.7. Objectives ........................................................................................................................ 10
  1.8. Research Methods ........................................................................................................... 10
  1.9. Structure of the thesis ...................................................................................................... 11
Chapter 2: Literature Review ................................................................................................ 12
  2.1. Introduction .................................................................................................................... 12
  2.2. Urbanization in Fiji – a short story ................................................................................. 12
  2.2.1. Urbanization and informal settlements in Fiji in pre-colonial times ......................... 12
  2.2.2. Urbanization and informal settlements in Fiji in the colonial era ............................... 13
  2.2.3. Urbanization and informal settlements in Fiji between 1970 – 1987 ....................... 14
  2.2.4. Urbanization and informal settlement in Fiji after 1987 ............................................ 15
  2.3. Poverty and Livelihood Security in Fiji ......................................................................... 17
  2.3.1. The Measurement of Poverty ........................................................................................... 17
  2.3.2. Poverty studies in Fiji ...................................................................................................... 19
  2.3.3. Sustainable Livelihoods ................................................................................................... 20
  2.3.4. Urban Poverty and the causation of informal settlements ............................................ 23
  2.4. Environmental Degradation ........................................................................................... 24
  2.4.1. The relationship between Environmental Degradation and Poverty ....................... 24
2.4.2. The impact of informal settlements on Mangrove Ecosystem ....................................... 25
2.5. Ecological Footprint Survey: an indicator for sustainable consumption ....................... 26
  2.5.1. Brief History of Ecological Footprint study ................................................................... 26
  2.5.2. Application and methodology of Ecological Footprint Survey ..................................... 27
  2.5.3. Some case studies - for ecological footprint analysis ................................................. 28
  2.5.4. Discussion of the strengths and weaknesses of Ecological Footprint Analysis .......... 30
2.6. Conclusion ...................................................................................................................... 32
Chapter 3: Research Methodology ......................................................................................... 33
  3.1. Introduction .................................................................................................................... 33
  3.2. Methodological Approaches ........................................................................................ 33
  3.3. Data Sources .................................................................................................................. 34
  3.4. Research Design ........................................................................................................... 34
    3.4.1. Interviews ....................................................................................................................... 35
    3.4.2. Field Observations ........................................................................................................ 36
    3.4.3. Consultations with relevant authorities ........................................................................ 36
  3.5. Sampling ....................................................................................................................... 37
  3.6. Research Analysis ......................................................................................................... 37
  3.7. Study Area .................................................................................................................... 38
  3.8. Limitations in Research ............................................................................................... 38
  3.9. Ethical Considerations ................................................................................................ 39
  3.10. Conclusion .................................................................................................................. 39
Chapter 4: Results and Findings ........................................................................................ 40
  4.1. Introduction .................................................................................................................. 40
  Part I. Description of the Case Studies ............................................................................... 40
  4.2. Veidogo Informal Settlement ...................................................................................... 40
    4.2.1. Background Information ........................................................................................... 40
    4.2.2. Geography .................................................................................................................. 41
    4.2.3. Demography ............................................................................................................... 42
    4.2.4. Socio- Economic Status ............................................................................................ 42
      4.2.4.1. Education ............................................................................................................... 42
      4.2.4.2. Employment and unemployment ......................................................................... 43
      4.2.4.3. Poverty ..................................................................................................................... 43
      4.2.4.4. Housing Type ......................................................................................................... 45
      4.2.4.5. Land Tenure ......................................................................................................... 46
4.3. Wailea Informal Settlement ........................................................................................... 46
  4.3.1. Background Information.......................................................................................... 46
  4.3.2. Geography............................................................................................................... 46
  4.3.3. Demography ........................................................................................................... 47
  4.3.4. Socio-economic Status .......................................................................................... 47
    4.3.4.1. Education........................................................................................................... 47
    4.3.4.2. Employment and Unemployment ...................................................................... 48
    4.3.4.3. Poverty .............................................................................................................. 49
    4.3.3.4. Housing Types ................................................................................................. 49
    4.3.3.5. Land Tenure .................................................................................................... 50
  4.4. Vatuwaqa Formal Neighborhood ............................................................................. 51
    4.4.1. Background Information....................................................................................... 51
    4.4.2. Geography ........................................................................................................... 51
    4.4.3. Demography ........................................................................................................ 51
    4.4.4. Socio-economic status ......................................................................................... 52
      4.4.4.1. Education........................................................................................................ 52
      4.4.4.2. Employment and Unemployment .................................................................... 52
      4.4.4.3. Poverty ........................................................................................................... 53
      4.4.4.4. Housing Type ................................................................................................. 53
      4.4.4.5. Land Tenure .................................................................................................. 54
  Part II. Ecological Footprint Survey Result ...................................................................... 54
    4.5. Background of Study ............................................................................................... 54
    4.6. Ecological Footprint Result - Veidogo Informal Settlement ..................................... 57
      4.6.1 Water Use ............................................................................................................ 57
      4.6.2. Food Use ............................................................................................................ 59
      4.6.3. Transportation ................................................................................................. 60
      4.6.4. Energy Use ....................................................................................................... 62
      4.6.5. Clothing Use .................................................................................................... 63
      4.6.6. Material Goods Use ......................................................................................... 64
    4.7. Ecological Footprint Result - Wailea Informal Settlement ....................................... 65
      4.7.1. Water Use ........................................................................................................ 65
      4.7.2. Food Use ........................................................................................................... 66
      4.7.3. Transportation ................................................................................................. 67
      4.7.4. Energy Use ....................................................................................................... 68
Chapter 6: Conclusion and Recommendation.................................................................102
6.1. Conclusion..................................................................................................................102
6.2. Recommendations.....................................................................................................105
6.3. Future research..........................................................................................................108
Reference List ..................................................................................................................109
Glossary............................................................................................................................117
Appendix .........................................................................................................................118
Appendix A - Fieldwork Questionnaire.................................................................118
Appendix B - The Original Questionnaire.................................................................123
List of Figures

Figure 1.1 the Conceptual Framework of study ................................................................. 3
Figure 1.2 Google Earth Image of the study area ................................................................. 6
Figure 1.3 River System flowing next to the study area ....................................................... 7
Figure 1.4 Employment Status in the study area ................................................................. 8
Figure 1.5 Education Status in the study area ................................................................. 9
Figure 2.1 Map of Fiji Islands ............................................................................................ 14
Figure 2.2 Households livelihood security in the context of urban households ................... 22
Figure 4.1 Unpaved narrow paths connecting houses in the settlement ......................... 41
Figure 4.2 Predominance of Swamp ................................................................................. 44
Figure 4.3 Housing in Veidogo informal settlement ....................................................... 45
Figure 4.4 Unpaved road networks ............................................................................... 47
Figure 4.5 Housing in Wailea informal settlement ....................................................... 50
Figure 4.6 Housing in Vatuwaqa ................................................................................... 54
Figure 4.7 Water Use in Veidogo .................................................................................... 58
Figure 4.8 Water Connection Meters in Veidogo .......................................................... 58
Figure 4.9 Food Use in Veidogo ..................................................................................... 60
Figure 4.10 Travel mode used by most residents ......................................................... 61
Figure 4.11 Transportation use ....................................................................................... 61
Figure 4.12 Energy Use in Veidogo ............................................................................... 62
Figure 4.13 Clothing Use in Veidogo ............................................................................. 63
Figure 4.14 Material goods use in Veidogo ..................................................................... 64
Figure 4.15 Water Use in Wailea ................................................................................... 65
Figure 4.16 Food Use in Wailea ..................................................................................... 66
Figure 4.17 Transportation Use in Wailea ...................................................................... 67
Figure 4.18 mode of travel in Wailea ............................................................................. 68
Figure 4.19 Energy Use in Wailea .................................................................................. 68
Figure 4.20 Clothing Use in Wailea ............................................................................... 69
Figure 4.21 Material goods use in Wailea ...................................................................... 70
Figure 4.22 Water Use in Vatuwaqa ............................................................................. 71
Figure 4.23 Food Use in Vatuwaqa .............................................................................. 72
Figure 4.24 Transportation use ..................................................................................... 73
Figure 4.25 Energy Use in Vatuwaqa ............................................................................. 74
Figure 4.26 Clothing Use in Vatuwaqa .......................................................................... 75
List of Tables

Table 4.1 Education Attainment of residents in Veidogo ........................................................ 42
Table 4.2 Employment Status in Veidogo informal settlement ................................................. 43
Table 4.3 Education Status in Wailea ...................................................................................... 48
Table 4.4 Employment Status in Wailea ................................................................................... 49
Table 4.5 Education Status in Vatuwaqa ................................................................................. 52
Table 4.6 Employment Status in Vatuwaqa ............................................................................. 53
Table 4.7 Water Use ................................................................................................................. 55
Table 4.8 Food Use .................................................................................................................. 55
Table 4.9 Transportation Use ................................................................................................. 55
Table 4.10 Energy Use ............................................................................................................. 56
Table 4.11 Clothing Use .......................................................................................................... 56
Table 4.12 Material Goods Use ............................................................................................... 57
Table 5.1 The Calculation for Ecological Footprint Result ..................................................... 95
1.1. Introduction

Urbanization has become a serious challenge to cities of developing countries in many regards, including environmental and social implications. The rapid growth of urban population in the Pacific Island Countries (PICs) is aggravating the living conditions of people already in poverty or near poverty (Khan, 2012). Significant urban growth in the region is attributed to real and perceived socio-economic inequalities, causing migration of the poor to towns and cities. Poverty and hardships are realities for many people moving into urban areas, many of them in search for better opportunities. Growing population and lack of livelihood opportunities encourage migration from rural areas and outer islands to urban center. Most urban poor reside in poverty afflicted urban environments. Still they are far better off than enduring depressed rural environments (Asian Development Bank, 2012a). In 2008, for the first time in history, about half of the world’s 6.7 billion people were living in urban areas. For the first time global urban population was bigger than the globe’s rural population. By the year 2030, 40% of the world population is expected to be rural dwellers and 60% urban; approximately 30% of these urban dwellers reside in slums (Jones, 2012).

A rise in urban population increases demand for urban services and infrastructure: water supply, provision for electricity, garbage collection, adequate drainage system, and transportation. Often this exceeds the capacities of local authorities. Urban livelihoods in the Pacific exert significant pressure on the environment, as many urban dwellers are reliant on the physical environment for day-to-day survival. The foreseeable result of this dependency are exploitation of natural resources for fuel wood, housing and construction, and land and water pollution due to generation of household waste. These factors invariably lead to loss of natural vegetation, insufficiency of clean water supply, and unmanaged sewerage systems.

Poverty and environmental degradation share a close relationship of creating a venomous cycle. Poverty leads to environmental stress, which in turn contributes to extreme poverty, which pressurizes the poor to engage in unsustainable practices, that deteriorates the physical environment (Oduwayne & Lawanson, 2006). The poor tend to degrade fragile environments due to lack of incentives and institutional support; for example to secure property rights. Fragile environments are often targets of degradation by humans. In areas occupied by informal settlements the situation is worsened by poor
sanitation and drainage, inadequate water supply and other basic facilities, poor housing structures, and inefficient household waste management (Siwar & Murad, 2001).

Growing population, rising poverty and insecure property rights play a major role in environmental degradation. As mentioned above, high rural to urban migration places great stress on urban environment in many developing countries. Poor people without own land and insufficient resources to rent houses gather on fragile environments, outside the formal housing market, often without basic facilities. The establishment of such settlements is difficult to control and even more difficult to manage once they are established. There is often lack of Government concern and action to cope with insecure and unequal land ownership, and inadequate access to resources in many Pacific Island countries. Governments hesitate to deal with population growth and are either unable, or unwilling to cater for the increasing demand for housing and employment. All these factors lead to uncontrolled growth of informal settlements along the urban fringe. Expansion of urban areas transforms the surrounding natural landscape, land use, and land cover to reshape land for high density buildings and limited open space, which often disrupts local ecologies, and increases environment fragility: flooding, water logging, solid and liquid waste.

Various methods have been applied worldwide to measure ecological impacts of water use, waste disposal, energy use, and other forms of consumption of cities and their suburbs. The most widely known method to measure the rate of consumption and resource utilization is the ecological footprint. This method evaluates the prolific land that an area (e.g. country or city) requires to provide food and natural resources, as well as what is used up for waste management of its residents. The average ecological footprint for individuals can be calculated in terms of productive land area, which can be compared with the global average land area that is sustainable. Ecological footprint can be calculated for areas (cities, countries, global) but also for households or individuals, to portray and compare footprints of affluent residents to low-income residents in a particular location (Satterthwaite, 2011). The gap between demand for natural resources and the ability of the ecosystem to replenish its services is widening for most of the countries around the globe (WWF & ADB, 2012). This deficit results in significant economic and environmental challenges. In Pacific Island countries, unsustainable resource use not only harms nature, but is becoming a threat to the natural resources of small economies.
Rapid urbanization in Fiji has led to an increase in the demand for urban housing and incapability of the poor to afford formal housing in urban areas has led to the establishment of informal settlements (Hassan, 2005). These settlements are locally referred to as “squatter” or “informal settlements”. In Fiji, the term “squatter” is broadly known for people residing in informal settlements and those with permission to occupy land through payment of rent, but without any security of tenure and deprived of basic services, and live in poorly constructed dwellings (Bryant, 1992). The mangrove covered areas are used for the expansion of informal settlements (Agrawala et al, 2003). This leads to significant land use changes, pressure on the physical environment, and is threatening the integrity of existing ecosystems.

This study will compare consumption patterns and degree of environmental awareness between residents of formal and informal neighborhood in Fiji’s capital city, Suva. An ecological footprint survey is the main basis of data collection to compare the available bio-capacity against existing population and assessing at the same time the community awareness of consumption and environmental sustainability. “Consumption”, in this research is defined as the use of various categories of resources to satisfy households’ needs. The baseline consumption indicators used in the research are: Water, food, energy, clothing, transportation, and other goods. The indicators are referred to as the categories.

1.2. The Conceptual Framework
The conceptual framework portrays that poverty and environment share a close relationship. Environment (e.g. mangrove ecosystems) is an important source of livelihood for many poor. However, in attempt to satisfy their needs, people overexploit natural resources, add pollutants, and are degrading environment quality which subsequently bounces negatively back on them. As indicated above, this study tests environmental awareness and exploitation for sustenance through an ecological footprint survey.

There are various stakeholders who play an important role in managing poverty and environment issues. These stakeholders are: the landowners; Government for state land and private persons/companies for freehold land, and the municipal bodies responsible for administering urban areas. In addition, many Non-Governmental Organizations (including faith-based organizations) work on poverty-environment nexus. The laxity of some stakeholders, as well as inappropriate strategies to deal with the issues enhances environmental degradation by the poor. The effectiveness of stakeholders in collaborating with the poor and adequate management of urban fragile environments would help to mitigate many environmental problems in urban areas.

1.3. Informal settlements in Fiji: A brief overview

The Fiji Islands are an archipelago with a total land area of 18,333 km², and a population of 837,271 people (as per 2007 census data). The annual population growth rate was 0.7% in the 2007 census data (Fiji Bureau of Statistics, 2015). The nation comprises 61.1% indigenous Fijians (iTaukei), 34.7% Fijians with Indian ancestry, and 6% of other ethnic background, living on 110 inhabited Islands out of a total of 332 islands. The Republic of the Fiji Islands has one city, Suva, which is the capital city, and a number of major administrative areas referred to as towns (except Lautoka which is a municipality with a city status). The majority of these towns are situated in coastal areas.

Informal settlement is a phenomenon apparent to urban areas of Fiji. About 15% of Fiji’s population lives in informal settlements, amounting to an approximate of 125,000 people in more than 180 informal settlements, with the largest proportion of these settlements concentrated in the Suva-Nausori corridor (UNICEF, 2011). At present Suva City alone is home to 36 informal settlements, while the Central Division has 85 informal settlements, stretching from Lami to Nausori (Department of Town and Country Planning, 2014). Most of these settlements are still expanding.
1.4. Justification of research

Urbanization has been a factor leading to proliferation of informal settlements in Fiji. Persistent struggle to make a living in Fiji’s agricultural areas increase numbers moving to Suva and other urban areas, in search of wage employment (Daye, 2009). In 1999, Fiji’s urban squatter population was approximately 45,000, which increased to around 100,000 in 2007, comprising approximately 12% of total population (Asian Development Bank, 2012b). Between 2002 and 2008 Fiji’s urban areas witnessed a 22% increase in the number of households, and 16% increase in urban population (Narsey et al, 2010). However, not everyone moving to urban areas have a secured roof over their head, with many of the unfortunates seeking shelter in informal settlements to find housing from where they can sustain livelihood. In Suva, informal settlements along the coasts are expanding, exerting pressure on the coastal areas (Bryant-Tokalau, 2012). This puts the fragile environment along the coast in danger of degradation.

The growing population in informal settlements has put significant demands on natural resource consumption and dependency on the environment around them. Looking at livelihood issues in urban areas, urban poverty is analyzed using household assets and services, together with wealth, income and expenditure surveys (Narsey, 2012). These factors determine the standard of living of households. Previous studies on Fiji’s informal settlements have evaluated migration and poverty relationship (Narsey, 2012). This research uses consumption patterns as the major drivers of environmental degradation and natural resource use. The study compares and contrasts the three case studies with one other, on the consumption patterns and the extent of dependence by the settlements on the physical environment. It highlights on the degree of environmental awareness of residents, and the measures that can be taken to promote environmental sustainability in the study areas. The case studies were selected as they contain both informal settlements and formal neighborhood next to each other, both having significant impact on the surrounding environment. To determine which group of people (poor or rich) has a greater significant role in environmental degradation and unsustainable resource use, an ecological footprint survey was adopted to measure and compare consumption pattern. The ecological footprint analysis tool is quite resourceful in determining human pressure on the physical environment, by measuring consumption patterns and earths replenishing capacity (Manoiu et al, 2014).
1.5. Background and context of the Study Area

The case studies of the research consist of three communities: Wailea, Veidogo, and Vatuwaqa. All three communities are located adjacent to Fletcher Road in the northern outskirts of Suva. Two of the locations are informal settlements, Veidogo and Wailea. The third, Vatuwaqa, is a formal neighborhood, providing residence for mainly lower middle class families as well as containing two industrial areas. In recent years the informal settlements have shown a significant population increase, placing much stress on the capacity of the area. One impact of this rising population is that informal settlements have encroached into the mangrove swamp in the neighborhood to accommodate new migrants. In the formal neighborhood population growth has been steady.

Referring to the relevant Governmental authorities administering the area (Department of Housing), residents are not intending to vacate the settlements at present on the basis that there are no other vacant places in Suva to accommodate the growing population of informal settlements. It would be a large-scale venture for the Government to resettle all informal settlements amounting to immeasurable time and money\(^1\); instead, the settlements are being provided with access to water, electricity and garbage collection to sustain living.

\(^1\) However, the Department of Housing is working to relocate the residents of Nanuku settlement (adjacent to Veidogo) to a formal neighborhood (Davuilevu Housing), as the land developer (Bhindi Brothers) has planned to develop the property on which the settlement is situated (Fiji Sun, Oct. 10, 2015).

(Source: Google Earth, 2015)

Figure 1.2 Google Earth Image of the study area.
Figure 1.2 above shows the location of case study area, including the three communities. As seen, both informal settlements are located next to mangrove swamp.

1.5.1. Topography

The study area is located at a relatively low elevation in relation to the mean sea level\(^2\). The topography of the study area plays a prominent role in worsening the environmental problems. Flooding is a common hazard to the settlements along the coast, and low elevation exacerbates the environment conditions in occurrences of heavy rain. The low altitude makes the entire area susceptible to frequent flooding, which is one of the primary difficulties faced by residents of the three communities. Adding to the complexity is the extensive land reclamation taking place in the vicinity of the study area, narrowing the river through increased sedimentation load, and removal of vast expanses of mangrove forest.

(Source: Google Earth, 2015)

Figure 1.3  River System flowing next to the study area.

Figure 1.3 shows the change in the river flow pattern over a period of 10 years, between 2005 and 2015. The river is getting narrow due to continuous siltation resulting from deforestation in the mangrove swamp.

\(^2\) According to Google earth imagery (2015) the average elevation above mean sea level of the three case study areas is 4.2 meters; with Veidogo informal settlement located at 4.8 meters above mean sea level, Wailea informal settlement at 3.3 meters, and Vatuwaqa neighborhood at 4.7 meters.
1.5.2. Demography

According to the 2007 census the study area has a population of 6620 inhabitants, with Vatuwaqa formal neighborhood having 4153 people, Wailea informal settlement 1922 people, and Veidogo informal settlement consisting of 545 people. The informal settlements have a proportionately higher population concentration in relation to the total land area of these settlements, exerting enormous pressure on the surrounding natural ecosystems.

1.5.3. Education and employment

The desire for better education and secure employment is the principal motive for people moving from other parts of Fiji to settle in the case study area. It is being observed that people in the informal settlements are mostly casual laborers, while the people in the formal neighborhood have permanent employment. The table below portrays the type of employment people are engaged in, as per the 2007 census data. It is noticed that majority people in the informal settlements are economically active. Unemployment rates vary as it is easier to find a casual employment in the municipality. Both the informal settlements and formal neighborhood have proportionately higher number of people who are not economically active, of which majority are the senior citizens, and teenagers in school, and housewives.

Figure 1.4 Employment Status in the study area.

Figure 1.4 shows the type of employment, the residents in the case study area are engaged in.

(Source: Fiji Bureau of Statistics, 2015)
The reason for such disparities in the employment status is highly linked to education attainment. People with higher education have well secured employment while people with lower education have difficulties in finding secure jobs. According to 2007 Census the informal settlements (Wailea and Veidogo) have relatively low tertiary education attainment compared to Vatuwaqa formal neighborhood as shown in the table below.

![Education status of the community](image)

(Source: Fiji Bureau of Statistics, 2015)

**Figure 1.5 Education Status in the study area.**

Figure 1.5 shows the education attainment level of the residents in the three communities.

### 1.6. Research Questions

Environmental degradation has become a major problem today, increasingly in the informal settlements of Fiji, where resource use is inappropriate and environmental degradation and quality has become a common feature because of high population density and lack of appropriate infrastructure. There is an urgent need to create awareness amongst the people on the importance of protecting the physical environment. Thus, the following questions have been derived to reflect the objectives of the study. These questions are merely for the researcher to test rather than the residents in the case study area:

a. What is the relationship between material status (poor/rich) and environmental degradation?
b. How do consumption patterns differ between informal settlements and formal neighborhood?

c. How can environmental sustainability be determined on the basis of consumption patterns?

1.7. Objectives

The objectives for this study are designed to broaden our understanding of environmental sustainability and consumption pattern with focus on Fiji’s informal settlements and formal neighborhood; particularly in the case study area (Vatuwaqa formal neighborhood, and Veidogo and Wailea informal settlements). The objectives are as follows:

a. To investigate on the assessment of environment sustainability in the literature review and apply modes of assessment in the field, through an ecological footprint survey

b. To compare consumption pattern of informal settlements to formal neighborhood

c. To analyze and compare environmental degradation through various means (observational survey, interviews, and reviewing real life images), in informal settlements and formal neighborhood

1.8. Research Methods

The fieldwork incorporates qualitative and quantitative approaches. Data collection included information from both primary and secondary sources. Primary data was collected through interviews and site visits over a period 2-months fieldwork study. During this time residents in informal settlements and formal neighborhood were interviewed using a structured questionnaire survey. Households were selected by the convenience sampling method.

Secondary data for the research included review of existing literatures and studies, and archival research which included reviewing the environment related legislations; for instance, Environmental Management Act (2005), Endangered Species Act, and census data from the Fiji Bureau of Statistics.

---

3 Chapter 3 discusses the methodology in greater detail.
1.9. Structure of the thesis

The thesis is divided into six chapters. Chapter one introduces the topic, and the case study area, with background information, research questions, objectives, rationale and brief discussion of methodology.

Chapter two reviews and discusses literature covering the topics of study and provides a hypothetical context towards the research undertaken. The chapter highlights the development of informal settlements in Fiji, the relationship between urbanization and poverty, the importance of ecological footprint analysis to understanding the extent of dependency on the physical environment, and the relationship of poverty and environmental degradation.

Chapter three gives insight on the methods used to collect data for the research. It discusses the approaches incorporated to collect data, ascertaining the data sources, the research design, sampling methods, research analysis, identifying study area, limitations and ethical consideration for data collection.

Chapter four describes the case study area in detail. This chapter looks closely on to background information, geography, brief history, demography, socio-economic status, findings and results, ecological footprint survey, and environmental degradation.

Chapter five compares the study area with each other, identifies similarities and differences of the informal settlements to one another and to the formal neighborhood.

Chapter six concludes the thesis with recommendations that arise from the fieldwork in the three communities.
Chapter 2: Literature Review

2.1. Introduction

This chapter discusses the four important aspects of the thesis; urbanization, poverty, environmental degradation, and ecological footprint survey from the perspective of existing literature. The chapter begins with a discussion on urbanization and informal settlement development in Fiji covering the pre-colonial, colonial, and post-colonial era. Further, poverty and livelihoods in Fiji are discussed from various perspectives; poverty measurement, poverty studies in Fiji, significance of sustainable livelihoods, and urban poverty and its relation to informal settlement development. Then the aspect of environmental degradation is discussed from the point of view of environmental degradation and its relationship to poverty, and relationship of informal settlements to their physical environment. The last aspect discussed is the ecological footprint analysis, unfolding a brief history of the analysis tool, its methodology and application, case studies of its application, and the strength and weaknesses of the tool.

2.2. Urbanization in Fiji – a short story

2.2.1. Urbanization and informal settlements in Fiji in pre-colonial times

Urbanization has always been an inevitable process of change for developing countries; in particular, extensively after World War II. In developed countries urbanization processes happened much earlier, usually closely connected to industrialization processes of the 19th century. In developing countries urbanization has brought an influx of rural migrants into towns and cities suburbs, changing the urban environment considerably (Sukhdeo & Griffin, 1982). Urbanization, a phenomenon recent to the Pacific Island Countries started in the second half of the 19th century driven by Europeans who had arrived in bigger numbers by then in Pacific Island societies and established their first urban centers. South Pacific towns developed as administrative centers for plantation and mining regions in the colonial era, which through time has evolved into a focal point of employment and rural-urban migration (Bryant, 1990).

The first towns in the South Pacific grew in the proximity of trading stations, for instance Levuka (Fiji), Papeete (Tahiti), Apia (Western Samoa), and Avarua (Cook Islands) (Sukhdeo & Griffin, 1982). Pacific cities then grew in response to the development in the rest of the country. In Melanesia, Fiji has one of the longest histories of colonial
urbanization (Bryant, 1990). Urbanization existed in Fiji since the beginning of colonial trade with the outside world. The growth of towns in Fiji, however, is largely a phenomenon of the period after 1945 (Whitelaw, 1966).

2.2.2. Urbanization and informal settlements in Fiji in the colonial era.

The 19th century brought opportunities for a prosperous Fiji, initiating the export-oriented agriculture which was the impact of the traders, resulting in the growth of settler societies (Daye, 2009). This period led to implantation of various political and ideological forms of capitalist relations in the country (Sutherland, 1992) leading to a higher demand for migrant laborers to work in the settler plantations for export crops. The colonial era in Fiji began when the country was ceded to the British Crown in 1874. It reigned over the colony for almost 100 years until the country achieved its independence in 1970 (Knapman, 1983). The colonial era brought profound changes to the nation. Agriculture intensified and demands for export oriented produce increased. Suva became the capital city, and laborers were imported to work in the plantations.

The colonial era introduced distinct and highly diverse ethnic patterns: the indigenous population living in the islands of “Feejee” since some 3000 years before the arrival of Europeans; people brought to “Feejee” from other Pacific Islands, typically black-birded in the first half of the 19th century and then finally laborers brought from India, contracted to work in the plantations and free Indians who followed these indentured laborers (Nayacakalou, 1966).

Suva was declared a city in 1953, after 72 years of being a town (Sukhdeo & Griffin, 1982). Between the decade of 1966 and 1976 the population growth rate along the Suva-Nausori corridor escalated to 69% (Griffen & Monsell-Davis, 1986). The increase in the number of Fijian population was a result of high movement from Maritime Provinces to the capital city. The period of 1960s witnessed greater out-migration from small island peripheries; during this period, the population of Fiji’s urban areas increased by 65%, with Suva representing an 83% increase (Bedford, 1985). Rural - urban migration was at its peak then, with population moving to the urban areas in search of better employment opportunities. There are diverse underlying reasons for increased movement to urban areas. The end of indenture labor system is one of the many profound reasons. The growing inequality in the incomes of the rural and urban population encourages migrants from the rural areas and outer islands to the urban centres. The rapid population growth was perceptible
in the decade of 1920-1930 (Lal et al, 1992). An increase in Fijian population was balanced by a greater increase in the Indo-Fijian population.

The growth and advancement of the sugar industry increased the development process of towns; Lautoka, Nadi, Labasa, and Ba showed greater demographic concentrations as a result of Colonial Sugar Refinery Company settlements engaged in sugar processing. The rapid development of small towns, and increasing importance of Suva as the centre of governance and commerce, led the urbanization in Fiji on a “take-off” stage (Sukhdeo & Griffin, 1982).

![Map of Fiji Islands](image)

(Source: Ezilon Maps, 2015)

**Figure 2.1 Map of Fiji Islands.**

### 2.2.3. Urbanization and informal settlements in Fiji between 1970 – 1987.

The 1970s was a new beginning for the nation. Fiji became independent in 1970, and a democratic system of constitutional Government emerged (Sukhdeo & Griffin, 1982). The years following independence fear amongst Fijians and Indo-Fijians polarized the two major ethnic groups especially concerning land tenure (Lal et al, 1992).

As the major administrative and commercial centre, Suva attracted a large proportion of the rural population, particularly Fijians (Nayacakalou, 1966). Following rapid population growth in the country urban drift became a rising issue (Hill, 1979). The increasing population in urban areas increased tensions to provide employment for job seekers. During this time urban areas were greatly affected by rising prices, rising costs,
high unemployment and low wages. Inflation was at peak during this period; and the nation marked two inflation events, one in 1974 and the other in 1980 (Sukhdeo & Griffin, 1982). The movement of people into urban areas was perceived differently by the two major ethnic groups. Most Fijians moved with the intention of returning to their rural areas of origin, while Indo-Fijian movement was on a permanent basis (Nair, 1985).

Between 1972 and 1973 approximately 12-20% of Suva’s population was concentrated in informal settlements, showing a 50% increase in the number of informal households, including tenants and subtenants (Bryant, 1990). Since the period between 1958 and 1976 Suva showed a considerable increase in informal settlement population. The major reason for movement into informal settlements by rural migrants was a search for higher paid employment, and better education. In the 1976 census Fiji noted approximately 24,000 individuals residing in informal settlements, with a growth of 12% per year in comparison to the overall population growth at the time of 4.5%. By 1978, 1083 illegal lean-to corrugated iron housing existed in Suva, of which 717 were owned by Indo-Fijians and 315 by indigenous Fijians (Sukhdeo & Griffin, 1982).

2.2.4. Urbanization and informal settlement in Fiji after 1987

Political instability in Fiji over the years was very often connected with land tenure issues. Fiji experienced its first two coups in 1987, followed by a period without elected Government until 1992. The nation then underwent two additional coups, one in 2000, and another one in 2006. In September 2014 elections brought an end to eight years without elected government and parliament. All four coups in the country had land tenure issues included and this clearly shows how urgent, but also how sensitive land issues are in Fiji. Informal settlements and policies to improve living conditions in such informal settlements frequently touch on land tenure issues. The political events play a major role in influencing the migration pattern from rural-urban areas. Following the 1987 coups ethnic tension became worse leading to an increase of outmigration by indo-Fijians (Daye, 2009). Perceived challenges to the land tenure system was one of the major reasons for the coup of 1987 and 2000. This conflict also led to a decline in land that has been leased out to Indo-Fijian farmers and had a severe impact on sugar cane production as well as rural to urban migration.

Towns and cities in Pacific Island countries are at the heart of economic modernization, innovation and income generation. At the same time they are centers
of political and social transformation. Perceived lucrative opportunities lure people towards urban centers, instigating developing urban areas to become origins of poverty, inequality and social tension (Storey, 2006). Continuous movement from rural to urban areas as well as the expansion of urban areas has led to the formation of villages in Pacific cities, which is evident through emergence of urban informality; including the expansion of informal settlements with the urban fabric and in the peri-urban areas (Jones, 2012). The continuous rural to urban migration widens the gap between “urban” and “rural” population. This in particular becomes evident through the existence of peri-urban settlements at the fringes of cities. According to the Asian Development Bank (2012a) about 50% of the urban population in Melanesia lives in informal settlements.

Today, urbanization in Fiji continues to increase with the demand for income earning opportunities in urban areas. The trend of urbanization cannot be reversed, despite the Government’s effort to transfer people back to rural areas. In the case of Indo-Fijian cane farmers who lost their leases and even their houses built on leased land, there is no rural village to return to. Problems urban dwellers are facing continue to grow (Bryant, 1992). Willis (2009) states that as “more and more of the world’s population reside in urban areas; access to housing has become a growing concern”.

At present 11-12% of Fiji’s population live in informal settlements, with between 25 and 33% of the total population living in poverty (Bryant-Tokalau, 2010).

The Melanesian countries; Papua New Guinea, Fiji, Solomon Islands, and Vanuatu have the greatest proportion of people in urban poverty residing in informal settlements (Jones, 2012). Informal settlements are the magnet for many migrants to urban areas. It is the home of the poor. Adequate housing in urban area is a valuable goal and a critical ingredient in addressing challenges of poverty. Accelerating growth of informal settlements has exacerbated the living conditions of urban poor, with scarcity of land being one of the main issues, affecting the urban poor in many dimensions: economic imparity, effect on social structure, and cognitive conditions of the affected group (Chandra, 1996).

The level of urbanization in Fiji increased from 35% in 1970 to 53% in 2005, and is expected to rise by 69% by 2030 (United Nations, 2014). The rapid growth of informal settlements creates tensions between traditional land owners and new settlers, resulting in tenure insecurity to be a complex problem. In Fiji’s urban
settings, informal settlements take various forms of occupancy, from informal settlements on state and customary land, to quasi-legal renting for customary lands. The increasing number of poor in Fiji’s capital city, Suva, is the result of growing urbanization. Growth of Suva is largely attributed to push and pull factors of rural-urban migration (Prasad & Mohanty, 2013). Rural to urban migration into the capital city has been the major factor contributing to population change in Suva (Prasad & Mohanty, 2013). Concentration of Fiji’s urban poor in informal settlements is not solely due to housing shortages, but due to lack of affordable housing (Naidu & Matadradra, 2014). Competition for state and indigenous land makes it difficult to find suitable land for housing. The poor and informal settlement dwellers of all ethnicities are highly concentrated on state land, which is the main form of vacant land available in the urban settings (Hassan 2007). Political instability, coupled with expiring land leases, has quickened the rural-urban movement, which increases the intensity of densely populated informal settlements in Fiji’s urban areas (Khan, 2012).

2.3. Poverty and Livelihood Security in Fiji

2.3.1. The Measurement of Poverty

The dynamic definition of poverty varies from country to country. At one point it can be described as the result of unemployment, inadequate income, landlessness, and inadequacy to fulfill basic necessities, or it can be viewed as the insufficient expenditure budget to purchase minimum standard of living, particularly nutritious food (Heshmati et al, 2015). Poverty in Fiji is manifested in many ways; for instance households’ failure to attain a specified threshold level of income based on family size (Hunte, 1997). Lack of opportunity amongst the poor is considered the greatest deprivation. The rate of poverty in Fiji at the time of independence in 1970 was 7%. It has increased five folds since then, and currently revolves around 35% (Goundar, 2012). Increasing levels of poverty and income inequality are the major problems, amongst the issues facing development processes in developing countries (Prasad, 1998).

Measuring poverty has always been a crucial issue in the Pacific region (Bryant-Tokalau, 1995). Poverty and inequality are considered primary concerns by the Fijian Government; however, there have been notable cases of inadequate actions to cope with the underlying cases of poverty - unequal landownership rights and insecure land tenure (Thornton, 2009). Poverty measurement varies from country to country.
In most cases it is determined through direct measurement of material deprivation – declining access to health care, inadequate housing conditions, and lacking access to quality education (Ploeg & Citro, 2008). Poverty has been a pressing problem in Fiji, long before the country gained independence, with absolute and relative poverty amongst the population (Khan et al, 2011). Escalating levels of hardships has been observed in all communities since the first military coup in 1987.

Poverty in Fiji is often measured as the relative gap between income earners. Fiji is viewed to be a relatively providential country, in economic and social context (Bryant, 1992). Poverty and vulnerability have a coherent affiliation; poor people are economically and environmentally vulnerable and the concentration of the poor and extent of vulnerability varies between informal settlements in urban areas. For instance 40% of informal settlement households live in absolute poverty, lacking ownership of any kind of asset (Mohanty, 2006).

Poverty has both qualitative and quantitative dimensions. Households’ income as an indicator of household welfare is emphasized to be a measure of poverty by many researchers (Mabughi & Selim, 2006). Households who are poor in one measure tend to be poor in others as well, indicating that poverty measurements by real income and real expenditure can be practical despite its incompetence to capture all elements of poverty (Warr, 2006). In South-east Asian countries like Thailand, Malaysia, and Philippines the basis used to measure poverty has been household incomes, calculated per household member, using gender and age distribution of the family units (Warr, 2006). In the United States, poverty measurement is considered to be a measure of economic deprivation. Livelihood insecurity relating to poverty is defined as the unavailability of adequate means to afford a minimally decent life – the inability to purchase goods and services necessary to afford stable housing, to find and hold an appropriate job, and cater for households health and education needs (Thornton, 2009). In addition livelihood security also includes the ability to produce whatever is required for a decent life and/or to have support systems (e.g. through social capital and/or government intervention) that support livelihoods. The poverty portfolio in Fiji consists of income, consumption, and expenditure attributes as a measurement for poverty at household level (Chattier, 2014).

In Fiji, the percentage of total number of people in poverty is higher than number of households in poverty, as poor family units are often larger than non-poor families.
(Narsey, 2012). There have been fundamental differences in poverty trends in rural and urban areas. In 2009, over one-third of the Fijian population lived in poverty, whereby the national poverty dropped by 5% between 2003 and 2009, with urban areas recording significant declining trends, while rural areas noted an unchanged trend of increasing poverty incidences (Huda & Calder, 2014). The Government of Fiji has various poverty alleviation programs – including upgrading of informal settlements, farming assistance, free education for primary and secondary schools, and family assistance schemes; however, poverty objectives are not being achieved (Goundar, 2013).

The Fijian Government has been working strenuously towards poverty alleviation. In 2002, $90m was allocated by the Government towards expenditure on poverty alleviation programs (Goundar, 2012). The programs included provision of income earning opportunities for the poor, provision of necessary skills for the unfortunate to take up income earning opportunities, and provision of social safety net for people not in situation to assist themselves.

2.3.2. Poverty studies in Fiji

Poverty is widespread in Fiji, with Suva, the capital of Fiji entailing the greatest number of urban poor concentrated in informal settlements (Ministry of Local Government, 2012). The Northern division in Fiji is considered to have a poverty rate as high as 53%, followed by Western division with 44%, and 24% in Central division; however, despite having lower poverty, Central division has the highest number of poor residing in the suburbs of greater Suva area (Pabon et al, 2012). Problems relating to high poverty rates in Fiji are attributed to racial tensions and conflicts; but poverty cuts across all racial groups (Daye, 2009). Urban areas of Fiji have noted increasing population densities in marginal areas – such areas record high poverty incidences. Informal settlements are growing on marginal areas, with an estimate of approximately 140,000 people residing in 190 informal settlements (Bryant-Tokalau, 2012).

Economic growth in Fiji during the period of 1950s and 1960s was viewed as era of reducing poverty; however, the 1970s witnessed a failure of economic growth to reduce poverty and achieve income equality; poverty rates increased despite of efforts to alleviate rising trends (Prasad, 1998). Poverty in Fiji is apparent through considerable spatial heterogeneity, which is impractical to measure by division level.
of household income and expenditure survey estimates (Pabon et al, 2012). Poverty incidences in Fiji escalated between 1977 and 2003, showing considerable increase in rural poverty by 22% within this period (Goundar & Xing, 2012). Still, the informal settlements in Fiji comprise a greater proportion of the population in poverty. Poverty has been viewed as a chronic problem for several decades in Fiji. Poor economic performance of the country, political instabilities and economic crisis drown more people into poverty (Khan et al, 2011). Underlying causes of poverty are characterized by increasing inflation rates, unemployment levels, lower wages, and unresolved land tenure problems (Kiddle, 2010b).

Vulnerability critically affects the poor. Declining access to livelihood makes the poor powerless socially, economically, and politically. In Fiji, most poor urban dwellers are found to live on worst quality land – on flood-prone areas, highly overcrowded areas, on roundabouts at busy intersections, and on edges of ravines (Mohanty, 2006). Increasing urbanization processes is fueling the formation of informal settlements in urban areas, disregarding vulnerable spatiality’s of these settlements to natural events and exposing the poor to disastrous consequences.

### 2.3.3. Sustainable Livelihoods

A livelihood is defined as the way in which people make themselves a living by using their capabilities, combined with required resources and assets (Haan, 2000). A livelihood is comprised of people, their capabilities, and the means of living (incorporating basic needs), income and assets (Gaillard et al, 2009). People are the foremost element in the livelihood approach. Individuals role are described as how they obtain resources and assets and confront difficulties in the effort to achieving their livelihood (Sanderson, 2000). A livelihood becomes sustainable when it can cope with and recover from stress and shocks, and cater for future generations; however, sustainability of livelihoods is often associated with vulnerability when it deals with poverty and famine (Gaillard et al, 2009). Livelihood is a mean to generate, accumulate, and protect assets, particularly financial and human capitals essential for producing, accessing and acquiring food (Hendriks & Hendricks, 2002). People often fall back to safety measurements to cope in the circumstances of shocks and stress; these safety measurements are short term responses for livelihood security and are specifically referred to as coping strategies (Haan, 2000). Vulnerability of livelihoods is dependent on the availability of assets. The more assets people have
the less vulnerable they are, and greater the erosion of assets the greater chances of insecurity (Mohanty, 2005 & 2006). Households with entitlement insecurities and fewer assets are the most affected by vulnerability (Hendriks & Hendricks, 2002). Lack of entitlement gives rise to poverty. The poor are often vulnerable to environmental degradation and natural hazards, and the natural resource environment is the primary asset for the poor for livelihood sustenance (Nadkarni, 2000). In the approach to production and consumption of food resources, the poor are often caught in the dilemma to trade-off between immediate household food necessities and environment sustainability, making poverty a major contributor to conflict between environmental harmony and meeting needs of the poor (Agena, 2008).

Livelihood strategies of the poor are often complex in both rural and urban settlements, ranging from natural resource use and food security practices in rural areas to coping with intense competition for limited resources, and accelerating urban growth in urban areas (Sanderson, 2000). Lack of income opportunities in rural areas influence people to depend on agriculture, making it an essential part of rural livelihoods; however, most households produce only a narrow range of products for sustenance, which leads to insufficiency and instability of food supply (Hendriks & Hendricks, 2002). Increasing populations are often considered to be the leading cause for environmental degradation, widening the gap between food production and food needs, greatly affecting the poor who are dependent on agriculture (Ellis-Jones, 1999). This often leads poor households into a dilemma to trade-off between immediate subsistence and long term sustainability (Hendriks & Hendricks, 2002).

Sustainability is a moving process and it is about being able to recover from stress and shocks and being resilient for natural and human induced processes (Ellis-Jones, 1999). Livelihood sustainability is closely tied to vulnerability in the face of natural hazards. People whose livelihoods are sustainable in events of natural hazards tend to be less vulnerable to environmental shocks (Gaillard et al., 2009). To understand urban household livelihood, a household livelihood security approach can be applied. This approach describes the role of assets in strengthening household livelihood, as shown in Figure 2.1 (Sanderson, 2000). Resources accessed in urban areas are usually through cash exchanges, although in Fiji and other Pacific Island countries urban food production (agriculture and animal husbandry) play an important role.
Financial capital is the greatest key to secure livelihood for the urban poor; however, financial capital is often fragile and to secure it, many of the urban poor depend on informal sector for income (Sanderson, 2000).

A livelihood becomes sustainable when people become capable to generate and maintain their means of living, and this is apparent through consumption levels, ownership and access to assets, resilience, coping and adaptation (Mabughi & Selim, 2006). Adaptability shares a close bond with vulnerability. Availability of adaptive capacity reduces risks of vulnerability (Mohanty, 2006). Most urban poor are amassed in informal settlements with insecure land tenure; having a degree of ownership of land not only provides households with land security but also reinforces shelter protection against vulnerabilities to natural hazards (Sanderson, 2000).

(Source: Sanderson, 2000)

Figure 2.2 Households livelihood security in the context of urban households.

Figure 2.1 describes access to income and other resources to meet basic needs and how assets are built up to withstand shocks and stresses. Most household resources are gained through payment, which is secured by undertaking productive activities, for instance, labor work to gain income. The poor often encounter barriers to accessing these resources, which are described as the status in society, and the control of resources by structures, example - Government authorities. The assets
owned by households are used as buffer against shocks and stresses, and to increase capability to improve access for human assets (better education for well-paid jobs).

2.3.4. Urban Poverty and the causation of informal settlements

Urban poverty and governance are contemporary issues relating to economic development in developing countries (Chaudhry et al, 2006). Variables affecting poverty are income and structural employment, as high levels of unemployment and livelihoods generating vicious outcomes are amongst the major causes of poverty (Iyenda, 2007). Urbanization in the Pacific is often population led rather than being driven by strong economic opportunities, leading to burgeoning informal settlements which have limited access to basic public infrastructure (Asian Development Bank, 2012a). Increasing number of people move from rural agricultural regions to the capital city in search of wage employment, out of which a reasonable number lack required skills, education, and expertise making them unable to secure permanent jobs (Daye, 2009). Employment opportunities in Fiji’s urban areas are limited (Hassan, 2007), however, urban areas continue to be the centers of spatial shift from rural to urban livelihoods (Storey, 2006).

Growth of informal settlements in urban areas of Pacific countries is two to three times greater than urban growth as a whole (Storey, 2006). Increasing informal settlements have now become a focus of poverty agenda in Fiji. The major factors contributing to increasing informal settlements are: rural-urban migration, poverty and unemployment, family disputes, land insecurities, housing shortage and high house rent in urban areas (Mohanty, 2006).

As highlighted above urban poverty is more than just insufficient income. It encompasses lack of access to services, poor living conditions, difficulty in meeting basic needs, and lack of representation in decision making processes (Storey, 2006). This is leading urbanization in the Pacific to become a process of change, containing both positive and negative outcomes. Expansion of informal settlements is attributed to economic opportunities available in urban areas. An urbanizing population brings many benefits into the urban areas – labor markets, specialization and productivity, however, it is also accompanied by challenges (Pabon et al, 2012).
2.4. Environmental Degradation

2.4.1. The relationship between Environmental Degradation and Poverty

Environmental degradation is accelerating dramatically in developing countries, increasing concerns for economic policies, growth and environment (López, 1992). Growth of towns and cities transform the natural landscape, reshaping the land surfaces to accommodate expansion of urban environment; however, these urban landscapes are concentrated with wide range of environmental problems as a result of urban based production and consumption, degrading the natural ecosystem and creating environmental impacts (Satterthwaite, 2003). Persistence in poverty incidences have made poverty alleviation a major concern for strategic planning, with a closer look at the connection between poverty and environmental degradation (Mink, 1993). Exposure of the poor to environmental degradation varies amongst countries. Most common grounds are occupancy of environmentally vulnerable locations by the poor, and availability of inadequate resources and coping strategies to overcome impacts of environmental degradation (Mink, 1993).

Small Island Developing States in the Pacific are the most vulnerable nations (Mohanty, 2006). Their smallness, limited land and environmental resources, and proneness to natural disasters make it defenseless to environmental degradation. Fiji has approximately 51% of its population residing in urban areas, with a growing proportion now residing in informal settlements, consisting of inadequate housing, insecure land tenure, and poor supply of urban infrastructure (Kiddle, 2010b). The poor are concentrated on environmentally unhealthy and fragile areas due to shortage of land, high land prices, and land tenure issues. Poverty is often considered to be the leading cause of environmental degradation. As the degraded environment reduces potential resources to be available for the present and future generation, it exacerbates poverty, creating a ‘vicious circle’, where poverty is the outcome of unequal resource distribution amongst individuals and communities (Rahman, 2004). The ‘vicious circle’ in developing countries is seen as direct dependence of the poor on the physical environment for everyday living (Nadkarni, 2000). Degraded environment constraints productivity of resources highly depended upon by the poor, and poverty restricts the poor to avoid damaging the environment, perpetuating impoverishment (Mink, 1992). It is perceived that poverty cannot be eliminated, but it can change the nature of environmental problems (Agena, 2008).
2.4.2. The impact of informal settlements on Mangrove Ecosystem

Mangrove forests are one of the most threatened habitats in the world. In Fiji mangrove exploitation is largely for firewood and building materials, and reclamation of mangrove forest for other uses (Agrawala et al, 2003). Mangrove ecosystems play important roles in providing environmental and ecological services. In 1985 the total mangrove covered area in Fiji was calculated to be 517km², with the largest areas being concentrated in the South Eastern and North Western Viti Levu shoreline and Northern Shore of Vanua Levu (Ellison & Fiu, 2010). Until 1975 mangroves in Fiji were considered part of the national forest reserve; however, after 1975 mangrove areas were placed under the jurisdiction of Department of Lands & Survey, whereby regulation of these areas were not monitored in a systematic way (Ellison & Fiu, 2010). Today mangroves have little protection and are being degraded due to continuous conversion to agriculture land, increase in sediment load from upland logging, and conversion of swamp to human settlements (Food and Agriculture Organization of the United Nations, 2005).

Fiji’s mangroves and coastal plants are owned by the state; however, the ususfructus rights are presumed to be belonging to indigenous Fijians, the traditional fishing rights (TFR) owners. The TFR owners regulate commercial fishing by non-TFR owners, but they generally do not monitor their own activities neither do they control logging activities by non-members in the mangrove forest. This has led to uncontrollable removal of mangroves for timber or firewood. Commercial uses of mangroves are controlled by the state.

Most informal settlements around Suva are found at places with large, connected webs of green space containing highly diverse species of plant life. Resilience of surrounding flora is useful to prevent erosion and flash flooding in events of extreme weather. To accommodate more houses people are destroying flora and making their survival susceptible to extreme climatic events (cyclones, flooding, and storm surges) (Heber, 2013). It is predicted that another 30,000 new houses will be built in Suva’s informal settlements in the coming 15 years, which will further aggravate pressure on mangrove forest (Kohler, 2013). In 1994, a study by Watling et al discovered that 6% of Fiji’s mangroves had disappeared due to human activities, such as expanding development projects, agricultural land, infrastructure, residential sites (mostly
informal settlements), and for fuel wood (International Global Change Institute et al, 2000). To date, the cycle of deforestation is continuous, underlining similar reasons.

Sustainable development strives to bring together concerns of meeting human needs to limit the harmful impacts of human activities on environment. To manage environmental problems it requires numerous public and private actors and strategically targeted preventive and curative actions to strengthen governance, improve policies, and improve urban operations (Leitmann et al, 1992). Cities are engines of economic development, and failure to manage impacts of rapid urbanization, threatens human health, environment quality and urban productivity.

2.5. Ecological Footprint Survey: an indicator for sustainable consumption

2.5.1. Brief History of Ecological Footprint study

The ecological footprint indicator was first introduced by Rees in 1992 and Wackernagel in 1994 and again by Rees & Wackernagel in 1996 (Ponthiere, 2009). The indicator measures land surfaces and water required by people for production of all goods consumed in the economy and to absorb wastes generated as a result of production (Ponthiere, 2009). Ecological footprint has been designed to estimate people’s impact on the planet and identifying thoughts on what is required to be done to reduce the negative impacts on the planet; the footprint measures the biologically productive areas on earth that is used by people to sustain livelihood (Wackernagel et al, 1999).

Ecological footprint has been widely utilized for sustainability analysis since its formulation (Venetoulis & Talberth, 2008). When the ecological footprint idea was put forward by Wackernagel and his fellows, it was first applied to figure out the available ecological space for entire population of the earth and the ecological space that has been used (Liyan et al, 2007). Ecological footprint analysis has been developed to a reasonably mature level, particularly when calculating national ecological footprint account; it has been used on a different scale of organization (Du et al, 2010). Footprint assessments have been applied to various scales of human population, from global to national, municipal and households (Wackernagel et al, 1999). Through time, many Governmental organizations and communities have incorporated ecological footprint as the main indicator for sustainability measurement. To assess ecological footprint, real demand is compared to real supply to evaluate how much of the real areas are needed to accommodate a given flow of resources and
ecological services (Borucke et al, 2013). Due to its capacity to provide a global image of human dependency on nature, through means of a single figure, ecological footprint analysis has become an increasingly utilized tool by scientists researching on human induced pressures on physical environments (Ponthiere, 2009).

### 2.5.2. Application and methodology of Ecological Footprint Survey

Human demand on ecosystems is continuously increasing, and outpacing the carrying capacity of the physical environment, placing the biosphere’s future ability to provide for humanity at risk (Borucke et al, 2013). Calculating biological capacity is an important aspect of ecological footprint analysis. Biological capacity represents the surfaces of ecologically productive area located within the study area (Bala & Hossain, 2010). In 1997, a researcher calculated ecological footprint of 52 countries and regions around the globe, using data obtained in 1993, and the outcome indicated an average ecological deficit of 0.8ha, of the earth’s entire human population (Liyan et al, 2007). Ecological footprint indicator is an important tool in evaluating the status of regional environmental conditions and resource utilization (Ping & Xinjun, 2011).

Variables required for the calculation of ecological footprint varies amongst researchers and areas of study. According to Du et al (2010) there are four sets of variables required to calculate ecological footprint; (1) population size in study area, (2) amount of consumables per individual from various categories, (3) amount of energy of various types consumed per person, and (4) amount of biologically available land. Wackernagel et al (1999) states two simple variables to calculate ecological footprint: (1) peoples consumption and waste generated, and (2) the biologically productive areas appropriated for production of the consumption. Depending on the context of study, sample size, and study area, most researchers’ breakdown the variables required in calculation of ecological footprint to various types of consumptions and productions in the study area.

Ecological footprint and bio-capacity are expressed in units of area on an annual basis, instead of being expressed in tons per year (Galli et al, 2012). Ecological footprint is a powerful index, as it has the capability to identify the dynamic processes of renewable resource use and environmental pressures as a result of human dependence and impact on physical environment. The size of ecological footprint is in direct ratio to impacts on environment. A bigger ecological footprint correlates to a
bigger impact on the environment. Ecological footprint itself is comprised of six categories: cropland footprint, grazing footprint, forest footprint, fishing ground footprint, carbon footprint, and built-up land (Wang et al, 2012). Ecological footprint has the capacity to capture hidden impacts of an activity on the environment, by quantifying direct and indirect impacts and estimating the amount of land area required to support for individual type of resources used (White, 2007).

Ecological footprint calculation as applied to analysis of a sub-national area has been assessed using three different spatial scales to scrutinize relationship between local inhabitants and global ecosystems. The three spatial scales utilized are: the whole province, the district, and the single communes (Bagliani et al, 2008). Such analysis through use of spatial scales allows for deeper understanding of spatial uniformity, territorial homogeneity, and spatial patterns featuring the allocation and withdrawal of natural resources. To calculate sustainability on a local scale, consumptions in a community can be divided into individual categories, such as: food, shelter, mobility, goods, and services; while territorial footprint can be categorized as: productive activities, transportation, waste disposal and waste management, and water management (Scotti et al, 2009). Economic development today has become an outcome to cost of consuming natural resources. Ecosystems are required to provide more natural resources and ecological services to absorb increasing waste (Dai et al, 2010). To achieve sustainable development, it has become important to be aware of the state of ecosystem deteriorated in a region, and its state of ecological security.

### 2.5.3. Some case studies - for ecological footprint analysis

All cities in the world depend on raw materials and other natural resources to upgrade its urban infrastructure, and to maintain industrial and service production to meet demands of the society (Jorgenson et al., 2010). Environmental problems significantly vary across cities depending on geographical location, climate, urban form, population density, and economic growth. Industrialization and rapid expansion of cities are the predominant threats to urban biosphere, and subsequent loss of biodiversity (Dahiya, 2012). To have a sustainable world, there is a need to secure the quality of livelihood of people within the capacity of nature (Wackernagel, 2007).

Emergence of the modern city transforms both social and natural landscapes, and facilitates consumption of natural resources (Jorgenson et al, 2010). Increase in urban
population leads to changes in types of housing, transportation, social epidemiology and social inequalities. There is also accumulation of population within major cities, posing concerns on the environment, as increasing population consume greater amount of natural resources (water, and energy) from previously disturbed environment.

China has advanced the utilization of ecological footprint analysis in its sustainability measurement. The country has applied the tool from national level to city to household level. Calculation of ecological footprint at household level included two different kinds of consumption: resource consumption, and energy consumption (Zhiying & Cuiyan, 2011). Consumption expenditure as per the study was mainly affected by income. Increase in income led to increase in expenditure and material consumption. The result of analysis showed that per capita per Chinese household, ecological footprint was rising, while per capita ecological carrying capacity was stable. China also applied the ecological footprint tool at the province level. The West Jilin Province calculated its ecological footprint to determine impact of lifestyle consumption on environment, and the environmental impacts burdened by the ecosystem from 1986 to 2006. The result portrayed that the ecosystem was degrading due to ecological overshoot (excessive resource exploitation, particularly for export) (Mingquan et al, 2010). Increasing population and urbanization is considered to be the major factors affecting ecological footprint capacity.

Liaoning, a province in China, applied ecological footprint analysis to its 14 cities, and onto the province as a whole, to assess sustainability and eco-efficiency. The analysis showed that ecological capacity for the cities and the province as a whole was overruled by human appropriation of natural resource base, with fossil fuel consumption as the leading cause for ecological deficit (Huang et al, 2007).

Chongqing, an important city in Western China has experienced resource depletion and environmental deterioration as a result of rapid economic growth, which led to scarcity of cultivated land, water and soil loss, acid rain, and environmental contamination (Dai et al, 2010). An ecological footprint analysis was applied to determine the ecological security, using two aspects: consumption pressure and production pressure on ecosystem. Consumption pressure index was applied to identify pressure on local ecosystem to fulfill natural capital consumption, while production pressure index was applied to determine the overload demand on
biologically productive areas from the production perspective, disregarding the ecological trade (Dai et al, 2010).

Today, increasing levels of consumption and pollution have become a growing concern, particularly to regions facing scarcity of natural ecological base (Moos et al, 2006). China, a country with a large landmass and growing population is confronted with increasing demand on its biologically productive areas, which has the possibility to threaten ecological security if ecological overshoot continues (Dai et al, 2010). Ecological footprint analysis tool has been applied to the country at different levels to ensure sustainable use of available natural resource base. In 2001 four cities (Guangzhou, Ningbo, Suzhou, and Yangzhou) were chosen as case studies to account for ecological footprint. The ecological footprint methodology used for urban framework was modified in consideration of local statistical data and actual conditions (Du et al, 2010). The result of the analysis argues that countries with abundant resources are less likely to be faced with ecological conflicts.

For most countries around the globe, the past four decades was a period of increasing economic growth, poverty reduction, and improved welfare; these changes have been achieved at the expense of the planet’s ecosystem and its ability to replenish (Galli et al, 2012). Taiwan also applied ecological footprint analysis to determine its ecological security base. The analysis revealed a steadily increasing consumption and production beyond its land capacity. The rising ecological deficit is attributed to overuse of global resources and intense pressure on the earth (Wang et al, 2012).

The success and competency of the ecological footprint has led the analytical tool to measure sustainability even at a university campus-level. University of Toronto at Mississauga applied the tool to calculate progress towards a broad goal to increasing sustainability of the campus (Conway et al, 2008). The campus staff, total number of faculty members, and students, was used to as population representative of the university.

2.5.4. Discussion of the strengths and weaknesses of Ecological Footprint Analysis

All empirical tools applied to measure variables contain a certain degree of strength and weakness, so does the ecological footprint analysis tool. Ecological footprint is a most successful tool to determine rate of natural capital usage by humans in attempt to satisfy their needs. An important aspect of this tool is that the variables used in measurement can be sub-divided into different categories of consumption and
production, which becomes handy in identifying different demands on productivity from various fields, allowing for implementation of measures in relation to requirements of individual fields (Penela & Villasante, 2008). Ecological footprint tool quantifies any given population mutually exclusive biologically productive area which must be used continuously to cater for resource supplies and absorption of waste (Wackernagel & Yount, 1998).

Ecological footprint is one of the reliable indicators for sustainability, as it helps in illustration of production and consumption impacts on the environment through incorporating both direct and indirect impacts, and provides a wide measurement for resource use impact, which can be used to inform people on the level of economic activity in relation to physical environment, and what elements a population should consider to safeguard natural ecological base (White, 2007). An important element that strengthens the indicator is that it uses the readily available data for computation of sustainability, making the methodology available to any entity interested in using the tool.

Ecological footprint tool has been criticized on numerous occasions, at some point in time, the criticisms override the strengths; however, the tool has been proven quite effective to most organizations and individuals utilizing it in their studies. One weakness of the tool is that the footprint often excludes potentially important variables; for instance, it does not consider the accounts for export of natural resources, which can lower the bio-capacity (Du et al, 2010). To calculate ecological footprint, a significant amount of information regarding natural resource consumption, economic goods and services, industrial processes, technological and energetic efficiency, and agricultural productive is required; however, obtaining these data is often difficult at the regional level, particularly at local level (Bagliani et al, 2006).

Ecological footprint indicator often disregards environmental impacts arising from material flows (various waste outflows), apart from emission of fossil fuel use, and fresh water consumption, which nowadays have become an increasingly worsening problem for many cities (Qing et al, 2004). Measurement of sustainability as determined through application of the tool is insensitive to small changes at individual level, as well as at a city level, for instance: not buying a vehicle, or riding bike to work. Ecological footprint pays scant attention to a city’s level of satisfaction to current consumption patterns and socio-cultural aspects (equity and technology) (Du et al, 2010). Ecological footprints portray an essentially bigger picture of various
human impacts in comparison to available biological capacity; however, not everyone’s ecological footprint is of same size (Wackernagel, 2007). Socio-economic factors are paramount determinant of ecological security, which is a major rationale on why urban areas have bigger footprint than rural areas, as more resources are consumed in urban areas (Dai et al, 2010). One also can argue that consumption patterns and waster generation has so many aspects that impossibly can be considered entirely in an analysis. Here comparative approaches show much strength when in different communities the same set of variables are considered: they might be all missing out some aspects, but at the same time all variables used are applied to all communities used in a study, which creates comparative, relative results that are rather accurate and reliable.

2.6. Conclusion
The chapter discussed the objectives of study through a literature survey. It has become evident that urbanization has led enormous amount of rural population to migrate to urban areas, and this has led to modification of the physical environment, which not only degrades environment quality, but threatens livelihood of urban poor, who are reliant on environment for daily survival. With time, Fiji’s mangrove ecosystems are being obliterated to accommodate the increasing influx of urban poor. There is a need for rejuvenation and enforcement of legal strictures to halt the progress of invasion of fragile ecosystems. This chapter also discussed the concept of ecological footprint analysis, which is the most important component of research; this analytical tool and its methodology has been applied to collect data regarding consumption and resource management in the three case study area. The results are compared and contrasted from each settlement to determine the rate of environment exploitation.
Chapter 3: Research Methodology

3.1. Introduction
The chapter discusses the methods and methodology incorporated in the entire research. The chapter begins with the discussion on the methodological approaches, conceptualizing its connection to the research. Further, it emphasizes the data sources and research design for the study, the sampling techniques used, research analysis, relevance of case study area, limitations, and ethical considerations.

3.2. Methodological Approaches
Data collection for this research used both qualitative research and quantitative research methods. Qualitative research is a technique applied to obtain data from a relatively small population, and these data are not analyzed through statistical methods (Meurer et al, 2007). In context of the case study, this research method enabled the researcher to understand the complexity of the issues affecting the people in the case study area, from their point of view, and construct interpretations. Qualitative data is obtained in word form, not numerical, and to obtain these data, the most efficient means are interviews and group discussions. As this research is based on determining the baseline consumption pattern in the informal settlements and formal neighborhood in Vatuwaqa, therefore, qualitative research became an important aspect of data collection. The research questions mainly involved exploration of the real life context: observing people’s behavior/consumption, opinion and attitude towards the physical environment, and the understanding of the livelihood basis. The qualitative research method was applied in the study through face-to-face interviews, using open-ended questions. Using this method, the researcher was able to obtain multiple perceptions, while conducting interviews, and observational surveys.

In the Pacific, “Talanoa” is the most common and traditional form of collecting information from villages and communities. This includes discussion about nothing in particular and interacting without a rigid framework (Vaioleti, 2006). Talanoa allows people to engage in social conversations that can lead to critical discussions. “The Talanoa process is a good example of both a method and a methodology which uses formal or informal discussion in Pacific Island research” (McFall-McCaffery, 2010). The Talanoa process can be used in one-to-one interviews and even in focus group discussions, and is widely used methodology across many disciplines. Talanoa is a form of qualitative research methodology. For this research, the researcher did
not consider Talanoa as the mean of data collection, since the questions prepared for interviews were quite straightforward and did not require discussion.

The quantitative method involves the conversion of data into numerical form to analyze numerically (Mack, 2010). In relation to this research, quantitative methods are applied to produce results for ecological footprint survey and conclusions drawn are used as a resolution to the objectives and research questions of the study.

3.3. Data Sources

The data source for this research was obtained using both primary and secondary sources. The quantitative methods are defined by the collection of information which can be numerically analyzed, while qualitative research is based on exploring information from the point of view of both groups and individuals and generates case studies summaries, instead of numeric data (ACAPS, 2012). Primary research helps the researcher to “collect data on events, objects, or people, which are measurable, observable and replicable” (Driscoll, 2011). The primary data for the research was collected through interviews with the people in the case study area, and observations. A set of interview questions⁴ were prepared to interact with the individuals in the settlement, and with the relevant stakeholders.

Secondary data involves information particularly collected by researchers not part of the current assessment and which has been analyzed prior to being included in the current requirement of research (ACAPS, 2012). These data are often used by the researchers in combination with other secondary data to create new datasets (Harrell & Bradley, 2009). The secondary data for the research was collected through archival research, exploring into the relevant legislations pertaining to the study: the Environment Management Act, Endangered Species Act, and census data. Further, information was collected from books, journals, Government reports, Non-Government reports, and internet, relating to the research theme.

3.4. Research Design

“Data collection and execution of a good case study depend crucially upon the competence of the researcher” (Rowley, 2002). For this research, the primary data was collected through interviews with the settlement residents, and consultations

⁴ See Appendix.
with the relevant authorities, field observations and field notes. Below is a brief description of these data collection methods.

3.4.1. Interviews
Interviews are one of the significant techniques to collect survey data and involve verbal communication between the researcher and the participant. Interviews consist of two paramount approaches, “unstructured in which the participant is allowed to talk freely about whatever they wish, to highly structured in which the participant responses are limited to answering direct questions”, (Fox, 2006). For this research, the interviewing approaches applied were structured and semi-structured. The need for semi-structured approach emerged as some questions included in the interviews required attitudinal information which were written down by the researcher upon discussion with the respondent. The Semi-structured approach applies open-ended questions, prepared in advance by the researcher (Fox, 2009). This approach is helpful in defining questions on the research topic, and provides opportunity to the researcher to generate discussion on the topic with the interviewee. This approach is quite handy to the researchers attempting to cover wide range of topics systematically than open-ended subject (Kikwawila Study Group, 1994). To successfully apply the semi-structured approach in the research, face-to-face interview was used. “Face-to-face interviews have the strength that the researcher can ask follow-up questions and use non-verbal communication to enhance the discussion on the topic”, (Driscoll, 2011). A set of 35 questions were prepared for interviews, including a range from open ended to closed questions. 200 individuals were interviewed, 100 from the formal neighborhood, and 100 divided amongst two informal settlements (50 each). The interviews were conducted on one person per household, with the houses selected on the basis of availability of residents. The entire interview duration lasted for two months, with five interviews per day. An iTaukei translator accompanied the researcher into the field, as most of the residents in the case study area are indigenous Fijians.

The interview questions were divided into three parts: background information; ecological footprint survey; and perception and awareness on environmental degradation. The open ended questions were assimilated in the first part of the interview questions; background information. While the remainder two parts consisted of closed questions, using the generic rating scale and Likert scale.
3.4.2. Field Observations

Observations are useful to the researcher in numerous ways. It helps the researcher to describe existing situations, and to learn about the activities of the people in the study area (Kawulich, 2005). The strength of observations solely depends on the research elements. The feasibility of the research questions decide on the type of observation carried out by the researcher. Observations are usually the alternative means to obtain data when other means to collect data is not applicable. Observations are a handy technique when acquiring valuable background information on the environment (Hancock et al, 2007). On visit to the study area for interview with residents, the researcher did observations on the landscape, housing conditions, environmental conditions (pollution, natural resource destruction, waste disposal), and residents living conditions. Photos and field notes were taken for backup evidence.

3.4.3. Consultations with relevant authorities.

A range of relevant departmental stakeholders dealing with the case study area were also interviewed. The data collected from these stakeholders are described below.

Department of Housing

This is the main government body responsible for monitoring the informal settlements in Fiji. As per the case study areas, the department is responsible for approval of new housing in the informal settlements formed on state land. All the new housing consents, extension and renovation to existing structures, and installation of electricity and water meters, has to be inspected and approved by the Director of Housing. The inspection is carried out upon requests received by the department and, approval of the queries is dependent on the comments from the inspection team. Information regarding the historical background of the case study area was obtained from this department.

Department of Environment

Information acquired from this department was concerning mangrove ecosystem, and regulations pertaining to the protection and management of Fiji’s mangroves since the establishment of the framework (Mangrove Management Act).
**Fiji Bureau of Statistics**

This department provided the latest census data, with information concerning the education, types of employment, age, housing, water, electricity, and population of the study area.

**Department of Town & Country Planning**

This department provided information regarding the land use of the study area, and the formal zoning of the site, as well as the possible reasons for expansion of informal residents in the study area and the Government action to control the accelerating growth of residents in informal areas.

### 3.5. Sampling

In late October to December 2014, 200 individuals were interviewed, one per household in the case study area, with greater proportion of the sample being indigenous Fijians, and majority women. Convenience sampling was used to select 50 respondents in each of the informal settlements (Veidogo and Wailea), and 100 from the Vatuwaqa formal neighborhood. Convenience sampling is a method where samples are easily accessible and willing to participate in a study (Teddlie & Yu, 2007). Convenience sampling is the least rigorous technique, and involves selection of the most accessible subjects (Marshall, 1996). Most of the survey respondents were women as many of the men were away engaged in employment. Based on the population estimates from 2015 (table 1.0), approximately 12% of the households were interviewed in Vatuwaqa (assuming a household comprises 5 people), 50% of the households in Veidogo, and 13% of the households in Wailea. Convenience sampling allowed the researcher to freely visit with people who were available during the day-time hours when it was feasible to conduct the interviews. While respondents were selected based on their availability, an attempt to interview respondents evenly throughout the geographical boundaries of the communities was attempted and successfully achieved.

### 3.6. Research Analysis

The data collected in the field was analyzed using Microsoft Excel, as it was the most convenient software available to the researcher at the time of data analysis. The data was analyzed to depict graphs and interpret the results in correlation to the research hypothesis and objectives.
3.7. Study Area

The application of case study research has been practical in exploring and understanding complex issues. In a case study methodology the researcher selects a small geographic area or specific number of individuals as case study (Zainal, 2007). The study area selected for this research was Vatuwaqa, Suva, a highly residential urban setting in Fiji, consisting of three informal settlements in the vicinity of a residential B, formal neighborhood. However, for this study, two informal settlements were selected and compared to the formal neighborhood, as well to each other. The two informal settlements selected have quite differences in the population size and the land area cover (Wailea covers a larger land area and a greater population then Veidogo informal settlement). This makes the study more captivating while comparing the similarities and differences, as well as interpreting the results as per data collection. The study area is located in the vicinity of the researcher’s home location; therefore, it was convenient to carry study in the site within the definite time frame.

3.8. Limitations in Research

The researcher had a few constraints while collecting data for the study. But these did not become an obstacle to meeting the desired objectives. The limitations are stated as follows:

- Language barrier is a problem in most societies. The researcher is only proficient in English and Hindi, which made it difficult to interact with most of the iTaukei residents in the settlement, who had limited knowledge of English. An iTaukei translator was hired to converse the questions with the indigenous Fijians.

- Time constraint is another factor; as the field translator was an undergraduate student at the time of study, so the researcher had to conduct fieldwork on the time available to the translator, which made data collection take a bit longer time.

- Weather conditions became a limitation as well, since the fieldwork began towards the beginning of cyclone season in Fiji (November – April), unexpected rainfall made it impossible to go out to the study site most of the time, as the swampy conditions in the informal settlements worsened during rainfall, with poor drainage leading to water logging, making it difficult to move around the settlement.
3.9. Ethical Considerations

On the duration of fieldwork, the researcher made it apparent to residents about the obscurity and discretion of the data collected, and its purpose to be used for study purpose only. To successfully interview most of the respondents in the informal settlements, an official letter from the Principal Supervisor was used to ease their reluctance to participate. None of the residents interviewed were asked their age, name, and other private details to maintain confidentiality of personal information. (Refer to interview questions in the Appendix).

3.10. Conclusion

This chapter described the methodological approaches employed to data collection, following a description of data sources, research design, research analysis, sampling method, limitations, and ethical considerations. The major focus of the chapter is the data collection methods, particularly the primary data, which forms the basis for ecological footprint analysis, which will be discussed in the following chapters.
Chapter 4: Results and Findings

4.1. Introduction

This chapter is divided into three parts. The first part is based on the description of the case study area in greater detail with respect to the research theme. Foremost, the informal settlements will be described, followed by the formal neighborhood. The elements that will be discussed include: background information, geography, demography, and social economic status. The second part of the chapter discusses the ecological footprint survey result using tabulated illustrations. The third part of the chapter discusses perception and awareness of environmental degradation in the three case study area; graphs and tables are used to show the striking differences.

Part I. Description of the Case Studies

4.2. Veidogo Informal Settlement

4.2.1. Background Information

Veidogo informal settlement is one of the slowly growing settlements, situated in the capital city of Fiji. The settlement is located in Vatuwaqa, an urban setting consisting of mixed land uses with residential, commercial, and light industrial zones (see figure 1.2). The area on which the settlement sits is zoned as “Residential D” under the zoning classification by the Department of Town and Country Planning (Fiji). “Residential D” zoning consists of low cost housing areas, particularly informal settlement areas in Suva (Raiwaqa, Nabua, Vatuwaqa, Nauluvatu, and Valenimanumanu settlements). Under the jurisdiction of this zoning the minimum lot size is 220m² allowing a minimum area for landscaping with adequate open space. The settlement is built on freehold land owned by a renowned business entrepreneur in Fiji, Bhindi Bros Industries. The land has been abandoned on the basis as it did not meet the requirements for development as proposed by the developer. It is located adjacent to coastal margin, which initiated dispute over development prospects. Over the years this has led the land to be occupied by rural-urban migrants, particularly migrants with too low income to afford better housing in the urban area, and poor socio-economic status.

---

5Interview with the Data Statistician (Anuragh Narayan), Department of Housing, Ministry of Local Government, Housing and Environment (November, 2014).
4.2.2. Geography

According to the Environment Management Act (2005) the Government of Fiji has the rights of jurisdiction of all the foreshore area, covering “shore of the sea, channels or creeks, which is alternately covered and uncovered by the sea at the highest or lowest tides” (Parliament of the Fiji Islands, 2005). These foreshore areas are naturally homes to vast mangrove ecosystems, but over the years, most of these areas have been modified for development, and other activities. A prominent usage is for informal settlements. Veidogo informal settlement is located on fringe of the freehold land, with three-quarter of the settlement extending into the mangrove swamp, making it to be part of both freehold and state land.

The settlement has a small creek along its eastern side, extending into the estuary. The area has a high water table due to its swampy, and water logged conditions, making it vulnerable to seepage from household waste, and liquid waste from nearby factories. The settlement is often affected by floods during heavy downpour and high tides, due to being located at a relatively lower elevation, at a height of 4.8 meters above mean sea level. In the vicinity of the settlement is a light industrial zone and residential B zone. There is no proper road access into the settlement. Narrow paths are linked from each house to an unpaved path outside the settlement, connecting to the main road.

(Photographer: Poonam Devi, 2015)

Figure 4.1 Unpaved narrow paths connecting houses in the settlement.
Figure 4.1 shows the narrow paths used as major connection to the main road. These paths are often covered with water and mud due to swampy condition and clogged drains.

4.2.3. Demography

The settlement has an approximate population of 545 people residing on 4.5 ha land, as per 2007 census data (Fiji Bureau of Statistics, 2015). The settlement has a total of 106 houses. People from 50 households (approximately half) were interviewed during fieldwork. The settlement has a high population concentration, with households having large families. Majority of elderly residents, infants, and children in primary schools are considered as “not economically active” (Table 4.2). The average family size is 5, determined through interviews during fieldwork, but the range is from 3 to 12 members per household.

4.2.4. Socio- Economic Status

4.2.4.1. Education

Education is a major strategy towards securing an appropriate job in the employment sector. The financial background of many families in Fiji often becomes a barrier to basic education (UNESCO, 2007). In Veidogo informal settlement education attainment level is slightly higher in female residents than in the male residents. This is surprising. The higher percentages for females are due to predominance of female population than males in the settlement. According to the 2007 census data, 36 % of the women in the settlement have advanced (higher secondary and above) educational status, whereas male population has 33 % in advanced education attainment. The tertiary education attainment is proportionately the same amongst women and men (Table 4.1). Of all the people with education are either in the workforce, pursuing further studies, or retirees. Interviews revealed that people with only primary education attainment mostly hold casual employment, and at times find difficulty in securing a job. Education is seen to be a key factor to sustain livelihood.

<table>
<thead>
<tr>
<th>Educational Status Veidogo</th>
<th>Total</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>545</td>
<td>261</td>
<td>100%</td>
<td>284</td>
<td>100%</td>
</tr>
<tr>
<td>Primary or Less</td>
<td>126</td>
<td>61</td>
<td>23%</td>
<td>65</td>
<td>23%</td>
</tr>
<tr>
<td>Lower Secondary</td>
<td>133</td>
<td>67</td>
<td>26%</td>
<td>66</td>
<td>23%</td>
</tr>
<tr>
<td>Upper Secondary</td>
<td>190</td>
<td>87</td>
<td>33%</td>
<td>103</td>
<td>36%</td>
</tr>
<tr>
<td>Tertiary</td>
<td>9</td>
<td>4</td>
<td>2%</td>
<td>5</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>87</td>
<td>42</td>
<td>16%</td>
<td>45</td>
<td>16%</td>
</tr>
</tbody>
</table>

(Source: Fiji Bureau of Statistics, 2015)
Table 4.1 shows the categories of educational attainment of Veidogo residents.

4.2.4.2. Employment and unemployment

Unemployment increases the urban poverty rate in Fiji. In search for better employment more migrants leave rural areas and move to cities and towns. Here they often add to the populations of those living in squatter settlements. In Veidogo, only 55% of 545 people are working with 35% males and 20% females. Looking at the education status (Table 4.1) not everyone with qualifications has a job and there is high number of residents “not economically active”. These groups comprise 60% of males and 78% females (Table 4.2). Most residents of the settlement moved here to have better access to employment and education.

<table>
<thead>
<tr>
<th>Employment Type</th>
<th>Total</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>545</td>
<td>261</td>
<td>100%</td>
<td>284</td>
<td>100%</td>
</tr>
<tr>
<td>Money Work</td>
<td>142</td>
<td>89</td>
<td>34%</td>
<td>53</td>
<td>19%</td>
</tr>
<tr>
<td>Money Work &amp; Sale</td>
<td>3</td>
<td>2</td>
<td>1%</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>Money-Work-Subsistence</td>
<td>3</td>
<td>1</td>
<td>0%</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>Subsistence Only</td>
<td>0</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Unemployed With Subs</td>
<td>0</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Unemployed - Actively Looking</td>
<td>19</td>
<td>13</td>
<td>5%</td>
<td>6</td>
<td>2%</td>
</tr>
<tr>
<td>Not Economically Active</td>
<td>378</td>
<td>156</td>
<td>60%</td>
<td>222</td>
<td>78%</td>
</tr>
</tbody>
</table>

(Source: Fiji Bureau of Statistics, 2015)

Table 4.2 shows the type of employment activities residents in Veidogo are engaged in.

4.2.4.3. Poverty

Poverty is prevalent in all informal settlements of Fiji. The poor living conditions and large family size are one of the apparent features underlining poverty incidence in the settlement. There is a strong relationship between risks of poverty and education level in Fiji (Asian Development Bank, 2012b). Poverty rates are higher for households where the head of household has substantially lower than secondary education. People with lower secondary attainment often have difficulty in securing a job. In Veidogo, instability to secure a well-paid job makes a large number of the population to remain in poverty. Worsening environmental conditions are seen as a contributory factor towards poverty incidence. Continuous removal of mangroves to build more houses has resulted in frequent flash floods during heavy downpours and high tide. Residents highlighted
that most places in the settlement are covered with ankle deep water during high tide, litter scattered around the settlement, as well as carrying along solid wastes dumped at the coast. Due to salt water infiltration the soil is unsuitable for producing crops, making people highly reliant on processed foods. Those with poor income and large families find it difficult to sustain livelihood in the settlement. The poor are often reliant on natural resources to sustain livelihoods. They lack means to buy resources (Ding, 2002).

The mangrove ecosystem is the main source of livelihood to most of the residents. They catch brackish water crustaceans and collect firewood. All natural ecosystems have a certain carrying capacity, beyond which the ecosystem is not able to replenish itself and deteriorates with time. Increase in the settlement’s population has resulted in more people dependent on the fragile environment, leading to unsustainable practices, such as: exploitation of the mangrove resources (firewood for cooking, and building material), which are slowly degrading now.

(Figure 4.2 Predominance of Swamp.

Figure 4.2 shows the water-filled area in the settlement due to predominance of swampy conditions, which easily allow incoming water to get trapped in the impermeable soil.)
4.2.4.4. Housing Type

Adequate housing has always been a problem for the poor. The quality of housing is an important indicator for the quality of life of the households (Narsey, 2012). The inability to afford better housing in urban areas of Fiji has led most poor migrants to settle in informal settlements. Low income, higher building material cost, and insecurity of tenure in informal settlements forces the poor to construct housing using shacks and recycled building materials. In Veidogo informal settlement the dominant housing material is corrugated iron and loose timber. Most of the houses are built on short stilts as the settlement is often covered in water during higher tides. The corrugated iron structures often appear to be rundown and rusty, making the houses vulnerable to natural disasters (cyclones, flooding, and tsunamis).

Figure 4.3 Housing in Veidogo informal settlement.

Figure 4.3 shows the housing type in the settlement. Timber and corrugated iron are the predominant building material.
4.2.4.5. Land Tenure
The area covered by the settlement consists of freehold land and state land. The land under state jurisdiction is the mangrove swamp, and was sanctioned as “Mangrove Reserve” under the 1985 Mangrove Management Plan. However, lack of administrative actions to control the removal of mangrove cover has led the swamp to be invaded by the human settlement. Different policies may exist for squatting on private land than on public land, squatting on private land may initiate stern actions, while public land may tolerate settlements (Abrams, 1966). Fiji has a successfully enacted land registration system, but the growing numbers of its urban informal settlements are outside access of Housing Authority developments and urban land reform (Bryant-Tokalau, 2014). Traditionally, informal settlements were found on state land, but today, most urban migrants are settling on native land, particularly on the urban fringe through various Vakavanua arrangements (Kiddle, 2010a). In context to Veidogo informal settlement the private land owner has not taken any action ever since encroachment on private land started and the Government is assisting people with the provision of basic infrastructure: water supply, electricity supply, and garbage collection.

4.3. Wailea Informal Settlement
4.3.1. Background Information
Wailea informal settlement is one of the highly populated settlements within Suva’s urban boundary. The settlement is located on the West of Vatuwaqa formal neighborhood. The settlement is zoned under “Residential D”, and sits on land formerly zoned as “Mangrove Reserve”. The relaxation on the part of planning authorities to enforce the zoning regulation on mangrove forests has led to accumulation of informal dwellers. With time the area has become populated with temporary building structures, and now it contains more than one hundred houses that are considered permanent structures.

4.3.2. Geography
The entire settlement sits on a mangrove swamp, which falls under the jurisdiction of state land. There is a river flowing on the western fringe, passing through vast expanse of mangrove forest, which slowly is being invaded by human settlements. The settlement is located on an elevation of 3.3 meters above mean sea level. As a result, the area has a

---

6 Interview with the secretary (Ms Premila) of Bhindi Brothers Industries, September 2015.
7 Residential D zoning consists of low cost housing areas, particularly informal settlement areas.
high water table and is often affected by flashfloods during heavy downpours. At the back of the settlement there is a drain linking the settlement to the industrial area in the neighborhood. According to residents the drain is a paramount reason for frequent floods as it is laden with heavy sediment load and solid and liquid waste from the factories, and creeping grasses. The drains are poorly managed by the Suva City Council. The settlement has a gravel road passing through it, and a bridge connecting the settlement to Grantham Road. The road access to households is unpaved and narrow paths. There are two churches and a kindergarten in the settlement.

Figure 4.4 Unpaved road networks.
Figure 4.4 show the unpaved paths used for major routes in Wailea informal settlement.

4.3.3. Demography
The approximate population in Wailea informal settlement is 1922 people, residing in 396 houses (Fiji Bureau of Statistics, 2015). Members of 50 households were interviewed as part of the research. Of the overall population, only 57% people are engaged in income earning employment, while the remainder is either unemployed, or economically inactive. The approximate family size per household is 5, however in few houses there are more than 7 people, including infants and children in primary schools.

4.3.4. Socio-economic Status
4.3.4.1. Education
For the poor in Fiji, the important concerns regarding education are the access to institutions, and quality of education (Narsey, 2012). In the settlement males hold
better education status than females. Four percent of males have completed tertiary while female population has 2% tertiary education. However, overall female education attainment rate is higher than in males. Approximately 54% of the females have attained advanced education, out of which 38% have attained till upper secondary level. The male population has an approximate of 51% attained advanced education, with 34% till upper secondary level.

**Table 4.3 Education Status in Wailea**

<table>
<thead>
<tr>
<th>Wailea</th>
<th>Total</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1922</td>
<td>947</td>
<td>100%</td>
<td>975</td>
<td>100%</td>
</tr>
<tr>
<td>Primary or lower</td>
<td>463</td>
<td>248</td>
<td>26%</td>
<td>215</td>
<td>22%</td>
</tr>
<tr>
<td>Lower Secondary</td>
<td>454</td>
<td>226</td>
<td>24%</td>
<td>228</td>
<td>23%</td>
</tr>
<tr>
<td>Upper Secondary</td>
<td>690</td>
<td>320</td>
<td>34%</td>
<td>370</td>
<td>38%</td>
</tr>
<tr>
<td>Tertiary</td>
<td>58</td>
<td>34</td>
<td>4%</td>
<td>24</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>257</td>
<td>119</td>
<td>13%</td>
<td>138</td>
<td>14%</td>
</tr>
</tbody>
</table>

(Source: Fiji Bureau of Statistics, 2015)

Table 4.3 shows education attainment in Wailea.

**4.3.4.2. Employment and Unemployment**

Living in an urban landscape has encouraged more residents to have their children educated and engage in better employment, as without proper education there is no opportunity for securing a well-paid job in the employment sector. The majority of residents in the settlement are engaged in “Money-work” employment; that is, income earned from being part of the formal sector. Approximately of 37% males and 20% females are engaged in the employment (Table 4.4). It is often difficult for females to find a suitable job and manage the family at the same time. In most cases females are left to tend the children and look after the elderly. There are also situations where females are encouraged to find employment to aid in managing the household food and living cost, as it is quite expensive to survive in an urban landscape, where there is lack of space for gardening and farming to feed the family.

Unemployment is a significant factor in this settlement and approximately 17% of the males and 21% females are unemployed (Table 4.4). A possible reason for this is inadequate education attainment level. Looking at the education attained, not many
residents have completed upper secondary and tertiary education. To enter Suva’s formal employment sector, it is important to have a good formal qualification and expertise. People with low qualification and skills are still able to find casual and low paid formal employment, and some are employed in the informal sector.

Table 4.4 Employment Status in Wailea

<table>
<thead>
<tr>
<th>Employment Type (Wailea)</th>
<th>Total</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1922</td>
<td>947</td>
<td>100</td>
<td>975</td>
<td>100%</td>
</tr>
<tr>
<td>Money Work</td>
<td>453</td>
<td>290</td>
<td>31%</td>
<td>163</td>
<td>17%</td>
</tr>
<tr>
<td>Money Work &amp; Sale</td>
<td>37</td>
<td>25</td>
<td>3%</td>
<td>12</td>
<td>1%</td>
</tr>
<tr>
<td>Money-Work-Subsistence</td>
<td>42</td>
<td>25</td>
<td>3%</td>
<td>17</td>
<td>2%</td>
</tr>
<tr>
<td>Subsistence Only</td>
<td>8</td>
<td>5</td>
<td>1%</td>
<td>3</td>
<td>0%</td>
</tr>
<tr>
<td>Unemployed With Subs</td>
<td>4</td>
<td>3</td>
<td>0%</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>Unemployed - Actively Looking</td>
<td>368</td>
<td>162</td>
<td>17%</td>
<td>206</td>
<td>21%</td>
</tr>
<tr>
<td>Not Economically Active</td>
<td>1010</td>
<td>437</td>
<td>46%</td>
<td>573</td>
<td>59%</td>
</tr>
</tbody>
</table>

(Source: Fiji Bureau of Statistics, 2015)

Table 4.4 shows the employment category of Wailea informal settlement residents.

4.3.4.3. Poverty
Life in poverty is prevalent amongst the urban poor and low income earners. In Wailea informal settlement, poverty is evident through poor living standards, housing conditions, and the number of family members engaged in employment. Survey data reveals that only a handful of the residents are poverty stricken. Unlike Veidogo informal settlement, Wailea has more people working in well paid employment and better living standards (this is evident through most households owning major electrical appliances, material goods, and automobiles, as well as satisfactory building structures).

4.3.3.4. Housing Types
Housing is often an indicator of income, level of security, and access to resources (Storey, 2006). “Poor housing is considered to be one of the major urban challenges in Fiji, approximately 43% of dwellings in greater Suva area are rated as below average to inferior quality compared with 25% in Suva city” (Prasad & Mohanty, 2013). Poor housing material is one of the perceptible features of informal settlements. In Wailea informal settlement, the dominant housing material is corrugated iron and loose timbers, featuring predominance of the makeshift housing types. The Government does
not permit the residents to build permanent structures. It is impracticable to build concrete structures in the settlement. The houses built use corrugated iron walls and roofs, and timber posts. Almost all houses are built on stilts as the settlement often gets covered in water during heavy downpour (Image 4.5). The underlying reason for flash flooding is siltation of the river running adjacent to the settlement. Extensive removal of mangroves to build housing structures has narrowed the river width and reduced the depth, which often overflows during rainfall.

![Figure 4.5 Housing in Wailea informal settlement.](image)

Figure 4.5 above shows the housing in the settlement. Wailea has a range from very poorly constructed to quite habitable houses.

### 4.3.3.5. Land Tenure

Wailea informal settlement sits on a former Mangrove Reserve, which is predominantly owned by the state. In the past the mangrove forest was the primary source of livelihood. Throughout time more houses emerged and the land was cleared to accommodate building structures. At present the area has mangroves only along the periphery. The Ministry of Local Government, Housing and Environment have a project-plan for “Squatter resettlement scheme” to formalize the land tenure and subdivide lots for each household. In most places the informal settlements are quite big and over a greater area, that it leaves the Government no choice then to grant special concessions to the dwellers, (Abrams, 1966). Wailea informal settlement was planned to be relocated; however, after a household survey conducted from 2004-2007 the relocation scheme was cancelled\(^8\). The Department of Housing does not have any firm reasoning for the cancellation of the scheme. To successfully accomplish the future redevelopment projects the department has prohibited new building structures and additional migrants into the settlement.

---

\(^8\) Interview with the Acting Technical Officer 1 (Fesaitu Mesulame), Department of Housing, Ministry of Local Government, Housing and Environment (May, 2015). However in late 2015 again rumours among residents of Wailea came up that they would be resettled soon.
Requests by the public to the Prime Minister’s Office are considered and people are permitted “temporary” residence on vacant state land, which is occupied by informal settlement dwellers. The temporary residence is defined through impermanent building material, particularly corrugated iron and loose timber structures. There have been cases when settlements were relocated following Government notice.

4.4. Vatuwaqa Formal Neighborhood

4.4.1. Background Information

Vatuwaqa formal neighborhood is one of the highly populated urban neighborhoods in Suva. The area consists of mixed land uses; formal residential dwellings, commercial centers, light industry, and three informal settlements. Vatuwaqa is located approximately 4 kilometers from the Suva City. The area is surrounded by mangrove swamps, which are threatened by continuous expansion of human settlements. The neighborhood is comprised under Residential B zoning of the Fiji’s zoning regulation. Vatuwaqa is home to hundreds of commuters and has a higher number of temporary tenants. The ethnic makeup of the settlement is mixed, consisting of residents of Indian and indigenous backgrounds and regional citizens (Nationals of South Pacific Island Countries).

4.4.2. Geography

The neighborhood sits on a flat terrain, with orderly constructed housing and a major road (Fletcher Road) passing through. Each household has proper road link connecting to the main road. On the south of the area, there is a river flowing to the estuary. It is the same river that passes also West of Wailea informal settlement. The river flows from the north-western direction, and is adjacent to the settlement along the western plane. To the north of the settlement there is a major commercial centre, “Nabua town”, a stopover for most commuters and workplace for majority of the people in the vicinity. The area has high water table, but it does not affect the settlement severely, because of formal (proper) drainage system.

4.4.3. Demography

According to the 2007 census data, the neighborhood has a population of 4153 people, living in 923 houses (Fiji Bureau of Statistics, 2015). Members of 100 households were consulted during fieldwork. The neighborhood has high population

---

9 Interview with the Data Statistician (Anuragh Narayan), Department of Housing, Ministry of Local Government, Housing and Environment (June, 2015).
concentration, evenly distributed over the entire residential zone, with majority residents are in the working class group, students, and retirees. The average family size per household is 4. The houses visited were along Fletcher road, Rifle Range, and Mukta Ben Street.

4.4.4. Socio-economic status

4.4.4.1. Education

Vatuwaqa formal neighborhood has proportionately higher number of people having completed tertiary education. An approximate of 23% females and 26% males have tertiary qualifications, as well as higher occurrences in lower and upper secondary education attainment level. A higher proportion of the population is in the formal sector, as determined by the education status. There are also majority of the population educated till primary and lower secondary education level. This group of men and women are engaged in the informal sector or part of the elderly population. There are also children in school counted under primary and secondary education attainment level.

<table>
<thead>
<tr>
<th>Table 4.5 Education Status in Vatuwaqa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Primary or Less</td>
</tr>
<tr>
<td>Lower Secondary</td>
</tr>
<tr>
<td>Upper Secondary</td>
</tr>
<tr>
<td>Tertiary</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

(Source: Fiji Bureau of Statistics, 2015)

Table 4.5 shows the educational attainment of Vatuwaqa formal neighborhood residents.

4.4.4.2. Employment and Unemployment

A higher population number in the settlement depicts more people economically active than in the informal settlements. Approximately 43% males and 28% females are economically active. Despite of majority females obtaining higher education status than males (Table 4.5), the percentage in the workforce is fewer. This is due to most females being housewives; however, there is reasonable number of females in employment, and
majority are involved in subsistence only. This group of women is involved in selling handmade artifacts and jewelries, and operating roadside vegetable stalls. The male population is highly engaged in employment, with majority in money-work. The neighborhood has a considerable number of people unemployed. The unemployment rate is 6% amongst both male and female population.

Table.4.6 Employment Status in Vatuwaqa

<table>
<thead>
<tr>
<th>Employment Type (Vatuwaqa)</th>
<th>Total</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>4153</td>
<td>2028</td>
<td>100%</td>
<td>2125</td>
<td>100%</td>
</tr>
<tr>
<td>Money Work</td>
<td>1370</td>
<td>815</td>
<td>40%</td>
<td>555</td>
<td>40%</td>
</tr>
<tr>
<td>Money Work &amp; Sale</td>
<td>45</td>
<td>23</td>
<td>1%</td>
<td>22</td>
<td>1%</td>
</tr>
<tr>
<td>Money-Work-Subsistence</td>
<td>47</td>
<td>27</td>
<td>1%</td>
<td>20</td>
<td>1%</td>
</tr>
<tr>
<td>Subsistence Only</td>
<td>5</td>
<td>2</td>
<td>0%</td>
<td>3</td>
<td>0%</td>
</tr>
<tr>
<td>Unemployed With Subs</td>
<td>7</td>
<td>4</td>
<td>0%</td>
<td>3</td>
<td>0%</td>
</tr>
<tr>
<td>Unemployed - Actively Looking</td>
<td>257</td>
<td>121</td>
<td>6%</td>
<td>136</td>
<td>6%</td>
</tr>
<tr>
<td>Not Economically Active</td>
<td>2422</td>
<td>1036</td>
<td>51%</td>
<td>1386</td>
<td>51%</td>
</tr>
</tbody>
</table>

(Source: Fiji Bureau of Statistics, 2015)

Table 4.6 shows the employment status of Vatuwaqa formal neighborhood residents.

4.4.4.3. Poverty

Poverty is considerably very low to non-existent in the neighborhood. The majority of the working class people have an adequate income to afford a decent living. The majority of the housing in the settlement is rented to the residents. Renting in Suva’s periphery is not cheap and rental prices in the settlement are often beyond the budget of the poor. The houses therefore are mainly inhabited by the medium to high income earners. The settlement is home to people with different background and roles, from working class group to students in tertiary institutes renting independently.

4.4.4.4. Housing Type

The housing in this neighborhood is particularly of better state than in informal settlements. Almost 80% of the housing is in good condition, with 20% in average condition. Housing conditions have not been a particular problem for residents. The majority of the houses are made of concrete structures with a few wooden and
corrugated iron built houses (Figure 4.6). Each house has a separate designated boundary, which is often marked by a fence.

Figure 4.6 Housing in Vatuwaqa.

Figure 4.6 shows the housing structure in the formal neighborhood of Vatuwaqa. All houses have designated boundaries, and are constructed in an orderly manner.

4.4.4.5. Land Tenure

The land tenure in the settlement is freehold land and state land. The households consulted for the research live on freehold land. The tenure system is managed by the Department of Lands and Surveys.

Part II. Ecological Footprint Survey Result

4.5. Background of Study

For this research an ecological footprint analysis was used as the main methodology to inform data collection. The survey undertaken had the goal to determine consumption patterns for two informal settlements and one formal neighborhood in the case study area. “Consumption”, in this research refers to the usage of resources of various categories to satisfy households’ needs. The resources are either obtained from the environment around them or purchased. The baseline consumption indicators used are: Water, food, energy, clothing, transportation, and material goods. These indicators are referred to as the categories, as each indicator has a list of questions pertaining to its relevance in determining the results. A sample “Personal Eco-Footprint Calculator” adapted from Tim Turner’s article in 2004 on “How big is my ecological footprint” was used as a guide to prepare the questions for the present

---

10 The state land tenure in Vatuwaqa includes the mangrove swamp, part of which is inhabited by the informal settlements.
study\textsuperscript{11}. Only the questions and consumption categories applicable to the study area and the country were taken into consideration.

The categories used in the survey to collect data are described below in tabulated form, outlining the type of questions under each category and the allocation of points used to calculate the results. The results are depicted in form of graphs, with most graph consisting ‘points’ on the \( Y \)-axis and the categories used to measure ecological footprint result on the \( X \)-axis. The “points” in the \( Y \)-axis are derived from the questionnaire, whereby each question had a set of points from which the best suitable point to the answer by respondents was chosen for analysis. The five categories are discussed below, explaining how the points are allocated for each question under each category.

\textbf{Table 4.7 Water Use}

<table>
<thead>
<tr>
<th>Question Type</th>
<th>Minimum Point</th>
<th>Maximum Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>How long do you shower on a typical day</td>
<td>0</td>
<td>90</td>
</tr>
<tr>
<td>How often you flush toilet</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>When brushing teeth, do you let water run</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Do you use water-saving toilets</td>
<td>-20</td>
<td>40</td>
</tr>
</tbody>
</table>

\textbf{Table 4.8 Food Use}

<table>
<thead>
<tr>
<th>Question Type</th>
<th>Minimum Point</th>
<th>Maximum Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>On a typical day, what do you mostly eat?</td>
<td>20</td>
<td>150</td>
</tr>
<tr>
<td>How much of your food is locally grown</td>
<td>0</td>
<td>60</td>
</tr>
<tr>
<td>How much of your food is organic</td>
<td>0</td>
<td>60</td>
</tr>
<tr>
<td>Do you compost fruit/vegetable scraps and peels?</td>
<td>-20</td>
<td>40</td>
</tr>
<tr>
<td>How much of your food is processed</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>How much of your food has packaging</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>On a typical day, how much of your food do you waste</td>
<td>0</td>
<td>200</td>
</tr>
</tbody>
</table>

\textsuperscript{11} A copy of the sample “Personal Eco-Footprint Calculator”, obtained from Tim Turner (2004) is attached in the appendix together with the questionnaire prepared by the researcher.
### Table 4.9 Transportation Use

<table>
<thead>
<tr>
<th>Question Type</th>
<th>Minimum Point</th>
<th>Maximum Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>How you travel to work/school</td>
<td>0</td>
<td>200</td>
</tr>
<tr>
<td>What is your vehicle fuel efficiency</td>
<td>-50</td>
<td>200</td>
</tr>
<tr>
<td>How much time do you spend in vehicles on a typical day</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>How many cars do you have in your driveway</td>
<td>-20</td>
<td>200</td>
</tr>
</tbody>
</table>

### Table 4.10 Energy Use

<table>
<thead>
<tr>
<th>Question Type</th>
<th>Minimum Point</th>
<th>Maximum Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you dry clothes outdoors or on an indoor rack</td>
<td>-50</td>
<td>60</td>
</tr>
<tr>
<td>Do you have a refrigerator</td>
<td>-50</td>
<td>50</td>
</tr>
<tr>
<td>Does your house have electricity</td>
<td>-50</td>
<td>50</td>
</tr>
<tr>
<td>Do you turn off lights, computer, and television when not in use</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>What do you use to cool off</td>
<td>-50</td>
<td>30</td>
</tr>
<tr>
<td>How many hours a day do you spend outdoors</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

### Table 4.11 Clothing Use

<table>
<thead>
<tr>
<th>Question Type</th>
<th>Minimum Point</th>
<th>Maximum Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you change your outfit every day and put it in laundry</td>
<td>0</td>
<td>80</td>
</tr>
<tr>
<td>Do you wear clothes that have been mended or fixed</td>
<td>-20</td>
<td>0</td>
</tr>
<tr>
<td>Is ¼ of your clothes handmade or secondhand</td>
<td>-20</td>
<td>0</td>
</tr>
<tr>
<td>Are most of your clothes purchased new each year</td>
<td>0</td>
<td>120</td>
</tr>
<tr>
<td>Do you give away clothes that you no longer wear</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>What percentage of your clothes in the wardrobe you never wear</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>How many pairs of shoes have you got</td>
<td>20</td>
<td>90</td>
</tr>
</tbody>
</table>
Table 4.12 Material Goods Use

<table>
<thead>
<tr>
<th>Question Type</th>
<th>Minimum Point</th>
<th>Maximum Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much garbage is created each day</td>
<td>-50</td>
<td>200</td>
</tr>
<tr>
<td>Do you reuse items rather than throw it away</td>
<td>-20</td>
<td>0</td>
</tr>
<tr>
<td>Do you repair items rather than throw away</td>
<td>-20</td>
<td>0</td>
</tr>
<tr>
<td>Do you recycle all your paper, cans, glasses, and plastic</td>
<td>-20</td>
<td>0</td>
</tr>
<tr>
<td>Do you avoid buying disposable items</td>
<td>-10</td>
<td>60</td>
</tr>
<tr>
<td>Do you use rechargeable batteries whenever possible</td>
<td>-30</td>
<td>0</td>
</tr>
<tr>
<td>On a typical day, how long do you use TV or computer</td>
<td>0</td>
<td>80</td>
</tr>
</tbody>
</table>

4.6. Ecological Footprint Result - Veidogo Informal Settlement

4.6.1 Water Use

Water is one of the critical elements, necessary for life. Access to safe drinking water is often a luxury entitlement in many less developed countries (Duraiappah, 1996). According to Howard & Bartram (2003), the World Health Organization definition of water use for domestic purpose is described using three categories: water for consumption (drinking and cooking), hygiene (personal and domestic cleanliness), and amenity uses (car washing and lawn watering). Water supply for consumption and hygiene is fundamental in every household. Access to adequate and safe water is one of the many challenges faced by residents of informal settlements in Fiji. In Veidogo informal settlement, not every household has access to formal water connection. Often a water connection is shared amongst 2-3 households. Houses that are new to the settlement often find difficulty in affording water meters and it is cheaper and more convenient to share the water bills with neighbors who provide the water. The households sharing water bills with houses that have water connection pay on a weekly basis to those owning the water meter. In most circumstances, people save water to reduce the incoming water bills. They do this by reducing water usage whenever possible; for instance, collecting water in buckets for washing, cooking, and brushing, and using water-saving toilets (cistern with two flush buttons, full and half buttons).
Figure 4.7 Water Use in Veidogo.

Figure 4.7 is a depiction of the water use in the settlement. All households interviewed have access to water connection (either own water meters or share connection with neighbors). Bathing and washing comprise greater percentage of usage, as the result for shower alone is 82.8, closer to the maximum value (90), depicting greater use. The result for bathroom use is also closer to the maximum value (40), while tooth brushing does not account for much water used. Further, almost every household has the modern water-saving toilet cistern. The results show that most water use by households is devoted to shower and bathroom uses.

![Average Water Use in Veidogo Informal Settlement](image)

(Photographer: Poonam Devi, 2015)

Figure 4.8 Water Connection Meters in Veidogo.

Figure 4.8 shows the water meter locations in Veidogo. All the water meters in the settlement are located at one place, closer to the main road in the South of the
settlement. These meters control water supply to all the households that have official water connection as well as those who get their water from their neighbors. However, the water distributed between houses with water meters and houses that get water from their neighbors is not measured.

4.6.2. Food Use
Low income and large families makes it difficult to live a pleasant lifestyle in informal settlements as a major part of the income is devoted towards food items. In Veidogo informal settlement, the swampy soil of the area makes gardening impossible so people are therefore often reliant on processed foods and vegetables sold in the local markets. The houses located on higher elevation have small flower gardens where people also plant a few vegetables. People usually do not apply any form of chemicals or fertilizers to the gardens, and most households use vegetable and fruit peelings for manure. Some 18% of the household consulted use compost and some 16% grow organic food. As mentioned above, greater dependence is on processed and packaged goods, which are more durable and easy to store compared to perishable food items like vegetables. This became very obvious in the survey: 74% of the people interviewed rely on processed food and only 13% of households purchase partially-packed goods. The remainder of the participants in the interview buys processed foods that contain packaging. Most households in informal settlements lack adequate food storage provisions to protect perishable food against spoilage and contamination, as they do not have refrigerators to preserve food (Mohanty, 2006). As only few households in Veidogo informal settlement have refrigerators, this lead to most households to be reliant on non-perishable and packaged food that can last for few days or weeks without spoiling. As most households have standard families, sufficient food is often prepared on a daily basis, which according to residents, are wasted in large amounts; only 0.8 % of the population does not waste food. This portrays that the settlement is not affected by hunger and starvation. The people may not be starving, but they may not be healthy.
Figure 4.9 Food Use in Veidogo.

Figure 4.9 shows the type of food consumed by the households in the settlement. The higher results depict greater consumption and the processed and packaged foods are the highly consumed food products in the settlement. Processed and packaged foods like those in cans and wrapped in plastics are loaded with preservatives which can have impact on human health in the long term.

4.6.3. Transportation

Transportation is a key element for communication in that it plays a major role in connecting the settlements to the wider neighborhood. Despite the fact that often no proper roads exist in Fiji’s informal settlements, the urban poor in general have reasonably good access to public transport compared to the rural population (Narsey, 2012). Veidogo informal settlement is located in the vicinity of a major transportation route, Fletcher Road, a primary travel route for commuters. As a result of low income in the settlement there are very few residents who own private vehicles. Actually there was only one household interviewed, which owns a vehicle, and that is recorded as fuel inefficient in the survey (Figure 4.11). The survey results show that 62% residents consider public transit as their main mode of transportation to reach schools and workplace. Eight percent of residents travel by private vehicles, whereby vehicles are provided by the employers of the respondents. The settlement is located in the neighborhood of commercial and light industrial zones, which provide jobs to most of the residents. For many it is therefore possible to walk to their workplace. There are also people in the settlements who work at the near-by commercial centres, and who do not
spend much time in travelling. This becomes quite evident in the result below (Figure 4.11).

**Figure 4.10 Travel mode used by most residents.**

Figure 4.10 shows the three modes of travel, as used by residents of Veidogo.

**Figure 4.11 Transportation use.**

Figure 4.11 depicts the time spent by people while travelling, the number of vehicles owned by residents and, the number of people using fuel efficient vehicle. The results depict that time spent in travelling to work is quite below the maximum value (100), depicting that workers don’t travel long distance to get to their workplace. Only one household in the sample population owns a vehicle, therefore the result for
vehicle ownership is quite low. The inefficient fuel consumption of the vehicle has increased the fuel inefficiency of the settlement.

4.6.4. Energy Use

Low living standards in Veidogo informal settlement resulted in efficient energy usage. Energy to a large extent is acquired through outtake from the natural environment, especially for cooking. Electricity supply is one of the critical infrastructures that the urban households have (Narsey, 2012). However, majority of the households in Veidogo informal settlement do not have electricity. The installation of power meter and posts are costly and as a result, most residents do not own any electrical appliances. Those households who have electricity do not own high power consuming appliance; such as, refrigerators, washing machines, and electrical fans. Only a handful of the households owned refrigerators (Figure 4.12). Clothes dry fastest when hung outside in a dry, hot and windy climate. Clothes hung to dry indoor concentrate moisture and increase risks of mold spores on clothing. The majority of households interviewed dried their clothes outdoors. Some households dry clothes indoors on small verandah or house frontage, due to the lack of open space.

Nearly everyone in the settlement is part of the informal economy, having several forms of casual jobs; for example, housemaids, roadside vegetable settlers, artifact sellers, shoeshine boys, and wheelbarrow boys. People are found to spend most of their time outdoors, earning their livelihood.

![Energy Use in Veidogo Informal Settlement](image)

Figure 4.12 Energy Use in Veidogo.
Figure 4.12 shows the several factors determining the energy usage in Veidogo informal settlement. According to the survey, “most of the time” residents hang clothes outdoors for drying. They hardly use electric clothes dryers. For electricity access, and owning electrical appliances, people are more energy efficient. The average results for electrical appliances have negative values depicting lesser use of such appliances.

4.6.5. Clothing Use

Clothing is a variable factor, depending on time (occasions) and expense. The variables used to calculate clothing use are: rate of new purchases, giveaways clothes, clothes never worn, second hand and mended clothes, and daily laundry. Clothing for different occasions is an important aspect in peoples’ lives. This is also true for Wailea informal settlement. As most people are in the working class group, and children attending schools, new clothes are frequently needed by residents. The survey revealed that most people in the settlement go for tailor-made and secondhand clothing. Only a few people are purchasing new clothes (Figure 4.13). New clothes are purchased on important occasions; for instance, at Christmas, and school uniforms at the beginning of school terms, or during store sales with reduced prices. There is a small fraction of population who own clothes that they never wear. In most situations the unworn clothes are given to the families and friends in the neighborhood.

Figure 4.13 Clothing Use in Veidogo.
Figure 4.13 shows the clothing usage as in Veidogo informal settlement. The lower and negative values show considerate utilization of income on clothing, whereas the greater values show that people spend more income on those categories of clothing. Further, the first bar portrays that most households put their everyday wear in laundry on a daily basis. These are the households having infants and people in employment, who change their clothing on a daily basis.

4.6.6. Material Goods Use

The use of manufactured materials is demanded by all people. In Veidogo informal settlement, people are keener in efficiently using the materials which are reusable (glass bottles and containers/ newspapers, plastic bags, clothing), recyclable (glass bottles and jars, plastic bottles, food and drink cans), and repairable (electrical appliances). According to the survey, most residents are least considerate on the purchase and inappropriate use of material goods, for instance, purchasing of disposable items such as paper & plastic plates and cups, and packaged food items. To most residents, even the disposable items are reusable; however, not all items can be used for long. Electricity is unavailable to most households due to high installation cost. People therefore rely on other means of lighting at night, such as torches and other electrical lighting appliances that can be operated by rechargeable batteries (people also use solar lighting which can be found at reasonably affordable prices in most retail outlets in Fiji). Further, the size of the household determines the amount of garbage created. Bigger household usually create more garbage.

Figure 4.14 Material goods use in Veidogo.
Figure 4.14 shows the extent of various material used in the settlement. The lower results for repairable, recyclable, reusable, and rechargeable items show greater usage of such items. There are also circumstances where people use most material goods inappropriately, for instance; high purchase of disposable items, greater waste production, and high usage of technological goods, such as TV and computer. The higher results for such items show higher usage.

4.7. Ecological Footprint Result - Wailea Informal Settlement

4.7.1. Water Use

Every household in the informal settlements desires to have its own water supply as it is cheaper in the long term and also more convenient. In Wailea informal settlement, approximately 26% of the households share water with neighbors. These households are either too poor to afford the installation of a water meter by the Water Authority of Fiji, or they have moved into the settlement recently. In most cases new migrants have to wait for long to have water meters installed at their houses. The process from filling the new water connection form to approval is very time consuming. Residents use most water on shower and bathroom use (Figure 4.7). In the context of shared water, the water bill is divided amongst the number of families sharing; therefore after division the value paid is lower than the total amount. All residents in the settlement are eligible for free water usage allowance. People make maximum use of the scheme.

![Average Water Use in Wailea Informal Settlement](image)

**Figure 4.15 Water Use in Wailea.**

Figure 4.15 shows the water use for different purposes in the settlement, depicting people waste more water on shower and bathroom uses. Higher results show greater usage.
4.7.2. Food Use

Lack of open space in Wailea informal settlement for backyard gardening is one of the obvious reasons for residents dependence on processed food products. Residents prefer packaged foods over locally produced, due to its durability. The packaging later on is reused within the household. Locally produced foods (fruits, vegetables, root crops, and spices) are available in the local markets at affordable prices; however, most locally produce is perishable, and has to be consumed within a short time. People find it expensive and time consuming to visit local vegetable markets on daily basis to buy fresh produce. Instead they prefer to buy processed foods in bulk once in a while and store it. Residents consume very little or no organic foods. Only a small number of households have mini backyard gardens, which are poorly managed and survive on inorganic fertilizers, and fewer are composting (Figure 4.16). Processed foods and cash crops share the same priority level; however, people prioritize processed foods over cash crops. Residents claim that no food is wasted at the end of the day, as all food is purchased, and food cost has to be considered. Food is prepared according to the family size, and the leftovers are eaten together with the next meal.

![Average Food Use in Wailea Informal Settlement](image)

**Figure 4.16 Food Use in Wailea.**

Figure 4.16 shows the points bestowed for each variable applied to measure food use in Wailea informal settlement. The higher values show greater misuse of resources.
4.7.3. Transportation

As already mentioned transportation is not a significant problem to most of the informal settlements in Suva. Informal settlements are usually found near major road links in Fiji. Wailea informal settlement is located behind residential B dwelling and is in the vicinity of Fletcher Road. Most people working in the vicinity prefer to take a walk instead or take a bus. The time spent for travelling is between less than 30 minutes to 1 hour. Many residents own fuel efficient vehicles (Figure 4.17). According to the vehicle owners, fuel efficient vehicles consume less fuel and cover greater mileage. Travel by public transit is the main travel mode of residents in Wailea informal settlement. 64% residents travel by public transport to the workplace and schools, while 22% residents walk to workplace. 14% residents travel using private vehicles.

![Graph showing transportation means in Wailea Informal Settlement](image)

**Figure 4.17 Transportation Use in Wailea.**

Figure 4.17 shows the time spent on transport while travelling to work/school (the lesser the values, the less time spent), the ownership of automobiles and the use of fuel efficient vehicles by automobile owners. The lesser points for fuel efficiency depicts that most vehicles are fuel efficient. The higher points for vehicle ownership show higher number of vehicles owned by residents.
4.7.4. Energy Use

In Wailea informal settlement almost every household has electricity access and only six percent of the sample households share electricity with neighbors. A fixed share of electricity cost is paid to the house owning the power meter on weekly to monthly basis, irrespective of kWh usage. The amount is about $30/month. Most households are cautious about electricity usage and they turn off appliances after use. Almost every house in the settlement has a television. A few own a refrigerator as well. These are the two major electrical appliances owned. Every household hangs clothes outside for drying in the small open space or house frontage. Except for the elderly, few housewives and children in school, most of the population is engaged in the workforce. Those who stay at home claim to spend most of their time outdoors, going for short walks or engaging in subsistence agriculture at the backyard or open space near their houses.

Figure 4.18 mode of travel in Wailea.

Figure 4.19 Energy Use in Wailea.
Figure 4.19 shows the energy use in Wailea informal settlement, as depicted by the variables used to measure energy use. The lower values show efficient energy uses.

4.7.5. Clothing Use

The majority of people interviewed change clothes and put it in laundry on daily basis. Those people whose outfit requires daily cleansing are school children and working people. The majority of people in the sample population go for secondhand and tailor-made clothes. The result for new purchases is quite high as well. New clothes are bought for particular occasions and/or festivals. Many residents have clothes which they never wear, and which they never give out to other people (needy ones) so far. There are also people who own bulks of shoes for different occasions. It is noticed that most people in the settlement spend much on material goods. Bearing in mind the expenses of the people on luxury items, the settlement does not contain many poor people. Although, the housing condition may seem disorderly constructed, but living standard is quite lavish for most households.

Figure 4.20 Clothing Use in Wailea.

Figure 4.20 the graph shows the clothing use variables in the settlement. The higher points portray higher expenditure, while the lower and negative values depict lower levels of expenditure on certain clothing needs. Residents are found to be spending more on new clothes and shoes. The graph also shows the points allocated for “daily
“laundry”. Most households in the settlement do laundry on a daily basis, as the result is closer to the maximum value (80).

4.7.6. Material Goods Use

Under this category, residents’ dependence on material goods and its utilization in daily activities is identified. Household items which are reusable, repairable, and recyclable are put to later use such as: jars, glass bottles, plastic items (containers, bags, bottles), and electrical items (repairable). For instance, unused plastic gallons are cut open into half and filled with soil, and used for planting spices and vegetables for family consumption. Residents are highly considerate on purchasing disposable items. They prefer to reuse, recycle, and repair items than purchasing items which can only be used only once or twice. Although, almost all houses have electricity access, there are few households which use rechargeable batteries, to lower expenses. Further, more household waste is created on daily basis in majority houses. The underlying reason for this is greater dependence on processed foods. More consumption of packaged goods leads to more production of household waste.

Figure 4.21 Material goods use in Wailea Informal Settlement

Figure 4.21 shows the variables for material goods use in Wailea. The higher points show greater expense on material goods, and the lower points show low spending on certain material goods. It is found that residents are repairing, reusing, and recycling
most items. Residents are found to spending most of their time and money on electronic goods (television, computer and mobile phones).

4.8. Ecological Footprint Result - Vatuwaqa Formal Neighborhood

4.8.1. Water Use
Water, a basic need is available in all formal residential neighborhoods. In Vatuwaqa formal neighborhood all the households have access to water supply. Greater water usage in the neighborhood is denoted by shower, washing and bathroom uses. Majority households use water-saving toilets; however, water wastage does occur. Most households are tenants and water bills are included in the rent amount. Water is often wasted by longer bathing time and washing of everyday wear.

![Water Use in Vatuwaqa Formal Neighborhood](image)

**Figure 4.22 Water Use in Vatuwaqa.**

Figure 4.22 shows the water use variables in Vatuwaqa formal neighborhood. The higher values show greater use of water for certain purposes. More water is shown to be wasted on bathing and washing.

4.8.2. Food Use
All the houses in the neighborhood have adequate space for gardening. However, only a small proportion of the households do backyard gardening. Artificial fertilizers are used for nutrient supply. A bigger proportion of the population depends on local vegetable markets for supply of fresh produce. The majority of households
claim that their daily meals contain non-organic food, as the produce bought from the vegetable markets are not always organically produced, artificial fertilizers are applied for greater output. A higher proportion of the people go for packaged food products. Food products are preferred to be packed in plastic bags, despite knowing the fact of the harmful effects the use of plastic has on the environment. Households report that most food is wasted on a daily basis. Food wastage is not a considerable issue for most residents. The income level in Vatuwaqa formal neighborhood is adequate to cover basic needs. Overall, Vatuwaqa formal neighborhood has the highest food wastage of the three case study areas.

Figure 4.23 Food Use in Vatuwaqa Formal Neighborhood

Figure 4.23 shows the food use results, as obtained from the variables applied to measure food usage. The higher results depict greater dependence on certain food products, and lower results show lower dependency on certain products. Majority spending is concentrated on packaged, processed, and non-organic food products. A very small proportion of expenditure is on locally food products, particularly cash crops.
4.8.3. Transportation Use

Transportation routes are an important feature linking the urban neighborhoods to its vicinity. In Vatuwaqa formal neighborhood the preferred mode of travel is by public transport, private vehicles and on foot. There are approximately equal numbers of people who travel by these three modes. The majority of high income and middle income earners own vehicles and prefer to use them when travelling. Although vehicle ownership is quite high there are a number of people who prefer to travel by public transport, as bus services are frequent with cheap fares. The neighborhood is in stage 1 of public bus service route.

![Transportation use in Vatuwaqa Formal Neighborhood](image)

**Figure 4.24 Transportation use.**

Figure 4.24 shows the variables employed to measure the transportation use in the neighborhood. The results portray that there are majority residents owning vehicles in the neighborhood; however, fuel inefficiency of most vehicles are considerably high. Also, as most residents have workplace in the vicinity, thus not much time is spent in travelling.

4.8.4. Energy Use

All households in Vatuwaqa formal neighborhood have access to electricity and almost all residents have major electrical appliances (refrigerator, washing machine, television and computer). Residents are cautious about electricity usage in their homes, and in most
circumstances turn off lights and appliances after use. Also, despite having electricity, not every household uses electric fan to cool off. People prefer open air ventilation over electric fans. Most people claim that in a day most of their time they spent outdoors, traveling to work, working in the compound, and going for walks. Majority of residents prefer to hang clothes outside to dry instead of using indoor rack.

![Average Energy use in Vatuwaqa Formal Neighborhood](image)

**Figure 4.25 Energy Use in Vatuwaqa.**

Figure 4.25 shows the variables used to measure energy usage in the neighborhood. The greater values show inefficient energy usage. Despite households owning major electrical appliances, most households are cautious about saving electricity whenever possible. This is evident by drying clothes outdoors instead of using clothes dryer and limited use of electrical coolers (fan) on warm days.

### 4.8.5. Clothing Use

A greater spending on material goods reflects on a higher income status. New clothes and shoes are purchased on a regular basis by majority of residents, with a considerable number of items that are never worn. There are few households who prefer to wear hand stitched or tailor-made and secondhand clothing. These people are moderate to low income earners. Very few of the clothes not worn are being given away to friends and
families. Majority households in Vatuwaqa formal neighborhood put their everyday wear in laundry. This increases the water usage for washing clothes.

Figure 4.26 Clothing Use in Vatuwaqa.

Figure 4.26 shows the variables used to measure clothing use in the neighborhood. Households spend major part of their income on clothing and shoes, as the number of new purchase per year is quite high with most clothes being never worn. The bar on daily laundry represents that most households wash clothes on daily basis.

4.8.6. Material good Use

Most households reuse/recycle items like containers, jars, bottles and paper. Material goods which have the potential to be repaired are fixed for further uses. Also, people highly use rechargeable batteries, much for torches, mobile phones, and lamps for emergency purposes. Still there is a high dependence on disposable items. These disposable items are paper and plastic plates and cups, usually discarded after one use. Garbage created every day is quite high in the households from which members were interviewed. This suggests that overall, solid waste generation is quite high in the neighborhood. This is probably due to increasing dependence on packaged goods, increasing the garbage load.
Figure 4.27 Material Goods Use in Vatuwaqa.

Figure 4.27 shows the material good use variables and the points devoted to it. The results show that dependence on material goods is quite high in the neighborhood. Better income status is a probable reason for luxury spending. There is a higher proportion of the population using computer and television on daily basis.

Part III. Environmental Degradation

4.9. Veidogo Informal Settlement

4.9.1. Perception and awareness of environmental changes

Environment degradation is obvious in the settlement. It is discernible by the extent of settlement expansion into the mangrove swamp, and people’s ever-increasing dependence on mangrove resources (firewood, and food source). In the survey conducted people were asked about environment related issues which affects the residents and poses threats to the environment. The issues were ranked in a range from 0-5. The most prominent issue relates to flooding and water pollution in the settlement. Poor sanitation and disposal of household wastes in the water ways pollute the drains running through the settlement. During high tide the rubbish and sewerage float around the settlement, which brings a high probability to expose residents to water-borne diseases. Also, water supply to the settlement is often
disrupted due to water pipe damages in the vicinity. Such damage also contaminates drinking water.

Figure 4.28 Perception and Awareness of environmental changes in the Veidogo informal settlement.

Figure 4.28 shows the issues affecting the people and the environment. The bars depict the level of influence the issues have on residents’ day-to-day continued existence.

Land pollution is also a significant challenge in the settlement. Development activities in the vicinity have led to changes around the settlement over time. More light industries have emerged near the coasts, emitting solid and liquid waste into the ocean. During high tide these wastes flow back into the settlement. The removal of vast areas of mangrove forests has made the settlement susceptible to frequent floods, which worsens the problem of water pollution and contamination of drinking water.

The settlement has no major road access to the houses, only unpaved slippery paths. Lack of an adequate transportation route and paved path is a struggle for most residents, particularly for elderly, sick, and disabled people.

4.9.2. Energy Use

Cooking fuel requires the major component of the energy that is consumed by the households. People prefer to use the cheapest energy source available to them as well as convenience. In Fiji’s urban area more than a third of the population uses firewood as cooking fuel (Narsey, 2012). In Veidogo most households use kerosene and
firewood as the main fuel source for cooking. Kerosene is one of the cheapest fuels in the market and it is readily available in the stores nearby the settlement. Firewood is the second most common fuel for cooking. It is readily available as the settlement is located in the heart of a mangrove forest. Mangrove wood is a good source of firewood and it burns well while still wet. Most people who are not able to afford kerosene use mangroves as fuel wood. People are not cautious about the adverse effect of smoke arising from the use of these energy sources on human health. Gas is the least energy source used for cooking in the settlement. It is costly and often beyond the budget of the low income earners.

Figure 4.29 Energy Source for cooking in Veidogo informal settlement.

Figure 4.29 above shows the percentage of households using the three different energy sources as the main fuel of cooking.

4.9.3. Household Waste Disposal

Solid waste disposal should not be a problem in Suva’s informal settlements as Suva City Council does garbage collection on a regular basis. In Veidogo informal settlement garbage is collected three times a week. A small disorderly constructed stand made out of loose timber and corroding tin is situated outside the settlement on the west and south of the settlement, where people throw their household garbage. These stands are poorly managed. Rubbish is often scattered around, until it is collected by the municipality. People do not bury most of the hazardous garbage (tube lights, bulbs, chemicals) as it is sometimes done elsewhere as the area is swampy, and buried material won’t stay buried.
for long before it is exposed to the surface, which would subsequently be a nuisance to the environment. The overcrowded building structure and lack of open space makes it impossible to burn waste. Veidogo informal settlement residents compost food and garden waste for manure for small home gardens. Material stuff like paper, aluminum cans, and glassware (jars, bottles) are used for storage purposes.

(Photographer: Poonam Devi, 2015)

Figure 4.30 household garbage collection stands.

Figure 4.30 shows the poorly constructed stand for garbage collection on entrance of the settlement, and near the light industry area.

![Household garbage collection stands](image)

Figure 4.31 Solid waste disposal means.

Figure 4.31 above graph shows the waste disposal means by residents in Veidogo informal settlement.

![Household Solid Waste Disposal Means - Veidogo Informal Settlement](image)
Figure 4.32 Composting and Reusing in Veidogo informal settlement.

Figure 4.32 shows the materials which are reused and composted in the settlement.

4.10. Wailea Informal Settlement

4.10.1 Perception and awareness of environmental changes

The landscape in the area has been modified to suit the present neighborhood. There has been removal of vast expanses of mangroves to accommodate buildings. This has degraded the environment and reduced environmental quality and diversity, making the environment as well as the settlement susceptible to adverse effects of natural calamities. Development has become a prominent environmental challenge, affecting people and their surroundings. Throughout time more houses have emerged in the settlement, adding up to the congested and disorderly organized structures. Movement of people into the settlement has led to the reclamation of land to accommodate an increasing population. This has also contributed to siltation in the nearby river, making it shallower, and increasing the frequency of floods. Flooding has become a phenomenon common to the settlement. Almost all households from which members have been interviewed have experienced flooding in the past few years. They have adapted to cope in the challenging environment. Water pollution is considered a serious problem in the settlement as many residents dispose-of household wastes in the river. Water is contaminated from industrial pollution and pollutions of residential areas which happens at the upwards to the river. Continuous
dumping of wastes and siltation has reduced the water flow. The small drains running through the settlements contain waste materials and are blackish in color, giving off stinky smell.

Figure 4.33 Drains within Wailea informal settlement.
Figure 4.33 above shows the water quality in the settlement. Household rubbish disposal into the drains has changed the outlook of drains. Most give off stinky smell and stagnant water becomes breeding grounds for mosquitoes.

Figure 4.34 Perceptions and Awareness of Environmental Problems in Wailea Informal Settlement

Figure 4.34 shows the numerous environmental problems faced by the people and the level of influence it has on the endurance in the settlement. The higher level of influence represents greater adversity of the environmental problems.
4.10.2. Energy for cooking

In Wailea informal settlement more people use kerosene as their main fuel source than gas or firewood. Kerosene is one of the cheapest petroleum fuels and is considered more convenient than gas. Cooking gas is quite expensive for low income earners and unlike kerosene it cannot be bought in small quantity. Although Fiji Gas is now available in 4.5kg cylinders, people find it expensive in comparison to kerosene. However, there are some households who use cooking gas on regular basis. Firewood is rarely available to residents, since most of the mangroves have been cleared during reclamation for housing development. Also, not every house has an outdoor open stove to burn firewood. As a result a big number of households from where members were interviewed find kerosene to be the best option for cooking fuel that is available.

Figure 4.35 Energy source used for cooking fuel in Wailea informal settlement.

Figure 4.35 shows the 3 energy sources used as cooking fuel by the certain percentage of households. Similar to Veidogo informal settlement, Wailea informal settlement also has a greater number of households using kerosene for cooking fuel. A considerable number of residents also use cooking gas.
4.10.3. Household waste and recycling
Solid waste disposal is a serious problem in Wailea informal settlement. Garbage is collected three times a week. There are two large garbage containers placed at the entrance of the settlement, in Wailea Street and Daya Street respectively. As the settlement is quite big, the amount of household garbage exceeds what the disposal container can collect. The container often overflows and then garbage spreads all over near the entrance to the settlement, giving a bad impression of the settlement (see Figure 4.35). According to the survey, almost all households dispose-of garbage in the containers provided by Suva City Council. Only a few bury hazardous materials. In most circumstances the impermeable soil in the settlement makes it difficult to bury household waste.

(Figure 4.36 Garbage Disposal.
Figure 4.36 shows the garbage bin setup for Wailea appears to be much better organized than Veidogo informal settlement; however, extent of littering around the bins is very much the same.)
Figure 4.37 Solid Waste Disposal means in Wailea informal settlement.

Figure 4.37 shows the methods of household garbage disposal in the Wailea informal settlement.

In the settlement people are reusing items and composting decomposable matter. Most people have vegetable gardens and they use vegetable peelings, and waste food as compost manure. Also, people in the settlement use glass containers, jars, and bottles for storing food ingredients and water, and consider it more durable than plastic ware.

Figure 4.38 Composting and reusing materials in Wailea informal settlement.

Figure 4.38 shows the materials reused and composted in the settlement.
4.11. Vatuwaqa Formal Neighborhood

4.11.1 Perception and awareness of environmental changes

Environmental problems exist in all highly populated areas. In Vatuwaqa formal neighborhood development is considered to cause major environmental problems since long time. The neighborhood has witnessed growth of commercial centers and industrial sites in the vicinity, and new housing developments. With high concentration of business and industrial uses, as well as emerging informal settlements, the rate of land pollution has considerably increased. This is evident by improper household and garbage disposal and solid waste from the business and industrial sites. Most households have experienced small flash floods in the past caused by extensive removal of mangrove forest to reclaim space for new housing in the informal settlements. The building up of siltation in the river diverts most water into the drains running adjacent to the neighborhood, which overflows during heavy rainfall. The liquid waste from the factory is believed to be disposed into the waterways, which during flooding flows into the drains, together with household wastes dumped into river and drains. Further, deforestation is happening at a very low rate in the neighborhood, and is more common along the coastal areas.

Figure 4.39 Perception and Awareness of environmental problems in Vatuwaqa formal neighborhood.
Figure 4.39 shows the environmental problems prevalent to the neighborhood, and the level of influence it has on the environment and lives of residents. Physical development and pollution are considered to be the most significant problems in the neighborhood.

4.11.2 Energy for cooking

The energy for cooking is determined by the households’ affordability of the energy fuel. In Vatuwaqa formal neighborhood, most people interviewed depend on “gas” as the main source of fuel for cooking. It is considered easy and safer to operate. There are some households with lower income who use kerosene for cooking. A very small proportion of the population uses electrical appliances for all their cooking needs. This group of people consists of high income earners and can afford to pay high electricity bills.

Figure 4.40 Energy Source for cooking in Vatuwaqa formal neighborhood.

Figure 4.40 shows the fuel sources used for cooking in Vatuwaqa formal neighborhood. Cooking gas is the major fuel source preferred by most residents.

4.11.3. Household Waste Disposal

Household garbage disposal is not a serious issue in the neighborhood. The garbage is collected from the neighborhood three times a week by the Suva City Council.
households pay garbage rates to the municipality. Approximately 95% of the population disposes-off all the garbage into the garbage collection bins. There are few residents who bury the hazardous items (tube lights, broken glass, pesticides, and flammable liquids). A small number of people interviewed burn most of the garbage; however, burning garbage is prohibited by the municipality, as it adds to the air pollution and affects the entire neighborhood.

Figure 4.41 Garbage disposal means in Vatuwaqa formal neighborhood.

Figure 4.41 shows the garbage disposal method as adopted by the households in the neighborhood.

Some households also compost, and reuse most of their material goods instead of discarding it. Leftover food and yard waste is composted and is used as organic manure for the backyard gardens. The waste food includes raw vegetable and fruit peelings. Mulching is a very rare practice in the neighborhood. Only a handful of the households use green waste from the yard in the vegetable and flower garden. Most of the paper and glass materials are reused by the households for other purposes. Paper products like newspaper are used for food cover and lunch wrappers. Glass bottles and jars are used for storage purposes, most commonly storing food items.
Figure 4.42 Composting and Reusing materials in Vatuwaqa formal neighborhood.

Figure 4.42 shows the materials which are composted and reused by the households. Paper and glassware are one of the highly reused products.

4.12. Conclusion

The three case study communities share similarities and differences in the resource use and dependence on the surrounding environment. The ecological footprint survey provides striking results in identifying the unsustainable resource use in the three communities. The results portray that not only income level determine the increase in unsustainable practices, but poverty is also a factor in forcing people to degrade the environment to sustain livelihood. The perception of residents on the adversity of environmental degradation is depicted through: land, water and sewage pollutants, development, and flooding being amongst the highly affecting environmental problems in the three communities.
Chapter 5: Discussion of Results: Comparison between Communities

5.1. Introduction

This chapter highlights the differences of informal settlements and a formal neighborhood with regards to the ecological footprint survey, and the perception and awareness of environmental change. Initially, it discusses the similarities and differences of the informal settlements to each other. After that, the similarities and differences of the informal settlements to the formal neighborhood are discussed. The chapter concludes with an assessment of which group (informal settlement residents or formal neighborhood residents) contributes more to environmental degradation.

5.2. Similarities and differences between the informal settlements

a. Ecological footprint survey result for Veidogo and Wailea

The informal settlements in Fiji share similar characteristics with regards to being overcrowded and with poorly constructed building structures, high poverty incidences, and vulnerable environment conditions. There are certain features that differentiate the informal settlements from each other. Not all informal settlements are poverty stricken, and poorly managed. The landscape plays a major role in defining the complexity in the settlement development. Settlements on low, flat, swampy terrain are more vulnerable to flooding and poor drainage than settlements on higher ground. There are other prominent factors that differentiate the settlements such as number of people in the workforce, number in poverty, number of households inadequately serviced with basic infrastructure, the extent of asset accumulation per household, and Government’s collaboration in upgrading living conditions. These factors are determinants of the quality of life in the informal settlements. Veidogo and Wailea informal settlements share common physical and social characteristics; but economically the settlements are quite different from each other. Consumption expenditure in these settlements varies. Households in Wailea informal settlement are significantly in a better economic status than in Veidogo informal settlement (Figure 5.1). This shows that consumption expenditure by households is greater in Wailea informal settlement, producing a greater ecological footprint result.
This research discusses the simplest aggregate consumption footprint of a densely populated residential area in Fiji’s Capital City. The study is a portrayal of how consumption patterns can be determined and the environmental degradation, generated by anthropogenic forces manifested in the case study area. Ecological footprint has been useful for its ability to compare the resource demands of different population groups with respect to the global productivity (Venetoulis & Talberth, 2008). The application of the ecological footprint analysis in the study area has shown substantial results in the consumption patterns of the settlements. Despite the fact that Wailea and Veidogo are both informal settlements, the analysis shows that consumption patterns differ amongst the two informal settlements. What is considered of poor quality in one settlement does not necessarily exist in the other settlements. The six categories (water, food, transport, energy, clothing, and material goods) used to collect ecological footprint data are being compared to show the striking similarities and differences. Average results are used to portray the data.

![Ecological Footprint Result - Veidogo and Wailea Informal Settlements](image)

**Figure 5.1 Ecological Footprint Result for Veidogo and Wailea.**

Figure 5.1 shows the average result of ecological footprint survey in Veidogo and Wailea informal settlements. Both the informal settlements have profoundly similar expenditure on food and water uses; however, consumption expenditure on transportation, energy, clothing, and material goods differ greatly.
Food consumption is the largest component of ecological footprint measurement in the informal settlements. A higher result for food consumption denotes a more unsustainable practice to obtain food items. In most part of the developing world, a high percentage of the biologically productive land and sea are utilized for food and energy production (WWF & ADB, 2012). In Fiji the majority of informal settlements depend on the biological physical environment for daily survival. A definite case in point from the present research is Veidogo informal settlement; despite the settlement’s greater dependence on locally produced foods, a greater percentage of the produce is non-organic, purchased from local vegetable market. Veidogo informal settlement has relatively greater expenditure for basic needs than Wailea informal settlement. A great number of households in this settlement depend on the mangrove forest for cooking fuel, as well as marine resources from the sea for their food supply. In Wailea informal settlement the continuous reclamation of mangrove swamp by humans has resulted in fewer mangroves existing in the vicinity of settlement. As a result fewer households depend on mangroves for energy source. Further, Wailea has approximately 5% of the households engaged in fishing as their major income sources. This shows that there is certain percentage of the population depending extensively on the natural resources for sustenance.

The income level, wealth, and way of living act as a determinant for an individual’s ecological footprint. Higher family incomes denote greater expenditure on daily basic needs and wants. Both the informal settlements have approximately similar proportion of people in the employment sector; however, on average Wailea informal settlement is economically more stable than Veidogo informal settlement. The perceptible disparities in the wealth status are reflected through greater consumption expenditure, particularly on clothing and accumulated asset (material goods) showing that households in Wailea informal settlement have greater footprint results. The land tenure of the informal settlements plays a major role in determining the accessibility to basic facilities. According to Abrams (1966) “squatting on private land may result in severe stern actions and hindrance in approving access to basic services, while on public land regulations can be relaxed”. The instance that Wailea is on public land has placed the settlement in the limelight of administrative planning, evident through mini upgrade projects, and availability of basic urban services. Veidogo informal settlement which is located on private
land has been a target of numerous ownership disputes, between Government and the land developer. Here it is more difficult to obtain security of housing on a complex tenure. More migrants are interested in moving into Wailea informal settlement than in Veidogo informal settlement. Apparently Veidogo is home to poorer dwellers than Wailea. This is evident through profoundly poor living conditions, and unclear access to urban services (electricity, water, and upgrading projects). This increases the settlements dependence on the mangrove ecosystem for food and energy supply.

b. Ecological footprint survey result – comparison between formal neighborhood and informal settlements

The urban setting of Fiji encompasses with diverse residential dwellings, ranging from low cost to high class formal neighborhoods. In the midst of these formal residential dwellings, there exist numerous informal residential settlements, which are distinguished through poorly organized housing structures, undefined land boundary, illegal or semi-legal occupancy of vacant land, and inadequate living conditions with declining access to basic urban services. The Vatuwaqa formal neighborhood shares the landscape with Veidogo and Wailea informal settlements; however, the distinction of the formal settlement from informal settlements is marked by legal boundaries. Wailea and Veidogo informal settlements have high similarity index in physical, social, economic, and environmental consequences. They greatly differ from the Vatuwaqa formal neighborhood. The living conditions are of improved level in formal neighborhood than in informal settlements.

The modern age has transformed the social and natural landscapes and has facilitated demand for natural resource consumption (Jorgenson et al, 2010). In today’s era, escalating population has aggravated demand for increasing dependence on natural resource to cater for the mass consumption. The formal neighborhood consists mainly of residents from lower to higher middle classes and is therefore from its living standards much higher than the residents of informal settlement residents. As a result, consumption patterns and expenditure on food, transportation, clothing, material goods, and energy use are apparently different in most scenarios. Expense for food is the highest household expenditure in all the three case study areas, followed by water and transportation. In Vatuwaqa formal neighborhood rent is a
major share of household expenses, alongside food and water. For this study, the expenses for rent, food, and transportation was not asked for from the interviewees.

In the literature it is often highlighted that the urban poor require affordable transportation to their workplaces, as they are not in the position to afford housing in the vicinity of administrative centres and as they also cannot afford motorized vehicles (Dahiya, 2012). In the study, however, it has been found that access to transportation routes is not a challenge in the case study area. The area is connected to one of the busiest and a major road network (Fletcher Road) in Suva, and many residents of the three communities live in walking distance to their workplaces and to major shopping centers. To compare expenses for transportation it has been found that Veidogo residents have expenditure on transportation greater than residents from Wailea informal settlement, as well as to the Vatuwaqa formal neighborhood. A professed rationale for this is due to the fact that, only one household from all the households interviewed in Veidogo owns an automobile which is older and inefficient in fuel consumption. This subsequently raises the inefficiency of transportation score of Veidogo informal neighborhood. On the other hand, Vatuwaqa formal neighborhood, and Wailea informal settlement have many households owning automobiles with varying fuel efficiencies. Attributing to the household consumption is greater expenditure on material goods and clothing in Wailea informal settlement and Vatuwaqa formal neighborhood, which outweighs the scores for Veidogo informal settlement. According to the gathered data there is no doubt that Veidogo is the poorer informal settlement in comparison to Wailea, which also becomes evident through its low scores of resource consumption at community level.

Energy efficiency is a critical issue for the society and country as a whole (Jorgenson et al, 2010). Energy consumption in the case study area is determined through dependence on electricity. Wailea and Vatuwaqa show considerable inefficiency in energy use; of the two, Vatuwaqa formal neighborhood has the highest score for energy use. One probable reason for Vatuwaqa formal neighborhood is that all the households in the sample population have access to electricity and a reasonable number of households have major electrical appliances. In Wailea informal settlement not every household interviewed has access to electricity and those who have own a limited number of electrical appliances. Veidogo informal settlement has the lowest score for energy use. The majority of
households interviewed did not have access to electricity at all. They own fewer electric appliances and also depend on battery operated appliances and solar lighting.

Figure 5.2 Consumption by community (Wailea and Veidogo informal settlements, and Vatuwaqa formal neighborhood).

Figure 5.2 depicts the average consumption score of the three case study area. The greater figures on Y-axis show greater expenditure on a certain category of consumption.

The continuous flow of resources to foster consumption is one of the essential processes occurring in urban areas as cities and its surrounding regions are cores of economic production and growth, as well as social and cultural activities (Wackernagel et al, 1999). Improved living condition and greater income leads to an increased demand for consumer items in Vatuwaqa formal neighborhood. This is also closely connected to wasteful utilization of resources, as the supply of materials for such consumption goods and to operate these goods depends on resources provided by the physical environment. It has to be highlighted that the impact is not necessarily seen in the neighborhood as many items are brought in from outside and the impact on the environment is not necessarily felt locally, but of course also outside produced items generate a footprint although resource use, resource degradation and pollution can remain invisible as they happen elsewhere. The following calculation tries to consider this.
To determine the extent of impact the three communities had on the physical environment, and the globe as a whole, the collected data designed for ecological footprint was analyzed using the formula obtained from Tim Turner’s article (2004)\(^\text{12}\). The formula and calculation is described in greater detail in (Table 5.1).

### Table 5.1 The Calculation for Ecological Footprint Result

<table>
<thead>
<tr>
<th>Ecological Footprint Categories</th>
<th>Veidogo Informal Settlement (Average points)</th>
<th>Wailea Informal Settlement (Average points)</th>
<th>Vatuwaqa Formal Neighborhood (Average points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Use</td>
<td>111</td>
<td>105.4</td>
<td>114.6</td>
</tr>
<tr>
<td>Food Use</td>
<td>322</td>
<td>304.4</td>
<td>303.1</td>
</tr>
<tr>
<td>Transportation Use</td>
<td>105</td>
<td>77.8</td>
<td>129.9</td>
</tr>
<tr>
<td>Energy Use</td>
<td>-31.4</td>
<td>72.6</td>
<td>108.6</td>
</tr>
<tr>
<td>Clothing Use</td>
<td>124.1</td>
<td>204.5</td>
<td>218.3</td>
</tr>
<tr>
<td>Material Goods</td>
<td>36.6</td>
<td>65.8</td>
<td>80</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>666.5</strong></td>
<td><strong>831</strong></td>
<td><strong>954.5</strong></td>
</tr>
<tr>
<td>Average Ecological Footprint (Grand Total/100)</td>
<td>= (6.7) ha</td>
<td>= (8.3) ha</td>
<td>= (9.5) ha</td>
</tr>
<tr>
<td>Acres (x 2.47)</td>
<td>(6.7 \times 2.47) = <strong>16.5 acres</strong></td>
<td>(8.3 \times 2.47) = <strong>20.5 acres</strong></td>
<td>(9.5 \times 2.47) = <strong>23.5 acres</strong></td>
</tr>
</tbody>
</table>

The table above describes the ecological footprint calculation for the three communities, using the average points acquired from the households interviewed. The average points for each category are added up and then computed into “hectares”, and “acres”. The results depict that Vatuwaqa formal neighborhood has the highest footprint, followed by Wailea informal settlement. The result for Veidogo informal settlement is much lower than for the other two communities. As a result of increasing expenditure and consumption, Vatuwaqa formal neighborhood has the greatest average ecological footprint result of 9.5 gha, followed by Wailea informal settlement with an average result of 8.3 gha and Veidogo informal settlement with the lowest result of 6.7 gha. The ‘gha’ is a representative for global hectare, which is

\(^{12}\) Refer to appendix
used as a measurement unit for calculating ecological footprint of human population and their activities.

Figure 5.3 Ecological Footprint Result by the three Communities.

Figure 5.3 shows the average ecological footprint result of the study area as derived from the consumption data in Table 5.1.

5.3. Perception and awareness of environmental degradation in informal settlements and formal neighborhood.

Many of the major cities have witnessed increase in informal settlements, accompanied with inadequate infrastructure and services to sustain the environmental quality; the outcome is poor housing structures, stacked together on overcrowded and deteriorating environments (Jimenez & Velasquez, 1989). Fiji’s informal settlements are experiencing similar trends, and also here these resulting factors are posing adverse environmental problems. The daily survival practices adopted by residents are considered to be the major causes of environment degradation. In the case study area, the swampy, water logged environment, poor constructed housing structures, and dense population generate environmental problems and worsen the adversity of the places. The environmental problems as highlighted by residents are quite common in Fiji’s informal settlements. Both Veidogo informal settlement and Wailea informal settlement are experiencing similar problems; however, the intensity of these problems varies amongst the settlements.
Figure 5.4  Perception and Awareness of environmental changes by the three communities.

Figure 5.4 shows the perception and awareness amongst residents in the study area regarding the adversity of environmental problems. It is clearly evident that Veidogo informal settlement is greatly affected with environmental problems.

The adversity of the problems arising due to environmental changes in the study area does not have a significant effect on residents’ lifestyle, or the intention to leave the area. People choose to continue residing in the area and are aware of the changes happening around them which happen as the result of their own activities. Veidogo informal settlement is exposed to more severe environmental, physical, and social challenges than Wailea informal settlement and Vatuwaqa formal neighborhood. The location (mangrove swamp) and land tenure (freehold land) upsurge the hardships in Veidogo informal settlement. The existence of fragile environment and insecure tenure has resulted in numerous problems affecting the settlement. Vatuwaqa formal neighborhood has considerably lower range of problems, still pollution (land, water, noise) is considered to be of troubling concern, accompanied with development activities occurring in and around the neighborhood that are also seen as challenging. The concerns relating to land and water pollution in the study area is significantly higher in Wailea informal settlement. There have been also cases of concern arising
from development activities. Wailea has noted continuous housing development and infrastructure upgrade in the settlement; however, these developments are beneficial to the settlement, regardless of environmental threats posed by housing encroachment on mangrove swamp. Most residents’ claim that environmental problems prevail as a result of increasing population, and ineffective measures taken to control new migrants.

5.4. Energy Use
Energy sources as cooking fuel is one of the essential necessities in any neighborhood. In Wailea and Veidogo informal settlements, households have different means to access these cooking fuels. According to residents of the three communities, the income level mostly determines the type of cooking fuel used in the households. Most households with adequate income are able to afford more expensive fuels such as gas, whereas households with lower income rely on kerosene and/or firewood, bought or collected from the mangrove swamp in the vicinity. Gas as a cooking fuel is widely used in Vatuwaqa formal neighborhood, where a few residents also use electricity for cooking purposes. Most people with better income prefer to choose gas over kerosene, as gas operated stoves is safer and easier to use than kerosene stove. A very small proportion of residents in Vatuwaqa formal neighborhood use kerosene stoves, and none of the households in the sample population (Vatuwaqa) use firewood. The proximity and abundance of mangroves encompassing Veidogo informal settlement has become the main mean for fueling majority wood stoves in the settlement; however, the unsustainable practices adopted to exploit mangrove forest result in massive deforestation. Kerosene is the widely used cooking fuel in the informal settlements. Almost every household owns portable kerosene stove. Kerosene is found in most of the consumer retail stores nearby at affordable prices regulated by the Commerce Commission, and it is cheaper than gas. Although most households have electricity access, using electricity for cooking is limited. This is also reflected in the fact that not every household owns electrical cooking appliances, and even those who own such appliances use them often on kerosene stove and firewood, to reduce electricity cost.
Figure 5.5  Energy source used for cooking by the three communities.

Figure 5.5 shows the dependence on energy sources for cooking fuel. A clearly evident factor is that electricity supply is not preferred as the cooking source in the informal settlements, although the majority of households use minor electric appliances in daily cooking, for instance: electric rice cooker, water heater, toaster, sandwich maker, and many more.

5.5. Composting, Recycling, Reusing and Household Waste Disposal

Recycle, reuse, and composting are being one of the convenient ways to reduce resource use in many neighborhoods. Both the informal settlements and formal neighborhood have reported a considerable rate in composting waste food, and are reusing paper, and glass. Here Wailea informal settlement shows a more efficient result in reusing than Veidogo informal settlement. Household garbage disposal is not a problem in any way. Few cases of littering have been observed in the informal settlements, particularly vastly in water ways. Daily household waste is either disposed into the bins provided and hazardous wastes are either buried or disposed together with household wastes. None of the residents interviewed pointed out burning wastes, as burning waste is prohibited in the informal settlements; however, in rare cases hazardous materials are burnt in the Vatuwaqa formal neighborhood.
Figure 5.6  Composting and Reusing by the community.
Figure 5.6 shows composting and reusing incidences in the three communities.

Figure 5.7  Household Garbage disposal means in the three communities.
Figure 5.7 shows the different waste disposal method adopted by residents in the three communities. Almost all household garbage is disposed into garbage bins.
5.6. Conclusion

It has been found that Wailea informal settlement and Veidogo informal settlement have quite varying results, whereas Wailea informal settlement and Vatuwaqa formal neighborhood are more similar when the results are concerned. It is unlikely for an informal settlement to have higher consumption pattern compared to formal neighborhoods. This is mainly because different social groups dominate the two different forms of settlement. Informal settlements consist mainly of low income earners with insufficient resources to afford better housing. Wailea informal settlement, however, shows that not all residents of this informal settlement are poverty stricken. Some have a decent income, surely not rich by any standard. All in all, income is the major determinant of consumption patterns, greater income leads to greater expenditure on daily needs and as well as long lasting consumer items. Increasing expenditures result in higher resource consumption and leads to a higher ecological footprint indicator.

The residents of Veidogo informal settlement are the poorest of the three case study communities. Many depend on the physical environment around them for their daily needs, such as food and firewood. Although they have the lowest footprint score, their increasing dependence on the surrounding ecosystem has resulted in severe environmental problems affecting the settlement. Observing the physical environment around the study area, the intensity of environmental problems arising as a result of human activity is great. People’s dependence on natural resources for survival is highest in Veidogo informal settlement and has greater contribution towards localized environmental degradation than the other two communities. The fact that the ecological footprint of the people of Veidogo informal settlement is lowest suggests that Wailea informal settlement and Vatuwaqa formal neighborhood that has similarly higher footprints cause greater environmental impacts elsewhere, but not necessarily in the immediate vicinity.
6.1. Conclusion

The changing rural to urban residential prototypes have led to widespread emergence of informal settlements, exerting pressure on housing, land, and basic urban services (Naidu & Matadradra, 2014). This continuous drift of rural population into urban areas is attributed to numerous pull and push factors. At present in Fiji, most informal settlements are found to be built on fragile environments. Households in these informal settlements (as in the case study settlements) are heavily dependent on the physical environment around them for daily lifestyle. In most cases, the environment is degrading due to continuous unsustainable practices. These practices are reflected through cutting down mangroves for firewood, removal of mangrove forest for land reclamation to accommodate housing, and disposing off of household wastes. During the survey, most interviewees from both informal settlements and the formal neighborhood revealed increasing concern about environmental exploitation; however, not every household felt empathy for the environment and its resources. To the majority, environment is the mean of survival, and exploitation is unlimited, irrespective to the damage done. There is a need for better environmental awareness. The Government and society can do much more to promote sustainability in the use of environmental resources, and impacting the environment in a positive way.

The study on consumption patterns and environmental awareness provides a comprehensive case study of three communities, two informal settlements and a formal neighborhood. The study in particular consisted of two parts; the first part discusses household consumption, through assessing household food use, water use, transportation use, energy use, clothing use, and material goods use, using an ecological footprint analysis methodology. The second part discusses the environmental challenges as perceived by residents of the three communities and their environmental awareness. The study discovered that consumption pattern differs between all three case study communities. There are numerous factors contributing to the difference in consumption pattern. Income is the most vital contributory factor. Higher income denotes greater expenditure on household consumption needs. High income is determined from the type of employment residents are engaged in. An improved living standard in Vatuwaqa formal neighborhood in comparison to the informal settlements depicts higher income in
the formal dwellings. More people having advanced education (tertiary) attainment in Vatuwaqa formal neighborhood is an indicator of a greater number of people engaged in well-paid and permanent jobs. Most residents in Veidogo and Wailea informal settlements are part of the formal employment sector; however, on average the informal settlements have lower living standards, with the majority of people being part of medium to lower paid employment.

Availability and access to basic services and facilities also determine changes in the daily lifestyle and consumption needs of people living in informal settlements and formal neighborhood. Access to electricity in Vatuwaqa formal neighborhood has resulted in households having possession of major electrical appliances and household assets, while limited electricity access in the informal settlements where very few households own major electrical appliances, and some households own no electrical appliances at all. The study shows most households in Wailea informal settlement have greater possession of household assets, including electrical appliances than households in Veidogo informal settlement. The ease of access to electricity, water, and transportation to each household is another important factor contributing to the households’ living standards. The declining access to the basic services in Veidogo informal settlement has led the majority of households to share water and electricity with neighbors, resulting in limited usage of these services in most cases, as well as limited possession of electrical appliances.

The location of the informal settlements plays an important role in determining the extent of environmental problems, as aggravated by the residents and changes occurring to the surrounding environment. The increasing dependence of Veidogo informal settlement residents on to the mangrove swamp for firewood as cooking fuel has led to clearing of majority trees in the swamp. This in return is resulting in increased frequency of flooding during high tides, increasing the vulnerability of the households to environmental problems. Both Veidogo and Wailea informal settlements sit on a significant mangrove swamp, therefore, swampy condition is still evident in the settlement, and is worsened during heavy downpours. Being built in the heart of a mangrove swamp, Veidogo informal settlement is exposed to numerous environmental problems. Flooding, water pollution, deforestation, sewage pollutants, and littering are the prime environmental problems affecting the settlement, and are becoming a hazard to survival. Continuous distress arising from environmental problems affects the settlement
greatly. Wailea informal settlement and Vatuwaqa formal neighborhood are also afflicted by environmental problems; however, Unlike Veidogo informal settlement, Wailea informal settlement and Vatuwaqa formal neighborhood have a lower propensity to environmental problems affecting the residents.

To determine the varying consumption pattern in the community, an ecological footprint survey was used as the main methodology of data collection and processing. For this purpose, the consumption data was divided into categories (food, water, transportation, energy, clothing, and material goods). This made the data collection and data analysis easier. The result derived was comprehensible to provide answers to the research objectives. Application of the ecological footprint methodology into the study proved it worth the effort. As the study was directed towards determining the impact of human dependence on the surrounding environment, it was necessary to measure the type of consumption needs people require to survive. The ecological footprint methodology provided an insight on the consumption factors that can be considered to find the explanation for the research questions and objectives. The study found that not only the privileged households have considerable footprints in urban areas; the urban poor have a proportionately equal contribution towards producing greater ecological footprints. This is determined based on the comparison of the results of the three communities. The result of Wailea informal settlement and Vatuwaqa formal neighborhood are quite similar to each other, while the result for Veidogo informal settlement is significantly different to that of Wailea informal settlement and Vatuwaqa formal neighborhood.

Looking at the living standards, living conditions, land tenure, and population of the three communities it appears unreasonable to compare informal settlements to a formal neighborhood. The case studies were however selected due to the three communities being located next to each other and presumed to have some level of impact on the mangrove ecosystem in the vicinity. At present the location of the case study includes three informal settlements, a formal neighborhood, and a light industry area. For this study, the Vatuwaqa formal neighborhood and two informal settlements, Wailea and Veidogo informal settlements were chosen, as Wailea is the largest informal settlement in the area and Veidogo is the smallest, and both are located in the mangrove swamps, while the Vatuwaqa formal neighborhood is in the midst of these two informal settlements. To make the study more meaningful, the result obtained from the informal settlement (Wailea) with a large population was compared to the informal settlement
(Veidogo) with a smaller population, and to the Vatuwaqa formal neighborhood to track similarity and difference in physical environment exploitation. The study revealed that households in Vatuwaqa formal neighborhood and Wailea informal settlement have greater ecological footprint than Veidogo informal settlement. This is due to unsustainable practices adopted to obtain resources for sustenance. It is found that Veidogo informal settlement residents spending are greatly restricted to basic needs only, while in Wailea informal settlement and Vatuwaqa formal neighborhood expenditure are impartially managed on basic needs and long lasting consumer goods. The uncontrolled expenditure on consumption goods and purchase of non-biodegradable products show that Wailea informal settlement and Vatuwaqa formal neighborhood have greater contribution towards environmental degradation in the long run.

In the study residents were asked about the extent of composting, recycling, and reusing most household materials. It was gratifying to note that most people are aware of the three “R”s (Reduce, Recycle, and Reuse) and are actually taking up the initiative to contribute towards keeping the surrounding clean. It was found that despite having greater footprint, Wailea informal settlement and Vatuwaqa formal neighborhood have higher percentage of people engaged in recycling, reusing, and composting than households in Veidogo informal settlement. Most urban poor in Fiji are unaware about the three “R”s. These groups of people collect: bottles, metals/iron, newspapers, and aluminum cans, which are recycled to make a new product. If all communities choose to engage in and support the program, then we can expect a cleaner and healthy environment. The Government and the municipality can take the three “R”s program from a state level to community level and enlighten people on the importance of the program towards promoting a healthy environment.

6.2. Recommendations

These recommendations are decided upon by the researcher, based on the data collection (observations, field survey) and archival research.

1. Natural environment protection

Most informal settlements are found on fragile environments, particularly mangrove ecosystems. Informal settlements in Suva which are located in and near mangrove swamps are: Wailea, Veidogo, Nanuku, Maravu, and Muanivatu settlements. Continuous reclamation of swamps to accommodate for new migrants threatens the
survival of the mangrove ecosystem and increases adversity of environmental problems (flooding, water pollution) prevalent in these informal settlements. The Government should intervene to control the growth and emergence of settlements on mangrove swamps. Under the Fiji Endangered Species Act 2002, section 3 (part 8), mangroves (*dogo*) are classified as a flora species in danger of extinction (Parliament of the Fiji Islands, 2002). The Government should reconsider the importance of this Act and implement penalties for breaching the law. The public, particularly the informal settlement dwellers should be made aware of these regulations. The Government should act as a mediator to manage issues arising from development occurring on mangrove ecosystem.

### 2. Revive “Residential D” zoning Act

The Government should reconstruct the Acts pertaining to land development in Fiji, especially the Zoning Act, and reintroduce policies highlighting the requirements for obtaining land, subdivision, transfer of land titles, and change of land use. Strict penalties should be introduced at all levels of transgression or breach. If possible, the Government can implement a new Act or a set of regulation for “Residential D” zoning. Under this act, policies should be directed towards informal settlements, stressing the criteria to obtain a place in the informal settlements\(^{13}\), the activities permitted and prohibited in the informal settlements, and the type of housing permitted (building materials). The Government should appoint a separate authoritative body\(^{14}\) to look into the matters pertaining to informal settlements.

### 3. Upgrade planning regulations

Urbanization and its correlation with growing population have increased demand for affordable housing in Fiji (Hassan, 2007). The Government is trying its best to cater for the growing demand; however, limited opportunities in the rural areas continue to push people out of farms into urban setting, outweighing the Government planning capacity. The costs and benefits associated with movement to urban areas is not always the same to all families and individuals (Thomas-Hope, 2011). Most migrants manage to afford housing and survive in an extortionate environment; however, those with

---

\(^{13}\) The Government provides a place for the disadvantaged (people who have lost property in fire, flood, or other natural calamity) and the very poor that send requests through the Prime Minister’s Office. A temporary place is provided in informal settlements on State Land (Personal Communication with the Senior Statistician, Department of Housing, Ministry of Local Government, Housing, Environment, Infrastructure & Transport, 2015).

\(^{14}\) At present the Department of Housing is responsible for management of informal settlements, apart from other housing matters on state land in Fiji.
lower income find informal settlements the only hope for sustenance in the urban context. According to Bryant-Tokalau (1995) “a significant gap exists between the poorer and middle classes, apparent in declining access to decent housing and services for the poor”. Provisioning for affordable housing, within the financial scope of the poor can help in increasing the hope among the poor to own a decent house, and at the same time reduce the number of new migrants into informal settlements.

According to Connell (2003) Fiji is the only country in the Pacific having policies directed towards improving the living standards in informal settlements. This sheds light of hope to the informal settlement residents; however, Government can take advantage of these policies and add clauses pertaining to adequate maintenance of the settlement and surrounding environment. In this way, the state can take control over the incoming migrants and limit the number of households existing in the settlement. For better management, every settlement should have an appointed committee responsible for internal matters, reporting to the Government on regular basis\(^{15}\), and a separate Governmental unit to be created, which would solely look into the matters relating to informal settlements in Fiji.

There are several upgrading projects on informal settlements in Fiji, and this are directed towards provisioning for improved basic services, and housing. There are over 120 informal settlements in Fiji administered by only one body, the Department of Housing; planning and provisioning for upgrading is often time consuming and a tentatively slow process. The latest statistical data collected for Wailea informal settlement was in 2005, since then there has been no formal visit to the settlement by the officials. To finalize the provisions for upgrading the Government has to work with the updated data. This signifies another timely data collection to match up with current issues critical to the residents. Thus to speed up the process, There is a need for consistent and routine visits to the informal settlements and data collection on the changing living standards (Bryant-Tokalau, 1995). The data collected can be used in identifying matters that need more attention to improving the living standards of the informal settlement residents. This can be premeditated through investigating on the access and availability of amenities to the residents, mapping out the number of settlements in need for a particular service and what alternatives residents use to get those services.

\(^{15}\) Most informal settlements in Fiji have a committee, which appoints a member (usually Pastor) to collaborate with the Government on major issues. Both the case study informal settlements have committee.
6.3. Future research

Ecological footprint tool has proved its worth in many ways; an insightful technique is measuring consumption and waste levels (Conway et al, 2008). The ecological footprint is quite uncommon to most areas of research in Fiji, using this tool to measure sustainability at a state level would help to resolve many unanswered questions directed to mismanagement of natural resources and physical environment. The analysis has its own challenges as it is never possible to fully conceptualize all possible areas of consumption and to totally map reality and record all relevant information without gaps. Still comparative studies make it easier to relatively make statements about resource use in varying locations. For the present study the ecological footprint tool helped in data collection and analysis for a small sample. A more comprehensive study could be carried out on different aspects of consumption, with greater emphasis on energy (carbon footprint), or water footprint, and health footprint. Apart from consumption future research can also be directed towards investigating on the health of the informal settlement residents, type of housing, and Government’s role in managing informal settlements and planning processes involved.

From a conceptual perspective more research on mobility and migration in the time of climate change could enrich our understanding of urban informal settlements. Often the assumption is that environment or climate related mobility is to bring people from dangerous areas to safe places (McAdam 2015). The situation of squatter settlements in Suva (and probably in many other urban areas in the developing world) however suggests differently: here people move to places that are obviously inferior, or even dangerous from an environmental point of view. Many of Suva’s informal settlements are prone to frequent flooding, insufficient drainage and challenges to solid and liquid waste management. All these add to health and other risks the people living in such settlements are exposed to. Here it seems that migrants choose such places because they provide security: security from being evicted as nobody else is interested to use these places because of their environmental inferiority, because they are dangerous (or in economic terms) costly places to settle. It seems that one form of risk (environmental risk) in traded in for another form (risk to be evicted). It is unclear how conscious such decisions are made; are they a clear reflection, calculating the risks involved, or just based on trial and error. In rapidly expanding urban areas it is also very likely that places that are unwanted by others today will be used tomorrow when urban space becomes even scarcer. Then the people in informal settlements have rather low bargaining power and have to move.


Bala, B., & Hossain, M. (2010). Food security and ecological footprint of coastal zone of Bangladesh. Environment, Development and Sustainability, 12, 531-545.


Food and Agriculture Organization of the United Nations. (2005). Global forest resources assessment 2005, thematic study on mangroves Fiji, Country Profile. Italy Forestry Department, FAO.


Glossary

**Basic (urban) services** – facilities provided by the municipality to the public, including water, electricity, street lights, garbage collection.

**Basic need** - resources which are considered essential for survival, including food, water, clothing, and shelter.

**Consumer goods (Long lasting)** - goods purchased to satisfy human wants through their use, including durable and non-durable goods.

**Consumption pattern** – a livelihood aspect, whereby certain amounts of goods and services are considered by households as essential for fulfilling their needs.

**Ecological footprint methodology** – method of data collection using components as that of an ecological footprint survey, for instance: water, transportation, food, clothing, energy, and material goods.

**Environmental awareness** – being aware about and subsequent enthusiasm to protect natural resources and physical environment.

**Environmental sustainability** - maintaining the features that are valued in the physical environment.

**Fragile environment** - natural environments sensitive to anthropogenic changes and should be protected from further harm.

**Household** - family unit

**Household assets** – ownership of major indoor merchandise, for instance refrigerator, television, furniture, fixtures.

**Sevusevu** – traditional Fijian ceremonial way of presenting kava as a sign of respect; for instance during a Vakavanua agreement.

**Tiri/dogo** – Fijian word for mangroves

**Urban poor** – urban residents who are identified as socio-economically vulnerable, or those with preferably lower income to sustain livelihood in an urban context.

**Vakavanua** – agreement system to borrow land from land owners.
Appendix

Appendix A - Fieldwork Questionnaire

Topic: Comparison of consumption patterns and environmental awareness in formal and informal communities in Suva, Fiji

Informal Settlements: Wailea, and Veidogo

Formal Neighborhood: Vatuwaqa

General Information

No: _____ Settlement Name: ____________________________ Date: _________________________

1. Background Information
   a. Household number: ________________
   b. For how many years have you been residing at this place?
      ________________________________________________________________
   c. What led you to move into this settlement?
      □ Employment □ education □ loss of land □ other:
      ________________________________________________________________
   d. Who owns this land?
      ________________________________________________________________
   e. Do you pay rent for staying here? □ Yes □ No
   d. Are you planning to move from here? □ Yes □ No
   e. Why are some houses numbered?
      ________________________________________________________________
   f. What material is your house made of?
      □ Modern concrete
      □ Wooden with partial concrete
      □ Wooden
      □ Corrugated iron
      □ Palm thatch
      □ Wooden/corrugated iron
      □ Others
      (Specify)________________________________________________________
Ecological Footprint

Water use
1. How long do you shower on a typical day?
   a.) No shower 0
   b.) 1-2 minutes 50
   c.) 3-6 minutes 70
   d.) More than 10 minutes 90

2. How often you flush toilet?
   a.) Every time you use 40
   b.) Sometimes 20

3. When brushing teeth, do you let the water run?
   a.) Yes 40
   b.) No 0

4. Do you use water-saving toilets?
   (6-9 litres flush)
   a.) Yes 20
   b.) No 40

Food
5. On a typical day, what do you mostly eat?
   a.) Beef /portions 150
   b.) Chicken/ portions 100
   c.) Farmed fish/portion 80
   d.) Wild fish/portion 40
   e.) Eggs/portion 40
   f.) Milk/dairy 40
   g.) Vegetables 20
   h.) Grains: bread, cereal, rice 20

6. How much of your food is locally grown?
   a.) All 0
   b.) Some 30
   c.) None 60

7. How much of food is organic?
   a.) All 0
   b.) Some 30
   c.) None 60

8. Do you compost fruit/vegetable scraps and peels?
   a.) Yes 20
   b.) No 40

9. How much of your food is processed?
   a.) All 100
   b.) Some 30
   c.) None 0

10. How much of your food has packaging?

11. On a typical day, how much of your food you waste?
    a.) None 0
    b.) ¼ of the food 100
    c.) One-third of the food 150
    d.) ½ of the food 200

Transportation
12. How you travel to school/work?
    a.) Foot 0
    b.) Bike 5
    c.) Public transit 30
    d.) Private vehicle 200

13. What is your vehicles fuel efficiency?
    (Litres/kilometer)/
    (gallons/60miles)
    a.) Less than 6 litres/ 2 gallons -50
    b.) 6-9 litres/2-2 ½ gallons  50
    c.) 10-13 litres/3-3 ½ gallons 100
    d.) More than 13 litres 200

14. How much time do you spend in vehicles on a typical day?
    a.) No time 0
    b.) Less than ½ a hour 40
    c.) ½ hour to 1 hour 60
    d.) More than 1 hour 100

15. How many cars do you have in your driveway?
    a.) No car 20
    b.) 1 car 50
    c.) 2 cars 100
    d.) more than 2 cars 200

Energy
16. Do you dry clothes outdoors or on an indoor rack?
    a.) Always 50
    b.) Sometimes 20
    c.) Never 60

17. Do you have a refrigerator?
    a.) Yes 50
    b.) No 50

18. Does your house have electricity?
19. Do you turn off lights, computer, and television when not in use?
   a.) Yes 50
   b.) No 50

20. What do you use to cool off?
   a.) Air conditioning: car/home 30
   b.) Electric fan -10
   c.) Nothing -50

21. How many hours a day you spend outdoors?
   a.) 7 hours 0
   b.) 4-6 hours 10
   c.) 2-3 hours 20
   d.) 2 hours or less 100

22. Do you change your outfit every day and put it in the laundry? 80

23. Do you wear clothes that have been mended or fixed? -20

24. Is ¾ of your clothes handmade or secondhand? -20

25. Are most of your clothes purchased new each year? 120

26. Do you give away clothes that you no longer wear?
   a.) Yes 0
   b.) No 100

27. What percentage of your clothes in the wardrobe you never wear?
   a.) Less than 25% 25
   b.) 50% 50
   c.) 75% 75
   d.) 75%+ 100

28. How many pairs of shoes have you got?
   a.) 2-3 20
   b.) 4-6 60
   c.) 7+ 90

29. All of your garbage from today could fit into a:
   a.) Shoebox 20
   b.) Large pail 60
   c.) Garbage can 200
   d.) No garbage created today -50

30. Do you reuse items rather than throw them out? -20

31. Do you repair items and use it rather than throw it out? -20

32. Do you recycle all your paper, cans, glasses, and plastic? -20

33. Do you avoid buying disposable items as often as possible?
   a.) Yes 10
   b.) No 60

34. Do you use rechargeable batteries whenever you can?-30

35. On a typical day, do you use TV or computer?
   a.) Not at all 0
   b.) Less than 1 hour 50
   c.) More than 1 hour 80

36. How many pairs of shoes have you got?
**Environment degradation**

1. **Perception and awareness**
This part of the questionnaire focuses on the changes to the natural environment in the recent years. Please provide information how you perceive such changes. Please give a rating for each of the challenges between -2 to 2. Tick in the boxes.

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Very low</th>
<th>Low</th>
<th>None</th>
<th>High</th>
<th>Very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>development</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land pollution (littering)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequent flooding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water pollution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sewage pollutants from pits and toilets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deforestation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid waste from the factories</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid waste from the factories</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overpopulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poverty</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to clean water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil erosion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnic tension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor sanitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise pollution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. **Basic information relating to environment degradation.**
   i.) **What form of energy do you use for cooking** (Gas/electrical appliances/firewood/others____)
   ii.) **Why do you use this energy form?**

________________________________________________________________________________________

________________________________________________________________________________________

   iii.) Please estimate how much energy your household consumes monthly.

<table>
<thead>
<tr>
<th>Energy source</th>
<th>Quantity consumed</th>
<th>Approximate cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>KWH</td>
<td></td>
</tr>
<tr>
<td>Petrol</td>
<td>Litres</td>
<td></td>
</tr>
<tr>
<td>Wood</td>
<td>bundles</td>
<td></td>
</tr>
<tr>
<td>Others (specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
iv.) What is the main source of drinking water for the household?

v.)

| Water piped directly into the house/yard |
| Public standpipe                           |
| Rivers/lake/spring                         |
| Wells                                      |
| Rainwater collected and stored in drums/tanks |

vi.) If the main source is “public standpipe”, approximately how far from this dwelling is the source?

vii.) How would you rate the quality of the drinking water?

| Excellent |
| Good      |
| Fair      |
| Not very good |
| poor      |

viii.) If you are metered, what is your 3 monthly water consumption?

_______________________________________________________________________________________

_______________________________________________________________________________________

Please indicate what types of waste you compost or recycle and how much of the time you do so.

<table>
<thead>
<tr>
<th>Items</th>
<th>Never</th>
<th>25% of the time</th>
<th>50% of the time</th>
<th>75% of the time</th>
<th>All the time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food waste</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yard waste</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed paper</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aluminum cans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ix.) How do you dispose of hazardous materials (batteries, paint, solvents, home and garden chemicals, fluorescent tubes and bulbs) at your home?

_______________________________________________________________________________________

_______________________________________________________________________________________

_______________________________________________________________________________________

THANK YOU
Appendix B - The Original Questionnaire
Below is the questionnaire from Tim Turner’s (2004) article “How big is my Ecological Footprint”

### Personal Eco-Footprint Calculator

Procedure: Complete each of the charts for a typical day in your home community. Add the points on each chart to obtain a subtotal for that category, and transfer it to the summary chart. Use the grand total to calculate your ecological footprint.

<table>
<thead>
<tr>
<th>Water Use</th>
<th>My Score</th>
<th>Transportation</th>
<th>My Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. My shower (or bath) on a typical day is:</td>
<td></td>
<td>1. On a typical day, I travel by:</td>
<td></td>
</tr>
<tr>
<td>No shower / no bath (0)</td>
<td></td>
<td>Public transit (30 per use)</td>
<td></td>
</tr>
<tr>
<td>1–2 minutes long / one-fourth full tub (50)</td>
<td></td>
<td>Private vehicle (200 per use)</td>
<td></td>
</tr>
<tr>
<td>3–6 minutes long / half full tub (70)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 or more minutes long / full tub (90)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I flush the toilet:</td>
<td></td>
<td>2. Our vehicle’s fuel efficiency is ___ liters/100 kilometers (gallons/60 miles).</td>
<td></td>
</tr>
<tr>
<td>Every time I use it (40)</td>
<td></td>
<td>less than 6 liters / 2 gallons (-50)</td>
<td></td>
</tr>
<tr>
<td>Sometimes (20)</td>
<td></td>
<td>6–9 liters / 2–2½ gallons (50)</td>
<td></td>
</tr>
<tr>
<td>3. When I brush my teeth, I let the water run. (40)</td>
<td></td>
<td>10–13 liters / 3–3½ gallons (100)</td>
<td></td>
</tr>
<tr>
<td>4. I washed the car or watered the lawn today. (80)</td>
<td></td>
<td>More than 13 liters / 3½ gallons (200)</td>
<td></td>
</tr>
<tr>
<td>5. We use water-saving toilets (6–9 liters/flush). (-20)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. We use low-flow showerheads (-20)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I use a dishwasher on a typical day. (50)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Subtotal:**

<table>
<thead>
<tr>
<th>Food</th>
<th>My Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. On a typical day, I eat:</td>
<td></td>
</tr>
<tr>
<td>Beef (150/portion)</td>
<td></td>
</tr>
<tr>
<td>Chicken (100/portion)</td>
<td></td>
</tr>
<tr>
<td>Farmed fish (80/portion)</td>
<td></td>
</tr>
<tr>
<td>Wild fish (60/portion)</td>
<td></td>
</tr>
<tr>
<td>Eggs (40/portion)</td>
<td></td>
</tr>
<tr>
<td>Milk/dairy (40/portion)</td>
<td></td>
</tr>
<tr>
<td>Fruit (20/portion)</td>
<td></td>
</tr>
<tr>
<td>Vegetables (20/portion)</td>
<td></td>
</tr>
<tr>
<td>Grains: bread, cereal, rice (20/portion)</td>
<td></td>
</tr>
<tr>
<td>2. ____ of my food is grown locally.</td>
<td></td>
</tr>
<tr>
<td>All (0)</td>
<td></td>
</tr>
<tr>
<td>Some (30)</td>
<td></td>
</tr>
<tr>
<td>None (60)</td>
<td></td>
</tr>
<tr>
<td>3. ____ of my food is organic.</td>
<td></td>
</tr>
<tr>
<td>All (0)</td>
<td></td>
</tr>
<tr>
<td>Some (50)</td>
<td></td>
</tr>
<tr>
<td>None (60)</td>
<td></td>
</tr>
<tr>
<td>4. I compost my fruit/vegetable scraps and peels.</td>
<td></td>
</tr>
<tr>
<td>Yes (-20)</td>
<td></td>
</tr>
<tr>
<td>No (60)</td>
<td></td>
</tr>
<tr>
<td>5. ____ of my food is processed.</td>
<td></td>
</tr>
<tr>
<td>All (100)</td>
<td></td>
</tr>
<tr>
<td>Some (50)</td>
<td></td>
</tr>
<tr>
<td>None (0)</td>
<td></td>
</tr>
<tr>
<td>6. ____ of my food has packaging.</td>
<td></td>
</tr>
<tr>
<td>All (100)</td>
<td></td>
</tr>
<tr>
<td>Some (50)</td>
<td></td>
</tr>
<tr>
<td>None (0)</td>
<td></td>
</tr>
<tr>
<td>7. On a typical day, I waste:</td>
<td></td>
</tr>
<tr>
<td>None of my food (0)</td>
<td></td>
</tr>
<tr>
<td>One-fourth of my food (100)</td>
<td></td>
</tr>
<tr>
<td>One-third of my food (150)</td>
<td></td>
</tr>
<tr>
<td>Half of my food (200)</td>
<td></td>
</tr>
</tbody>
</table>

**Subtotal:**

<table>
<thead>
<tr>
<th>Shelter</th>
<th>My Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Number of rooms per person (divide number of rooms by number of people living at home)</td>
<td></td>
</tr>
<tr>
<td>Fewer than 2 rooms per person (10)</td>
<td></td>
</tr>
<tr>
<td>2 to 3 rooms per person (80)</td>
<td></td>
</tr>
<tr>
<td>4 to 6 rooms per person (140)</td>
<td></td>
</tr>
<tr>
<td>7 or more rooms per person (200)</td>
<td></td>
</tr>
<tr>
<td>2. We share our home with nonfamily members. (-50)</td>
<td></td>
</tr>
<tr>
<td>3. We own a second, or vacation home that is often empty.</td>
<td></td>
</tr>
<tr>
<td>No (0)</td>
<td></td>
</tr>
<tr>
<td>We own/use it with others. (200)</td>
<td></td>
</tr>
<tr>
<td>Yes (400)</td>
<td></td>
</tr>
</tbody>
</table>

**Subtotal:**

Page 1
<table>
<thead>
<tr>
<th><strong>Personal Eco-Footprint Calculator</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Use</strong></td>
</tr>
<tr>
<td>1. In cold months, our house temperature is:</td>
</tr>
<tr>
<td>Under 15°C (59°F) (-20)</td>
</tr>
<tr>
<td>15 to 18°C (59 to 64°F) (50)</td>
</tr>
<tr>
<td>19 to 22°C (66 to 71°F) (100)</td>
</tr>
<tr>
<td>22°C (71°F) or more (150)</td>
</tr>
<tr>
<td>2. We dry clothes outdoors or on an indoor rack.</td>
</tr>
<tr>
<td>Always (-50)</td>
</tr>
<tr>
<td>Sometimes (20)</td>
</tr>
<tr>
<td>Never (60)</td>
</tr>
<tr>
<td>3. We use an energy-efficient refrigerator.</td>
</tr>
<tr>
<td>Yes (-50)</td>
</tr>
<tr>
<td>No (50)</td>
</tr>
<tr>
<td>4. We use compact fluorescent light bulbs.</td>
</tr>
<tr>
<td>Yes (-50)</td>
</tr>
<tr>
<td>No (50)</td>
</tr>
<tr>
<td>5. I turn off lights, computer, and television when they're not in use.</td>
</tr>
<tr>
<td>Yes (0)</td>
</tr>
<tr>
<td>No (50)</td>
</tr>
<tr>
<td>6. To cool off, I use:</td>
</tr>
<tr>
<td>Air conditioning: car / home (30 for each)</td>
</tr>
<tr>
<td>Electric fan (-10)</td>
</tr>
<tr>
<td>Nothing (-50)</td>
</tr>
<tr>
<td>7. Outdoors today, I spent:</td>
</tr>
<tr>
<td>7 hours (0)</td>
</tr>
<tr>
<td>4 to 6 hours (10)</td>
</tr>
<tr>
<td>2 to 3 hours (20)</td>
</tr>
<tr>
<td>2 hours or less (100)</td>
</tr>
<tr>
<td><strong>Clothing</strong></td>
</tr>
<tr>
<td>1. I change my outfit every day and put it in the laundry. (80)</td>
</tr>
<tr>
<td>2. I am wearing clothes that have been mended or fixed (-20)</td>
</tr>
<tr>
<td>3. One-fourth of my clothes are handmade or secondhand. (-20)</td>
</tr>
<tr>
<td>4. Most of my clothes are purchased new each year. (120)</td>
</tr>
<tr>
<td>5. I give the local thrift store clothes that I no longer wear.</td>
</tr>
<tr>
<td>Yes (0)</td>
</tr>
<tr>
<td>No (100)</td>
</tr>
<tr>
<td>6. I buy hemp instead of cotton shirts when I can. (-10)</td>
</tr>
<tr>
<td>7. I never wear ___% of the clothes in my cupboard.</td>
</tr>
<tr>
<td>Less than 25% (25)</td>
</tr>
<tr>
<td>50% (50)</td>
</tr>
<tr>
<td>75% (75)</td>
</tr>
<tr>
<td>More than 75% (100)</td>
</tr>
<tr>
<td>8. I have ___ pairs of shoes.</td>
</tr>
<tr>
<td>2 to 3 (20)</td>
</tr>
<tr>
<td>4 to 6 (60)</td>
</tr>
<tr>
<td>7 or more (90)</td>
</tr>
</tbody>
</table>