The Ecological Footprint of Wellingtonians in the 1950s

By

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Preface

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Abstract

Population and economic growth lead to increased demand for resources; these resources rely on land or water, which are both finite resources on Earth. Globally humanity is currently operating at an unsustainable level, demanding more land than available. One method used to measure this is ecological footprinting. The World Wildlife Fund (WWF) regularly estimates the ecological footprints of most countries, from this information it is estimated that New Zealand is using less productive land than is available and therefore is in ecological deficit. Research has been conducted by the Ministry for the Environment, to calculate the ecological footprints for New Zealand and its regions. However, no research has been conducted for Wellington city.

The research of this thesis therefore uses current methodologies to estimate the ecological footprint of Wellingtonians in 1956 and 2006. In conjunction with this, research was also conducted to understand the lifestyles and quality of life during the 1950s and today. This is used to form comparisons between the ecological footprints that are 50 years apart. The ecological footprints and the relevant quality of life and lifestyles are also compared to indicate any relationships that may exist between these factors. Finally the research looked at the possible effects on the current lifestyle and quality of life of Wellingtonians from reducing the relevant parts of the ecological footprint. To achieve this three methods were used, firstly calculations based on the ecological footprint methodology developed by Wackernagel and Rees, and two surveys which consisted of a questionnaire and then focus group discussions, completed by residents of Wellington who lived in the city during the 1950s.

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List of Definitions

Biocapacity	area of physical land available per person for the population studied, determined by dividing the area of productive physical land available in the area analysed by the population
Carrying capacity	the number of individuals whose resource consumption can be sustained within a given area of land
Ecological footprint	area of land required per person to produce and sustain the resources consumed by a population per year
Fair earth share	the amount of land available to each person in the world, if all ecologically productive land on earth was evenly divided among the world population
Focus group	group of people, with common characteristics, who participate in a group discussion involving the sharing of information and opinions
Global hectares	area of land measured by the ecological footprint accounting for local productivity of land so the footprint can be compared globally
Sustainable	item capable of being maintained at a constant level or use without using up natural resources or causing ecological damage
Wellington City	as defined by the Wellington City Council, including Wellington CBD, surrounding suburbs, Johnsonville and Tawa
Wellington Region	as defined by the Wellington Regional Council, including Wellington City north to Otaki
Wellingtonian	a person or resident living in Wellington City

1. Introduction

This chapter provides an overview of the research undertaken to answer the question *'What was the ecological footprint of Wellingtonians in the 1950s and the associated lifestyle'*. The purpose of the research is discussed, explaining the research significance and the potential addition to knowledge; this is followed by the aim of the study. Next is a discussion on the scope of the thesis, outlining why the research was limited to Wellington City and reasons for selecting the 1950s. Lastly, an outline is given of the chapters of the thesis.

1.1 Overview of the study

Globally people are becoming more aware of the affects humanity is having on the earth, as new research is undertaken and new information published (for example the WWF Living Planet Reports published every two years). This public awareness was apparent by 1972, when 'Limits to growth' was published by Meadows et al. followed by the Brundtland report, 'Our common future' in 1987. These reports discussed, for the first time in detail, the consequences of humanity's consumption of natural resources, and the predicted period within which this could be sustained before resources were depleted or exhausted. These publications highlighted issues caused by the lifestyle of people and used current trends to predict what could happen in the near future. An astonishing number of the predictions for global population, consumption, production and pollution have become reality today, with some levels surpassing what was predicted to happen. Turner compares the publication of 'Limits to Growth' from 1972 with 30 years of reality, highlighting predictions that have became reality and factors that are now worse than in earlier predictions (Turner, 2008). One of the issues today, is that humanity has surpassed the carrying capacity of the earth. Carrying capacity is the maximum level possible in terms of population, consumption, production and use of resources that can be borne by a certain area of productive land. Human population, as one factor, is continuing to grow. The United Nations predicts it will reach a maximum world population of 9.2 billion people in 2075, declining to 8.3 billion in 2175 and eventually stabilising at 9 billion in 2300 (United Nations, 2004, pg 2). With this continued population growth researchers are now working to change lifestyles and consumption, in an attempt to lower the effects humanity is having on the earth, and in turn create more sustainable lifestyles. A common method used to measure the effect people have on the earth is ecological footprinting. This method determines the amount of productive land (and sea) needed to sustain the lifestyle of people in a country or city (For example the Cardiff and Alberta ecological footprint studies, discussed in Section 2.4).

This thesis focuses primarily on Wellington, New Zealand with some reference made to New Zealand as a whole. Research shows that New Zealand has a relatively high ecological footprint in comparison to other developed countries (WWF, 2010). Some research has been conducted by the Ministry for the Environment into the Wellington region's ecological footprint, concluding that in order to sustain the consumption of the residents of the Wellington region; land from outside the region is required because the region is in ecological overshoot (MFE, 2003, Section 12). It is not clear when New Zealanders in Wellington were last operating sustainably as a city.

This leads to the significance of this research. From the literature review it became evident that there is no published information regarding the ecological footprint of Wellingtonians living in Wellington city, and very little information or understanding as to when the city was last operating at a sustainable level. These matters are important at both government and public levels in order to propose changes that must be made to daily lives to alter the ecological footprint of the city. The selection of two years, 50 years apart, allows for comparisons to be made between the ecological footprints, lifestyles and consumption changes.

1.2 Aim

The aim of this report is to calculate the ecological footprint and describe the corresponding lifestyle of Wellingtonians in the 1950s. This will be compared with the current ecological footprint and lifestyle of people living in Wellington, estimated using the same methodology as the 1950s ecological footprint. Another important aspect is the extent to which life in 1950s Wellington was acceptable. If the current ecological footprint of Wellingtonians is to be altered to a more sustainable level, lifestyle adjustments and changes must be made. The aim of this research is to understand what life was like in a time when ecological footprint is anticipated to be lower (this will be established later through calculation, Section 4.6) and whether it was perceived to be acceptable. This is significant because it may be possible to establish a relationship between how acceptable life is and the ecological footprint of Wellingtonians in the 1950s and at present. The outcomes will establish whether it is possible to reduce the current ecological footprint, while still maintaining an acceptable lifestyle for Wellingtonians. The data relating to the ecological footprint will be used to determine whether and how the current ecological footprint can be altered or reduced to a sustainable level.

1.3 Scope

The scope of this research primarily focuses on Wellington city, with some comparisons made with New Zealand and global data. Information and data were gathered relating to Wellington in the 1950s, specifically the year 1956. This is because for the first time New Zealanders were living what was considered a modern lifestyle, as will be discussed further in Section 2.6. Only Wellington city was chosen for this study to limit the scope of the research, and focus on an area that is primarily urban. This enables the study to draw conclusions for this area with the potential to develop and further apply the methodology to other cities within New Zealand.

1.4 Research Approach

To achieve the aim of the study *Chapter 2 - Literature review*, discusses published information on ecological footprint analyses and other information related to this assessment method. The majority of the information dates from the 1970s, when researchers started to focus more on the effects humanity was having on the earth, outlining how consumption and production were not sustainable in the long term. This chapter is divided into three parts.

> *Part 1* discusses published information related to the ecological footprint, briefly discussing its definition, the origins of the methodology, and how ecological footprints are calculated. In addition, past calculated examples for countries and cities are examined with a focus on the methodologies and results.
>
> *Part 2* focuses on the study area, presenting information for both New Zealand and Wellington. This part explains the reasons for selecting the 1950s, briefly discusses New Zealand in the past and present, and defines the area of Wellington city.
>
> *Part 3* discusses one of the survey methods used to obtain information from people who lived in Wellington in the 1950s. It defines focus groups and the details of focus group discussions.

Chapter 3 – Research Methodology, explains the methodology used. This chapter also presents the hypothesis leading to the research question. It discusses the elements used for ecological footprint analyses, explaining further how the ecological footprint was calculated for Wellingtonians in the 1950s.

This chapter also discusses the two footprinting methodologies used; the original pioneered by Wackernagel and Rees in 1996 and a methodology adapted for New Zealand by Kathryn Bicknell. Lastly, this chapter explains the relevance of focus groups for this research.

Chapter 4 – Results, presents and discusses the results from all the research; published information relating to Wellington during the 1950s; the ecological footprint assessments; and outcomes from questionnaire and focus group discussions. This chapter is divided into four parts.

> *Part 1* discusses published information and statistics for Wellington in the 1950s. This information is divided into the five main categories of an ecological footprint: food; housing; transport; consumer goods: and services. Statistics from the 1956 Population Census are presented and discussed. Information relating to Wellington today is discussed briefly. This is followed by the results of the most recent Quality of Life survey conducted for the Ministry of Social Development.
>
> *Part 2* reports the findings of the ecological footprint of Wellingtonians in 2006. Calculations for the estimated ecological footprints are made for each of the five main categories and separated into land types. The current ecological footprint for Wellingtonians in 2006 is discussed and analysed before the 1950s ecological footprint as this calculation, based on readily accessible data, was used to establish the method used for both.
>
> *Part 3* reports the findings of the ecological footprint of Wellingtonians in 1956. Information is presented in the same format as the preceding 2006 ecological footprint. A comparison is made between the results of the 1956 footprint and the 2006 ecological footprint.
>
> *Part 4* discusses the results of the surveys; the questionnaires and focus group discussions. The analysed results from both methods are discussed in terms of the main opinions and information given by the participants.

Chapter 5 – Conclusions and Discussion, draws conclusions from the results of the research, discussing, comparing and contrasting the ecological footprints of Wellingtonians in 1956 and 2006. Following this a comparison is made of the ecological footprint results with the perceived quality of life results from published information and personal accounts from the participants in the surveys. Conclusions are drawn in regard to the affects of reducing ecological footprint and the possible changes to lifestyle.

Chapter 6 – Reflection and Future work, reflects on the research methodologies discussing issues that arose through the research. It also suggests alterations to the methodologies and changes to data collection needed in order for this research to be reproduced for other cities and countries. Following this, further research for better understanding sustainability in New Zealand is recommended at local and national scales.

Author's Preface

Globally we are increasingly more aware of the detrimental affect humankind is having on our home, the Earth. The authorities and people conducting research into global warming, carbon emissions, and ecological footprint are unfortunately the people possibly contributing the most to these factors. This is because they are likely to come from developed countries and from middle to upper class backgrounds. With economics and wealth, come development and high consumption, especially when compared with developing countries.

I certainly do not deny I am part of this problem and that I am contributing to the deterioration of our environment. I cannot use excuses like "I am from a developed country", "I live in the city", "I'm part of generation Y", or "if I adjust my lifestyle it will not have a huge affect." This is despite the fact I am certainly aware and concerned at the rate at which we are consuming resources that are vital to this earth and everything living on it. Out of interest I wanted to find out how many planets we would need if everyone lived my lifestyle. According to the Global Footprint Network's personal footprint calculator (http://www.footprintnetwork.org/en/index.php/GFN/page/personal_footprint/), the global population would need 2.3 planet earths to live my lifestyle and my ecological footprint is 4.1 global hectares of earth's productive land. Both these results are well above the global average, as currently worldwide we need about 1.5 planet earths, in other words our demand is exceeding supply by 50% (WWF, 2010) (for land and water). The global ecological footprint averages 2.7 global hectares per person (WWF, 2010); while globally we only have 1.8 global hectares per person available. I would suggest you check out this calculator and give it a go, as sometimes it is easy to deny that we as a nation or person are part of the problem or cannot do anything to significantly change our current situation. While my ecological footprint is not exactly accurate, as it is based on me living in NSW, Australia because there is no New Zealand data available in the calculator, it still indicates that I am contributing to our global resource issues. I asked several colleagues, who do research at Victoria University of Wellington with me, to work out their ecological footprints as well. Their results ranged from 2.2 to 3.1 planet earths and with footprints between 4 and 5.1 global hectares.

2. Literature Review

Part 1 – Introduction to Ecological Footprint Assessment

2.1 Introduction

This chapter reviews the current information published on ecological footprint assessment. Researchers have been analysing the current and future effects that modern lifestyles and levels of resource consumption are having and are predicted to have on the earth both now and in the future (WWF, 2010, Living Planet Report). A reliable methodology for measuring and comparing the effects that the operations of countries or cities are having on the environment was created in the late 1990s. This methodology was pioneered and described by Wackernagel and Rees (1996) in their book 'Our Ecological Footprint.' This assessment method enables a systematic measuring of the effects humanity has on the environment. The results can be presented visually and in numerical form so that they can be understood by the general public and related back to everyday lifestyles.

The information included in the literature review aims to provide background information with regard to ecological footprint assessments, New Zealand and Wellington, and focus groups. Further published information is included throughout the thesis where applicable.

Part 1 of this chapter explains what an ecological footprint analysis is and examines the difference between carbon footprints and ecological footprints, and explains why the latter methodology was used for this research. The different methodologies used to calculate an ecological footprint for a country are discussed. Two past studies into ecological footprints for Alberta, Canada and Cardiff, Wales are given as calculated footprint examples to demonstrate the outcomes of an ecological footprint assessment. Three main examples are given of New Zealand's most recent ecological footprint calculations, conducted by Bicknell, Ministry for the Environment and the World Wildlife Fund. Part 2 contains background information about New Zealand and Wellington, including defining the study area and comparing Wellington in the 1950s to the city at present. Lastly, in Part 3 the use of a questionnaire and focus groups is discussed, together with why these were useful for gathering information relevant to this study, the process and the advantages and disadvantages of these methodologies.

2.2 Ecological Footprint Analysis

To explain ecological footprint assessments, this section of the thesis is divided into three subsections. The first explains the overall concept of what an ecological footprint is and the second explains the difference between ecological footprint analysis and carbon footprint analysis and the last part discusses why this methodology was used for this research.

2.2.1 What is an Ecological Footprint?

The word footprint is a commonly used term, generally referring to the area or mark left behind by an object or action. In the case of an ecological footprint, it is the 'mark' or depletion of natural resources left behind due to human consumption and actions. Ecology, in simple terms, is the science of relationships and interactions between organisms (in this case human beings) and their environment (the Earth). The definition of ecology from an economic perspective has been described differently. It is defined as the 'scientific analysis of the flows of energy, material, and information through ecosystems and of the competitive and cooperative mechanisms that have evolved for the allocation of resources among different

species' (Wackernagel and Rees, 2007). Therefore, the concept of an ecological footprint is the measure of these flows and hence the impact humans have on the earth. Ecological footprints are calculated using the assumption that for every resource used there is an associated area of land need to produce and supply that particular item. Bicknell described the ecological footprint as 'the amount of productive land required to support the consumption of a given population indefinitely' (Bicknell, 1997, pg 1). For example, any item of food requires not only land for it to be grown, but land is needed to produce the energy for transportation and processing of the food item or to absorb the carbon emissions from these processes.

2.2.2 What is an Ecological Footprint Assessment?

This section gives a brief overview of what an ecological footprint is; a more in depth discussion is provided in Section 2.3 (page 8). As defined by Wackernagel and Rees, 'Ecological footprinting analysis is an accounting tool that enables us to estimate the resource consumption and waste assimilation requirements of a defined human population or economy in terms of the corresponding productive land area' (Wackernagel and Rees, 1996, pg 9). The land area is given in hectares (ha) or global hectares (gha); global hectares take into account productivity of land relative to the rest of the world, so that the resultant footprint area can be compared internationally. Initially, the ecological footprint is calculated for the city or defined area (for example a country). This total footprint is then divided by the population to find the ecological footprint of an average person (gha/person or ha/person). The resultant footprint can then be compared internationally (if given as gha/person), to determine the relativity of the footprint to other countries. Information needed to calculate an ecological footprint can be obtained from statistical data, relating to an area's imports, exports, consumption, production and waste. Once this information is collected it is then categorised for ease of analysis, and there are several ways this can be done. Wackernagel and Rees suggest five categories (food, housing, transportation, consumer goods and services) for data separation and these are discussed further in Section 2.3.1. Land use is also categorised; Wackernagel and Rees use eight land use types (discussed further in Section 2.3.1) based on classifications used by The World Conservation Union (IUCN). It is advised that these or similar categories are used, so footprint results can be compared with previous calculated footprints, although sub categories can be added. Once the data is categorised an ecological footprint can be estimated for each category (for example food only), and these separate footprints are then added to find the total ecological footprint.

2.2.3 Difference between Carbon Footprinting and Ecological Footprinting

It is understood that ecological footprinting estimates 'how much land and water area is required on a continuous basis to produce all the goods consumed, and to assimilate all the wastes generated, by that population' (Wackernagel and Rees, 1996, pg 61). As explained the output from the ecological footprint calculation is expressed in hectares per capita (ha/capita) or global hectares per capita (gha/capita) to support the population. In contrast, a carbon footprint 'is a measure of the impact our activities have on the environment, and in particular climate change. It relates to the amount of greenhouse gases produced in our day-to-day lives through burning of fossil fuels for electricity, heating and transport' (Carbon Footprint Ltd, 2010). From these descriptions it can be seen that these two concepts are measuring the impact of humanity on the environment but in different ways. Unlike ecological footprinting, carbon footprinting 'is a measurement of all greenhouse gases we individually produce and has units of tonnes (or kg) of carbon dioxide equivalent' (Carbon Footprint Ltd, 2010). Thus carbon footprinting is essentially about reducing fossil fuel energy uses and any climate change effects resulting from these. Carbon footprints do not deal with all the other resources that go into making up a western lifestyle. When calculating a carbon footprint, only carbon that is being released into the atmosphere is measured or estimated, although this is only a

small percentage of the carbon present in the world. This can be understood further by looking at the carbon cycle (Figure 1).

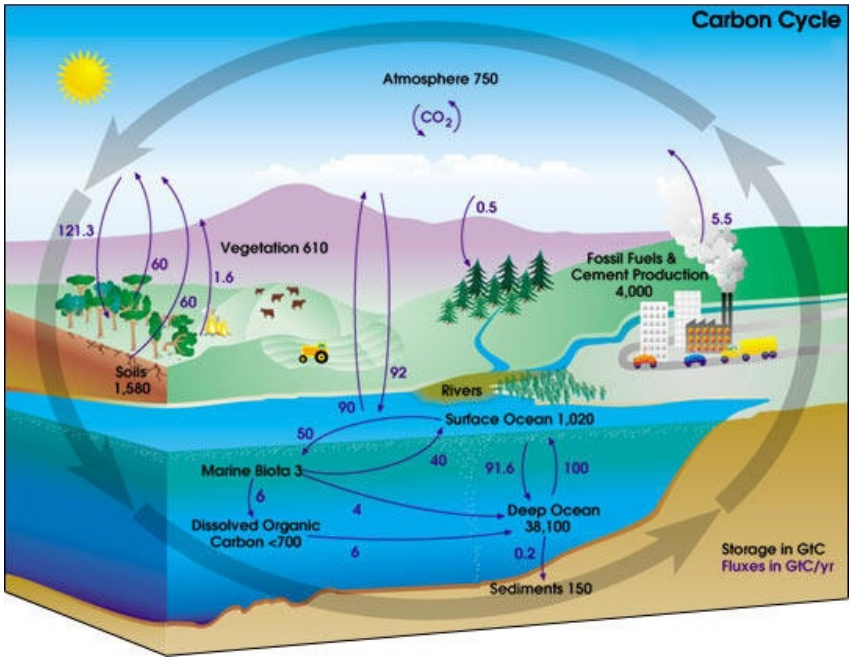

Figure 1: Carbon cycle

(Source: http://earthobservatory.nasa.gov/Features/CarbonCycle/carbon_cycle4.php)

Note: values shown in Giga tonnes of carbon dioxide and Giga tonnes of carbon dioxide per year

In Figure 1 above, values in purple show fluxes in carbon dioxide levels, this is the amount of carbon dioxide released into the atmosphere or absorbed per year. Human activities add approximately 5.5 Giga tonnes of carbon dioxide (GtC) into the atmosphere per year. Values in black indicate the stored carbon dioxide levels. It can be seen that there are about 750 GtC of CO_2 stored in the atmosphere, while there are significantly higher levels stored or locked up in soils, vegetation, the surface of the ocean and at deep ocean levels. This is because 'not all of the carbon dioxide that has been emitted by human activities remains in the atmosphere' (NASA, 2010). Some of the carbon dioxide is absorbed and therefore stored in the land and ocean. So by measuring the carbon footprint of an area, the CO_2 emissions of that area are calculated, however, some of this carbon is then absorbed, and this can lead to an over estimation of carbon footprints. However, ecological footprints do include the impact of all energy uses, from various sources, renewable or non renewable. One element of ecological footprints is similar to a carbon footprint. This is the energy land or CO_2 component. This estimates how much ecologically productive land would be needed to absorb all the CO_2 released through the consumption of fossil fuel energy.

2.2.4 Why use Ecological Footprinting?

The aim of this research is to understand whether Wellington was operating sustainably in the 1950s and how it compares to the present day. Ecological footprint analysis was one of the methods used to achieve this aim; the other was through a questionnaire and focus group discussions, with people who lived in Wellington in the 1950s. Ecological footprinting enabled a more in depth analysis to measure human impact on the environment. It also provides an outcome that can be understood by the wider public as it is compared to available productive land area. The resultant ecological footprint covers more aspects than a

carbon footprint. A carbon footprint measures the CO_2 emissions from burning fossil fuels only, whereas ecological footprint estimates the land required to support all aspects of a particular lifestyle. Ecological footprinting indicates how sustainable or unsustainable a community is for the year that the ecological footprint was calculated. If the land required to support the community is larger than the land area available within that community, this indicates that current operations and consumption of the community are unsustainable and that it is in ecological deficit. This is because land has to be 'borrowed' from the surrounding communities. If this is occurring in one community it may not be of concern although recent research indicates that the world has overshot its land capacity by 20% (Meadows et al, 2004), indicating 'borrowing' of land is a widespread issue resulting in more land being borrowed than is available worldwide. This is made possible through the consumption of non-renewable resources. This percentage has since increased with the most recent research conducted by WWF stating the world has now overshot its biocapacity (for land and water) by 50% (WWF, 2010). The aim, therefore, is to look at the footprint of Wellington in the 1950s in terms of what was a fair earth share footprint both then and now as a measure of sustainability. The following sections outline how ecological footprints are calculated; this provides a step by step process of the Wackernagel and Rees, and the Bicknell methods of calculating ecological footprints. This is followed by examples of ecological footprints calculated for countries. Following this are several examples of calculated ecological footprints for New Zealand, and the differences in results between the methodologies.

2.3 Calculation Method

To understand the concept of ecological footprint analysis in more depth this section of the thesis discusses how ecological footprints are calculated. The methodology used to calculate ecological footprints is that published in 'Our Ecological Footprint' by Wackernagel and Rees in 1996. Variations of this methodology have been produced since. This methodology was adapted for New Zealand by Kathryn Bicknell and published in the book 'New methodology for the Ecological Footprint with an application to the New Zealand Economy.' Ecological footprint analysis involves collecting data relating to a selected year or period of time for both methodologies. A step by step process is set out in 'Our Ecological Footprint' by Wackernagel and Rees, pages 63-79.

Calculating ecological footprints is based on the idea that resources (material and energy) consumed require a measurable amount of land to produce or provide the resources. Therefore, to calculate an ecological footprint for an average person the amount of resources consumed must be determined. This is done by calculating the ecological footprint of an area first, for example a city, and then dividing by the population rather than only focusing on one person. This results in the average ecological footprint of a person living in that area. The information that follows explains the process of how this is done, and the section that follows provides calculated examples of ecological footprints for Alberta, Canada and Cardiff, Wales.

The first step, in the Wackernagel and Rees approach, is to estimate the annual consumption of particular items for the selected population; this data is obtained from national statistics. Some examples of national data sources relating to New Zealand would be the NZ Transport Agency[1] and Statistics New Zealand[2] (Census and Trade information). The average per person consumption can then be determined by dividing the total consumption level for the selected population by the population size. To simplify the data collection process for this first step, data is collected and separated into five major consumption categories. These are; Food, Housing, Transportation, Consumer Goods and Services. These categories

[1] http://www.nzta.govt.nz/
[2] http://www.stats.govt.nz/

can be divided up further if required; Wackernagel and Rees give the example of subdividing Transportation into public and private transportation (Wackernagel and Rees, 1996, pg 68).

The land needed to provide a community with the resources required to sustain the consumption of an item or service is divided into the following four types; energy land; consumed land; currently used land; land of limited availability. These categories are divided up further into eight main categories relating to the uses, Table 1.

Table 1: Land use categories

Source: Wackernagel and Rees, 1996, Pg 68

Land Category	Land Use Category	Label
Energy land	a. land "appropriated" by fossil energy use	(ENERGY OR CO_2 LAND) Note: if we opt for fuel crops, this would remove some land from categories c, d e or f.
Consumed land	b. built environment	(DEGRADED LAND)
Currently used land	c. gardens	(REVERSIBLE BUILT ENVIRONMENT)
	d. crop land	(CULTIVATED SYSTEMS)
	e. pasture f. managed forest	(MODIFIED SYSTEMS)
Land of limited availability	g. untouched forest	(PRODUCTIVE NATURAL ECOSYTEMS)
	h. non- productive areas	(DESERTS, ICECAPS)

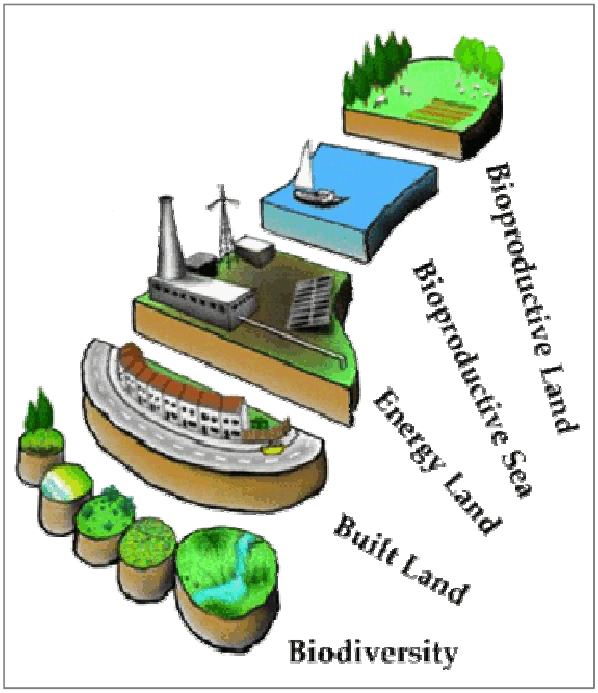

Figure 2: Land use categories

Source: http://www.bestfootforward.com/ecological_footprint

Energy land is defined as the land area required to sequester the CO_2 emissions corresponding to the amount released from the consumption of fossil fuel energy. This is calculated by determining the area of

trees needed to absorb the CO_2 released. Radiata pine are commonly grown trees in New Zealand, and 1 hectare of pine trees locks up 4 - 7 tonnes of elemental carbon per year which is equivalent to 15-26 tonnes of CO_2 from the atmosphere per year (Berg, 2009). Alternatively energy land can also be used to describe the land needed to grow an energy source, such as timber or other biomass, or the land required for a hydro scheme. This approach assumes that 'because energy can be 'grown' in the form of trees and fuel crops, it is possible to convert one measure to the other: energy can be expressed in terms of an area of land' (Vale et al, 2009, pg 17). This is a valid approach because 'energy is fundamental to everything we do in the modern world' (Vale et al., 2009, pg 17). Using the housing category of the ecological footprint, an example of the energy land component is the household operational energy and embodied energy in the housing materials, maintenance and disposal. These components can be converted to a land area by determining the energy to land ratio (Gigajoules per hectare of land). Some examples of common energy to land ratios are given below in Figure 3. Wackernagel and Rees' research has suggested that for most developed countries the energy land component can be up to 50% of the overall ecological footprint. This is the approach used to calculate the ecological footprint of a Wellingtonian in the 1950s and 2006. More information on the energy to land ratio for New Zealand can be found in the Section 3.4.3 (page 35).

Energy Source		Productivity (in Gigajoules per hectare per year)	Footprint for 100 Gigajoules per year (in hectares)
Fossil Fuel	Ethanol approach	80	1.25
	CO_2 absorption approach	100	1.0
	Biomass replacement approach	80	1.25
Hydro-electricity	Average	1,000	0.1
	Lower course	150-500	0.2-0.67
	High altitude	15,000	0.0067
Photovoltaics		Up to 40,000	0.0025
Solar hot water		1,000	0.1
Wind energy		12,500	0.008

Figure 3: Productivity of common energy sources
Source: Wackernagel and Rees, 1996, pg 69

Degraded land refers to land used in the built environment. This is land that had been 'paved over, built upon, eroded or otherwise degraded land' (Wackernagel and Rees, 1996, pg 75). The land is considered to be consumed and with no potential to be productive in its current state. Using the housing category as an example again, degraded land is the area of land covered by the footprint of the houses in the area examined. This land area cannot be used for any other purpose.

The third land category is **currently used land**, and this category covers several types of land use; *gardens, crop land, pasture, and managed forest*. This land is considered productive land, as it is currently used to produce resources needed to sustain human life. Gardens refer to land areas used for vegetable and fruit production, and this land typically has the highest ecological productivity. This land is labelled 'Reversible Built Environment.' Land used as crop land is also categorised under currently used land. This is land that produces crops other than fruit and vegetables. This is given the label 'Cultivated Systems'. In the case of housing, garden land is the area of land covered by the section minus the footprint of the house; crop land can also be calculated by estimating the area used to produce crops.

The last two currently used land categories are pasture and managed forest, and both land uses are labelled as 'Modified Systems'. Pasture land is used for dairy, meat and wool production. Land used for managed forests is defined as 'land committed to providing forest products' (Wackernagel and Rees,

1996, pg 77). Forest land, for the housing category, is the area of land needed to grow the volume of timber needed to build the houses. New Zealand forests have the highest growth rates in the world; the average annual volume of timber is 25 m^3/ha/year (Evergreen Forests Limited, 1996).

The fourth land category is **land of limited availability**; this category includes untouched forest and non-productive areas. Land used for untouched forest represents 'virgin forest ecosystems whose harvest would lead to a massive net CO_2 release that would be recovered only after 200 years of subsequent ecological production on this land' (Harmon et al, 1990, pg 699-702). Worldwide this land area equates to 'about 1.5 billion hectares of nearly untouched forest ecosystems that both serve as a substantial carbon pool and provide habitat to the bulk of the Earth's species' (World Resources Institute, 1992). This land is given the label 'Productive Natural Ecosystems'. Lastly, are non-productive areas, labelled as 'Deserts, Icecaps', and as this suggests this land category covers areas of land that can never be productive, for example the Sahara and Antarctica. This land use is considered 'ecologically unproductive for human purposes' (Wackernagel and Rees, 1996, pg 70).

2.3.1 Process for Ecological Footprint calculation

The total ecological footprint, of a population or average person, is calculated from the information discussed previously. Data is collected for each main category e.g. for housing, the data can either be on a national, local or individual scale, depending on what is available and the method used (bottom-up or top-down see following section). Sometimes a combination is used if there is insufficient data, and this data can then be averaged out, for example if data is being collected for an average person and data is only available for the population this can be divided by the population to find the figure for an average person. Once data is collected for each main category it can then be categorised into land use categories to estimate the footprint for each.

Using the Housing footprint category as an example, the types of data typically collected for the area studied are:

- Population (needed for all footprint categories);
- Number of houses;
- Average size of houses;
- Average section size;
- Construction of houses;
- Volume of timber per house;
- Household operational energy;
- Embodied energy associated with construction, maintenance and disposal of houses;
- Construction waste.

The energy to land ratio of the area must be identified, and this is typically 100GJ/ha (earth's capacity to assimilate CO_2) according to Wackernagel and Rees. However, some countries, such as New Zealand, have more productive forests; because of this New Zealand forests may yield up to 150 GJ/ha/year (Bicknell et al., 1998). This value also assumes that all energy consumed is derived from fossil fuels, and does not account for hydro-electricity or wind generation, which form some of New Zealand's primary energy supply. If this is the situation for the population being studied the percentage of renewable to fossil fuel energy can be multiplied by the associated productivity of the energy sources (as shown in Figure 3).

Following this, the data must be converted to land area (ha). For housing, energy land is estimated by converting the household operational energy and embodied energy to the land area required by applying the energy to land ratio associated. Consumed land is simply found by estimating the area covered by houses. Garden land is the land used for an average section (minus the footprint of the average house). Forest land (or managed forest) is calculated by determining the volume of timber needed to build an average house in the area, and then the annual volume growth per hectare is used to calculate the area of forest needed to yield the required timber. The overall ecological footprint is calculated by summing the ecological footprints for each land use category.

If data is collected on a local basis, the resultant ecological footprint will be that for the local population. This value is then divided by the population to calculate the ecological footprint in hectares or global hectares to sustain an average person. Otherwise, if data is collected for an average individual the resultant ecological footprint will be for an average. The population's ecological footprint can be found by multiplying the average person's ecological footprint by the population. Taking the area of the location studied and dividing it by the population gives the bio-capacity or the area of land available for each individual.

It must be acknowledged that the land on the earth is a finite resource; land is rarely reclaimed, and therefore there is a fixed amount of productive land available to sustain humanity. This is known as the carrying capacity, and Wackernagel and Rees refer to it as a 'fair earth share'. The global carrying capacity is about 1.8 hectares per person (Wilson, 2001, pg 1). 'Overshoot' is the amount of land being used over the global carrying capacity; this is also known as ecological deficit. A population can also be in ecological reserve if using an amount of land below its carrying capacity. The Living Planet 2010 report calculated the ecological footprint of New Zealanders was 7.7 ha in 2005, with an available bio-capacity of 14.1 ha, and as a result New Zealand had an ecological reserve of 6.4 ha.

2.3.2 Bottom-up and Top-down Methods

Ecological footprints are calculated for national or sub-national populations. Examples of sub-national populations are regions, states, provinces, prefectures, cities, socio-economic groups, households and individuals (Footprint Network, 2009). Therefore, Wellington city is a sub-national population.

There are two methods to calculate the ecological footprint of a sub-national population: 'bottom-up' and 'top-down'. The 'bottom up' or component method involves estimating the 'ecological footprint of all of the individual products consumed by the sub-national population and these are summed together' (Footprint Network, 2009) to calculate the ecological footprint of the sub-national population. Conversely the 'top-down' or compound method estimates the ecological footprint at a national level and the sub-national footprint is estimated by apportioning this national footprint between the sub-national populations.

The Ministry for the Environment discusses the differences between these methods stating that 'it has been suggested that a 'bottom-up component analysis be utilised to estimate regional and personal ecological footprints' (MFE, 2003, Section 20.1). 'Bottom-up' analyses are detailed, flexible and easily understood by the end-user. They provide the end-user with relatable information regarding personal energy use, transport details, food consumption, spending on goods and services and waste. However, this approach can result in under counting and double counting or miscounting, due to the data available and overlapping of data between categories.

A hybrid of the two methods can be used. The Ministry for the Environment suggest that a hybrid of the 'bottom-up' and 'top-down' methods 'would probably provide the best outcome, enabling results to be presented in terms understood by the individual' (MFE, 2003, Section 20.1).

2.4 Ecological Footprint Examples

This section gives examples of calculated ecological footprints. Two cases are discussed to demonstrate ecological footprints, the Alberta Ecological Footprint and the Cardiff Study Ecological Footprint. Full reports can be found for these studies on the internet; Alberta Study (Wilson, 2001) and Cardiff Study (Collins et al, 2005).

2.4.1 Alberta Footprint

In 1999, a study was conducted to calculate the average ecological footprint of the citizens of Alberta, Canada. This study was a follow up to a previous one conducted in 1961, to determine what growth and changes had occurred during the time since the initial study. The methodology used for this study was based on that used by Mathis Wackernagel in his Canadian footprint analysis. Not all data required to calculate the ecological footprint at a provincial level was available; therefore a combination of provincial and national (Canada) data was used. Imported land has been accounted for in the report, however no details are given in regard to how import and export land was calculated.

'In 1999, Alberta had a population of 2,964,684 people and a land area of 66,200,000 hectares' (Wilson, 2001, pg 5). Through this study it was found that 'between 1961 and 1999, Alberta's ecological footprint grew by 66 percent – increasing from 6.5 hectares per person to 10.7 hectares per person, over five times the global ecological carrying capacity of 1.8 hectares per person' (Wilson, 2001, pg 1). In the World Wildlife Fund's "Living Planet Report 2010' (WWF, 2010), it is stated that 'Alberta has the world's fourth largest ecological footprint per capita.' This subsequent study highlighted issues with the current lifestyles of Albertans, and also addressed future predictions. 'Alberta's ecological footprint is forecast to reach 15 hectares per person by 2020, over eight times the global ecological capacity' (Wilson, 2001, pg 1).

In 1961, the ecological footprint of Albertans was still larger than the carrying capacity. The increase to 10.7 hectares per person indicates that recommendations and changes suggested from the first study were not implemented successfully. The areas of increase in the size of the Alberta ecological footprint between 1961 and 1999 are shown in Table 2.

Table 2: Ecological footprint changes 1961-1999

Source: Wilson, 2001, pg 2

Ecological footprint type	Increase
Energy footprint	89%
Food footprint	12%
Other footprint	126%
Ecological footprint	66%

In 1999, Albertans required 31,722,172 hectares (Wilson, 2001, pg 5) of land to support their consumption of goods and services. This study also found that there was a significant difference in the ecological footprint between the poorest and wealthiest Albertans. 'The poorest 20 percent of Albertans have a

footprint of 6.5 hectares per person while the wealthiest 20 percent have a footprint of 15.8 hectares per person' (Wilson, 2001, pg 15). This reveals that the wealthiest Albertans have almost 225% times the impact on the environment when compared with the poorest residents. This is expected as income and money spent are linked with resource flows (Chambers et al., 2000, pg 140).

The four main areas of increase in the ecological footprint between 1961 and 1999 are shown in Table 3.

Table 3: Area of ecological footprint 1961-1999

Source: Wilson, 2001, pg 22

Ecological Footprint Component	% change
Personal goods and services	244%
Transportation and communication	166%
Health care	137%
Taxes	132%

This study clearly showed the depth of information that can be gained from an ecological footprint analysis. The Alberta analysis in 1999 highlighted some significant issues with the current consumption of the city and what is predicted to happen in the future if consumption trends continue unchanged.

2.4.2 Cardiff Footprint

Cardiff, Wales is the second example used to illustrate the results from an ecological footprint study. This study was conducted between January 2003 and January 2005 (Collins et al., 2005, pg 1), and calculated the ecological footprint of Cardiff residents for 2001. Cardiff is the capital city of Wales, and in 2001 had 307,300 residents and 123,580 households.

The outcomes from this study found that Cardiff residents were consuming resources beyond the carrying capacity of the city. The average ecological footprint of a Cardiff resident, in 2001, was '5.59 global hectares per resident (1,717,807 global hectares for all 307,300 residents)' (Collins et al., 2005, pg 1). The available land area in Cardiff is 13,699 hectares (Collins et al., 2005, pg 12). Therefore, the land required to sustain the residents' resource consumption during 2001 was 125 times (Collins et al., 2005, pg 12) the actual land area available, resulting in additional land area being 'borrowed' from elsewhere. The lifestyles and levels of resources consumed by the Cardiff residents were not sustainable, as the residents would need to utilise 82% (Collins et al., 2005, pg 12) of the 2.1 million hectares of the land area in Wales. In order for the residents of Cardiff to be living sustainably they would need to reduce their ecological demand by 66%, through reductions in their resource consumption levels. This result also means that 'if everyone on earth lived the same lifestyle, then we would need nearly three planets worth of resources to meet our needs' (Collins, et al., 2005, pg 1). This statement clearly demonstrates that Cardiff residents are living beyond the land resources available to them.

Similar to the Alberta study, the Cardiff study used the methodology developed by Wackernagel and Rees (1996). The focus for this study, when calculating the ecological footprint, was consumption rather than production. Similar to the approach used by Wackernagel and Rees (Wackernagel and Rees, 1996) the data collection was divided into several categories. These included; food, travel, household consumables and durables, waste, infrastructure (housing and construction), energy and water, services and built land (Collins et al., 2005, pg 9). The ecological footprint for each of these categories was calculated individually

and summed together to calculate the overall ecological footprint of the city. This number was divided by the population to determine the ecological footprint of an average Cardiff resident.

Food and drink were found to make the largest contribution to the overall ecological footprint, accounting for almost a quarter of the total. The food and drink ecological footprint was 1.33 gha/capita (Collins et al., 2005, pg 23). This is due both to what people were consuming and how they were consuming it. For example processed foods and eating takeaways had a higher ecological footprint, with 90.1% of the total amount of food consumed in 2001 eaten at home, and 9.9% eaten outside the home (Collins et al., 2005, pg 25). More significant though is the amount of processed fruit eaten, as 36.6% of all fruit consumed was processed, while 63.4% was fresh. Processing of food adds to the ecological footprint as more energy and resources are involved.

Imported resources need to be accounted for when calculating the ecological footprint. Imported products have used land resources from other countries in the production process and also require transportation to the country of consumption. In the Cardiff study imported products were not accounted for differently to those that were produced locally.

> Imported products 'were integrated in the domestic supply table i.e. the figures for imports and domestic production were joined together in the 76x76 matrix (this is usually referred to as a 'competitive' table and means in economic terms that imports have identical properties and therefore act as substitutes for domestically produced products). This is done because no separate information on the industrial use of imports was available; the economic use matrix amalgamates domestic production and imports' (Collins et al., 2006, pg 146).

This means that no allowance is made for where products were made or that fact they might have higher or lower footprints due to the different energy use scenarios in the countries of production. The assumption has been made that these factors will balance each other out through this method.

2.4.3 Canberra Footprint

In 1998, the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) published a report for Canberra's Ecological Footprint (Close & Foran, 1998). This report used a 'top-down' approach using Australian consumption data, which was apportioned to the population of Canberra to estimate the average person's ecological footprint. The methodology or outcomes of this study are not discussed in this report. The published report provides readers with an easily understood explanation of the process and results from this ecological footprint calculation. More information relating to this can be found in Section 3.4.3.

2.5 New Zealand's Ecological Footprint

New Zealand's ecological footprint has been calculated through three studies. The first study was undertaken by Kathryn Bicknell et al. (1998) for 1991 and published in 'New methodology for the ecological footprint with an application to the New Zealand economy'. A subsequent study was undertaken for the Ministry for the Environment for 1997/1998. The third was in the Living Planet 2010 report (WWF, 2010), which calculates the ecological footprint of most countries biennially (the most recent being the Living Planet 2010 report). These studies will be discussed in this section to compare New Zealand's most recently calculated footprint with other countries.

2.5.1 Bicknell's Assessment of New Zealand

The first study and methodology discussed in relation to New Zealand, is that conducted by Bicknell et al. in Lincoln University in 1996. Bicknell et al. (1998) used a methodology based upon that developed by Wackernagel and Rees (1996) to calculate the ecological footprint of New Zealand for 1991. In 1991, New Zealand had a population of 3,408,000 (Bicknell et al., 1998, pg 156) and the ecological footprint was calculated to be 3.49 ha per person (Bicknell et al., 1998, pg 156). As Bicknell used a different methodology than those previously used to calculate ecological footprints for other countries, the results are not directly comparable with these others. This is because Bicknell does not take into account equivalence factors. Land in New Zealand is 2.5 times (MFE, 2003, Executive Summary) more productive that the global average, and applying this factor would result in an adjustment of the ecological footprint to 8.75 gha per person. However, the following table from Bicknell et al., 1998, pg 157, does show international comparisons of ecological footprints.

Table 4: International ecological footprint comparisons

Country	Ecological footprint [ha/person]
US	5.10
Canada	4.27
New Zealand	**3.49**
Netherlands	3.32
India	0.38
World average	**1.80**

Note: the source for all countries excluding New Zealand is Wackernagel and Rees (1996).

The national ecological footprint was 11,893,920 ha, which equates to 64% (Bicknell et al., 1998, pg 157) of the total productive land available in New Zealand. This figure includes land owned by the Crown. This is significant because, in 1991 New Zealand was one of a few countries not running an 'ecological deficit' in order to fuel the consumption of the country, but instead it had an ecological reserve. Included in the national ecological footprint is imported land, which is land embodied in products and services imported from outside the country. Over 26% of the total ecological footprint is imported land, equating to 3,201,961 ha. This is largely because New Zealand relies on imports to supply the country with some of the resources required (like white goods). On the other hand, 14 million ha (Bicknell et al., 1998, pg 157) of land was embodied in New Zealand exports, this being mainly agricultural land embodied in primary agriculture products.

The aim of the research published by Bicknell et al. was to 'propose the use of a modified form of input-output analysis to calculate the ecological footprint' (Bicknell et al., 1998). In discussing the modified methodology used, Bicknell states that the methodology used by Wackernagel and Rees to calculate the Canadian ecological footprint relies on an 'eclectic mixture of data sources, drawing on research from several countries and spanning an extremely long time horizon' (Bicknell et al., 1998). Therefore, the results 'cannot be easily reproduced or meaningfully compared across time or between populations' (ibid). In modifying this methodology using New Zealand as a case study, Bicknell aimed to use a more integrated approach to calculating the ecological footprint. This was achieved through the use of established databases that are regularly updated. Examples of these for New Zealand are Statistics New

Zealand and Valuations New Zealand. Also of use are international databases such as those of the Food and Agriculture Organisation of the United Nations (FAO).

An important aspect of any ecological footprint analysis is the amount of imported land or land embodied in imports from other countries. This is a significant value in New Zealand with imported land contributing to almost a third of the total ecological footprint in 1991. However, the lack of information on the land intensity of overseas production makes the analysis of imports more difficult. Through 'assuming similar production techniques, the land embodied in goods and services imported directly to final demand can be calculated by multiplying the value of an import by its corresponding domestic land multiplier' (Bicknell et al., 1998, pg 154). This approach for accounting for imported land is similar to that used in the Cardiff study and is the common method so it can be integrated into the overall ecological footprint. Again this results in no allowance for where the products are made and the fact they may have a higher or lower footprint as a result of different energy use.

2.5.2 Ministry for the Environment Assessment of New Zealand and its regions

More recently, research was conducted by the Ministry for the Environment (MFE) to calculate the ecological footprint for New Zealand for the year 1997/1998. This research also included calculation of the ecological footprint of New Zealand's 16 regions, as determined by the regional council areas. This section will cover the methodology, findings for New Zealand and the Wellington region, and compare New Zealand's ecological footprint internationally and Wellington's results nationally.

The methodology used for this study was based upon that developed by Bicknell et al (1998), as discussed above. The methodology calculated the ecological footprints based on an input-output analysis, which tracked the flow of embodied land. The methodology was divided into two parts. Firstly, the calculation of the 'domestic land embodied in goods and services consumed by the New Zealand population' (MFE, 2003, Section 2.2). Secondly, the analysis expanded on the information found in the first part to include 'land embodied in products purchased from overseas and removes the land embodied in produce sold overseas' (MFE, 2003, Section 2.2).

From this information the final estimated ecological footprint from New Zealand was calculated by adding:

- The domestic land embodied in products consumed locally;
- Domestic energy land required to sequester CO_2 emissions embodied in products consumed locally;
- The land (and energy land) embodied in products purchased overseas but consumed locally.

(MFE, 2003, Section 2.2)

Through the use of an input-output analysis the total New Zealand ecological footprint was calculated to be 11,684,500 ha (MFE, 2003, Executive Summary) for 1997/1998. At that time there was 17,783,949 ha (MFE, 2003, Executive Summary) of usable land available in New Zealand. Usable land is the total land area of New Zealand disregarding national parks, forest parks, reserves and non productive land. Therefore, New Zealand is occupying only 65.70% of its potential capacity. This is significant because New Zealand is one of a very few countries, along with Australia and Canada, still operating below their carrying capacities, also described as having an ecological reserve. 'This means, assuming our current per capita footprint, New Zealand could increase its population by 1.52 times before it overshoots its ecological carrying capacity' (MFE, 2003, Section 3.1.1).

This total ecological footprint for New Zealand equates to a per capita ecological footprint of 3.08 ha per person (MFE, 2003, Section 3.1.1) for the year 1997/98. The Bicknell (Bicknell et al.,1998) case study of New Zealand, calculated the per capita ecological footprint at 3.49 ha per person (MFE, 2003, Section 3.1.1) for the year 1991. The Ministry for the Environment's report discusses several reasons why Bicknell's estimate is higher that their calculation. These include, the use of international data not relevant to New Zealand, related to the energy to land ratio, and the fact New Zealand has a relatively high percentage of hydro-generated electricity (65.37% (Statistics New Zealand, 2000) of total energy produced) compared with international averages, which results in fewer CO_2 emissions per joule of energy produced. Also, Bicknell et al (1998) appear to have used a lower CO_2 absorption value per hectare of land. They used a value of 0.9563 tonnes of carbon, which was calculated by Wackernagel and Rees (1996) as the average international value. In fact New Zealand's land absorbs more CO_2 per hectare than the global average. It has been established that New Zealand's Pinus Radiata plantations absorb 3.6 tonnes of carbon per hectare (Hollinger et al, 1993) and New Zealand's indigenous forests absorb 1.6 tonnes of carbon per hectare (Hall & Hollinger, 1997), both values being higher than the global average. This use of international data has resulted in the energy land calculation by Bicknell et al (1998) being 23% of the total, whereas the Ministry for the Environment study showed the energy land component to be 16.6%.

Another discrepancy between Bicknell (Bicknell et al., 1998) and the MFE results relates to the estimate for land use by sectors. Bicknell's estimate was 10% higher (MFE, 2003, Section 3.1.1) than that used by the MFE. This resulted in a higher value for this segment of the New Zealand ecological footprint.

Table 5 shows the land use types that made up New Zealand's ecological footprint for the year 1997/98.

Table 5: Ecological break down of Land use types

Land use type	Ecological footprint (ha)	Percentage of overall Ecological Footprint
Agricultural land	8,036,060	68.8%
Energy land	1,944,940	16.6%
Degraded land	959,250	8.2%
Forest land	744,410	6.4%

Source: MFE, 2003, Section 3.1.1

Table 6 shows the product types that made up New Zealand's ecological footprint for the year 1997/98.

Table 6: Ecological Footprint break down for Products

Product types	Land embodied (ha)	Percentage of total
Manufacturing sector products	5,200,100	44.5%
Service Sector products	3,042,820	26.0%
Imported household products	1,232,760	10.55%
Direct purchase of utilities (gas, water and electricity) and construction services	642,270	5.3%
Land occupied by household dwellings and surrounding sections + energy land (required to absorb CO_2 emissions for household purchases)	616,730	5.28%

Source: MFE, 2003, Section 3.1.1

In comparison, to the ecological footprints of other developed countries, New Zealand is in a better situation. Most developed countries are in fact overshooting their carrying capacity. For example, The

Netherlands overshoots its available productive land or carrying capacity by 2 - 3 times (van Vurren and Smeet, 2000). For a direct comparison between New Zealand and overseas countries an adjustment needs to be made to New Zealand's ecological footprint, because New Zealand's land is 2.5 times (MFE, 2003, Executive Summary) more productive than the global average. Therefore, every 'hectare of New Zealand land is equivalent to 2.5 hectares of the global average land' (MFE, 2003, Executive Summary). With this adjustment made New Zealand's comparable ecological footprint increases to 8.35 global hectares (global equivalent/person) (MFE, 2003, Executive Summary). Bicknell's ecological footprint with this adjustment was 8.75 gha per person.

Table 7 shows how New Zealand's adjusted ecological footprint compares to some of the adjusted ecological footprints for other countries. Note that all of the countries that have negatively adjusted ecological footprints have higher per capita incomes (per capita GDP) compared with New Zealand (MFE, 2003, Executive Summary). The United States, which has an ecological footprint 46.70% higher than that of New Zealand, has a GDP per capita twice that of New Zealand's. The fact US citizens live energy intensive lifestyles is also reflected in the high energy land component of the average US person's footprint.

Table 7: World comparison of New Zealand's Ecological Footprint

Country	Comparison to New Zealand's adjusted Ecological Footprint (ha)
United States	+ 46.70% (12.23 ha per person)
Denmark	+ 25.86%
Ireland	+ 14.13%
Australia	+ 1.80%
New Zealand	**8.35**
Canada	-8.02%
France	-12.57%
Hong Kong	-14.49%
Germany	-25.03%
United Kingdom	-25.03%
Netherlands	-28.33%
Japan	-29.34%

Source: MFE, 2003, Executive Summary

This study also calculated the ecological footprint of New Zealand's 16 regions as determined by the regional council areas. Through the same input-output analysis it was calculated that the Wellington region's footprint (Wellington city was used for this study) was 1,029,010 ha which equates to 9.6% of New Zealand's total ecological footprint (MFE, 2003, Section 12.2t). In 1997/98 Wellington's population was 428,699, making it the third most populated region after Auckland and Canterbury (MFE, 2003, Section 12.1). Wellington is the fourth smallest region in New Zealand, in terms of land area, this being 812,503 ha (MFE, 2003, Section 12.1), with 723,190 ha of this land being productive or usable land. Wellington is therefore in an ecological deficit of 305,820 ha. Overall, Wellington had the third largest regional ecological footprint behind Auckland and Waikato. Auckland's ecological footprint was 2,319,940 ha and Waikato's was 1,048,860 ha or 9.79% of New Zealand's total ecological footprint (MFE, 2003, Section 3.1.1). Therefore, Wellington overshot its available productive land 1.42 times. Auckland and Nelson were also in an ecological deficit in 1997/98; Auckland significantly overshot its available land by a factor of 4.82. These three areas are also the most densely populated regions in New Zealand. The 'Wellington region is very urban (even with the Wairarapa sub-region considered), and has relatively high population density (52.76

people/km^2) which is the third highest in the country' (MFE, 2003, Section 12.2). Therefore, almost by necessity these regions depend on the appropriation of land from surrounding regions to support their ecological footprint (for food and other products). Wellington's additional land is appropriated from Taranaki, Canterbury and overseas, and land imported from Taranaki and Canterbury is embodied in the agricultural sector of the footprint (MFE, 2003, Section 12.3).

Table 8 below shows the four main land use types and the ecological footprint area associated with each of these land types for the Wellington region.

Table 8: Wellington's regional ecological footprint by land use type

Land use type	Ecological footprint (ha)	Percentage of Wellington's regional footprint
Agriculture land	705,610	68.6%
Energy land	186,999	18.1%
Degraded land	82,270	9.4%
Forest land	40,000	3.9%

Source: MFE, 2003, Table 12-1

Table 9 shows the separate goods and service purchases and the region's ecological footprint associated with each of these purchases.

Table 9: Wellington's regional ecological footprint by goods and service purchases

Goods and Service purchases	Ecological footprint (ha)	Percentage of Wellington's regional footprint
Manufacturing	443,990	43.1%
Domestic final demand	220,660	21.4%
Service sector	179,770	17.50%
Agriculture products	135,910	13.2%
Utilities and construction	44,240	4.3%
Forestry	4,210	0.4%

Source: MFE, 2003, Table 12-2

Overall, the Wellington region is a net consumer of land, from outside of the region. This is due to 770,810 ha being embodied in imports, while 385,050 ha of land are embodied in exports, a difference of 385,760 ha (MFE, 2003, Section 12.5.2).

The regional ecological footprint resulted in a per capita footprint of 2.40 ha (MFE, 2003, Section 12.2); this is below the New Zealand average of 3.08 ha per person, as calculated by the MFE. Wellington's per capita footprint was the 5th smallest out of the 16 regions, as Nelson, Auckland, Tasman and Taranaki all had smaller per capita footprints. 'The main factor that seems to contribute to this relatively low per capita footprint is the efficiency achieved through the concentration of the urban population in the Wellington region' (MFE, 2003, Section 12.2). This is a reference to the availability of efficient public transportation, such as the bus and rail systems in Wellington. Although research done by the Ministry of Transport states that people in Wellington and Auckland travel more than in rural areas in terms of annual passenger kilometres travelled (Ministry of Transport, 2009), in both cases this difference is attributed to higher passenger kilometres on public transport.

In summary, the MFE's 2003 report on the ecological footprint of New Zealand and its 16 regions, including Wellington, showed that New Zealand's total ecological footprint was 11,684,650 ha or 3.08 ha per person in 1997/98. This result meant that New Zealand's ecological footprint was below the carrying

capacity of the country, using only 64% of the usable land available nationally. Conversely, Wellington's ecological footprint for 1997/98 overshot the region's carrying capacity 1.42 times. The region's ecological footprint was 1,029,050 ha or 2.40 ha per person. This is significant as it indicates that presently Wellington's ecological footprint is most likely still overshooting the region's carrying capacity.

It is evident from this information that New Zealand as a country is below its ecological carrying capacity, whereas the Wellington region is overshooting its carrying capacity. So far this information has focused on two calculated examples of ecological footprints for New Zealand and the Wellington region. It is also vital to look at the wider picture and understand what the world's ecological footprint is and compare this with New Zealand and other countries.

2.5.3 Living Planet Report 2010

The World Wildlife Fund (WWF) has written several reports in relation to biocapacity and ecological footprints. This section discusses the 2010 Living Planet report which used data relating to the year 2007, the most recent year for which data was available. This report addressed biocapacity and ecological footprints for the world and most countries. It was determined through this research that 'during the 1970s, humanity as a whole passed the point at which the annual Ecological Footprint matched the Earth's annual biocapacity – this is, the Earth's human population began consuming renewable resources faster than ecosystems can regenerate them and releasing more CO_2 than ecosystems can absorb' (WWF, 2010, pg 34). This is described as 'ecological overshoot' and this situation has been continuing since.

In this report it is stated that since the 1960s 'the ecological footprint shows a doubling of our demands on the natural world' (WWF, 2010, pg 4). This indicates that our 'unprecedented drive for wealth and well-being of the past 40 years is putting unsustainable pressures on our planet' (WWF, 2010, pg 4). From the research conducted by WWF it is understood that globally since 1961 both population and the average footprint have increased, and that this is why ecological footprints for countries around the world changed from being sustainable to the point where this is no longer the case.

This increase in the average footprint is due to increasing demand for resources as a result of economic growth. These resources include 'food and drink, energy, transport, electronic products, living space, and space to dispose waste, particularly carbon dioxide from burning fossil fuels' (WWF, 2010, pg 4). Many of these resources can no longer be sourced from within the boundaries of a nation, and therefore are sourced from other parts of the world, in turn increasing the ecological footprint of these products, as a result of transporting the goods. Many of these issues relate to rich countries, because many developing countries live within their biocapacities, out of necessity rather than choice. This is due to the lack of access to some resources, their lifestyles and economic situations. 'Rich nations must find ways to live much more lightly on the Earth – to sharply reduce their footprint, including in particular their reliance on fossil fuels' (WWF, 2010, pg 4).

In 2007, the global ecological footprint was 18 billion global hectares (gha), which equated to 2.7 gha per person. On the supply side, the total productive area or biocapacity, was 11.9 billion gha or 1.8 gha per person (WWF, 2010, pg 34). Therefore, the world was in 'ecological overshoot' of 50 percent, in other words 1.5 planets were needed to sustain the global consumption of 2007. Or it would take 1.5 years to regenerate the resources used by humanity in 2007 (WWF, 2010, 34).

If this overshoot persists, humanity faces several potential issues. These issues include greater pressure on ecological services, increasing the risk of ecosystems collapse, and potentially permanent losses of productivity. It is unknown at what point these issues may become reality and start affecting humanity and

other species on earth. It is predicted that continuing 'business as usual' will result in humanity requiring two earths by 2030 (WFF, 2010, pg 9), to absorb CO_2 waste and sustain the consumption of natural resources. However, unfortunately, the earth and the land available on it are finite. At this stage humanity does not know of another earth that can be used to sustain human consumption or create more land, so humanity must change before the effects of resource consumption become evident, by which point drastic actions may need to be taken.

As stated, the ecological footprints for most countries when calculated vary according to how the calculation was done, including that of New Zealand. The tables below show the results from the WWF study; the tables include information on New Zealand's ecological footprint and biocapacity and compare these results with other world figures.

As New Zealand is considered to be a high income country, information for the ecological footprint and biocapacity of high income countries is included in Table 10 and Table 11 below.

Table 10: Living Planet Report 2010, New Zealand's Ecological Footprint

		Ecological Footprint 2007 (global hectares per person)						
Country/ Region	Population (millions)	Total Ecological Footprint	Carbon[3]	Crop Land	Grazing land	Forest[4]	Fishing ground	Built-up land[5]
New Zealand	4.2	4.9	2.29	0.74	0.23	1.26	0.31	0.06
High Income Countries	1,031.4	6.1	3.78	1.02	0.23	0.70	0.26	0.07
World	6,671.6	2.7	1.44	0.59	0.21	0.29	0.11	0.06

Source: Global Footprint Network, 2010

New Zealand's ecological footprint for an average person, according to the Living Planet 2010 report, is 32nd in the world. Changes in the methodology used in the 2010 report, resulted in significant changes between the ecological footprint for New Zealand in 2007 and in 2005 (the previous report). In 2005, New Zealand's ecological footprint was 7.7 gha person and 6th highest in the world. Whereas it is now 4.9 gha per person, almost double that of the world average. Some of the countries with higher ecological footprints include United Arab Emirates (10.7 gha, the highest), United States of America (8 gha, 5th), Canada (7 gha, 7th), Australia (6.8 gha, 8th) and United Kingdom (4.9, 31st). New Zealand's footprint is lower than that of the average for high income countries according to WWF.

Most of the components that make up New Zealand's footprint are higher than the world values although New Zealand has in a lower overall footprint. New Zealand's agriculture industry contributes to these higher footprint values. The operations and resources used in the agriculture industry have contributed to the cropland, grazing land and forest components of the country's footprint. There are significant differences in these footprint components between New Zealand and the world and higher income countries. The Living Planet Report calculation has also taken into account the productivity of land, as with the Ministry for the Environment report, although this leads to a smaller value than the latter's estimation of 8.35 gha/person.

[3] Carbon footprint of a country's consumption includes direct carbon dioxide emissions from fossil fuel combustion, as well as indirect emissions for products manufactured abroad. World carbon footprint also includes consumption-related emissions not allocated to individual countries, such as from flaring of gas or oil, cement production, and tropical forest fires.
[4] Forest footprint includes fuelwood.
[5] Built-up land includes areas dammed for hydropower.

Table 11: Living Planet Report 2010, New Zealand's Biocapacity

Country/Region	Biocapacity 2007 (global hectares per person)					
	Total biocapacity[6]	Cropland	Grazing land	Forest	Fishing ground	Ecological reserve of deficit (-) (gha/person)
New Zealand	10.8	0.44	3.11	5.06	2.09	5.9
High Income Countries	3.1	0.99	0.29	1.19	0.49	-3.0
World	1.8	0.59	0.23	0.74	0.16	-0.9

Source: Global Footprint Network, 2010

Biocapacity, also known as carrying capacity, is the amount of productive land available, per person in global hectares, to sustain the resources appropriated for a given country. Table 11 above shows the biocapacity of New Zealand, high income countries and the world. It is clear from this table that there is significantly more land available in New Zealand (10.8 gha/person). New Zealand has the 9th highest biocapacity in comparison to the other nations, behind Gabon (1st), Bolivia, Mongolia, Canada, Australia, Congo, Finland and Paraguay (8th). New Zealand is also operating with an ecological reserve of 5.9 gha/person, as opposed to the global ecological deficit of -0.9 gha/person for the world overall. In comparison high income countries have a larger ecological deficit of -3.0 gha/person. This deficit is probably due to the lifestyles of people, leading to them using more resources in comparison to middle and lower income countries.

The number of countries in ecological deficit, as calculated in the Living Planet 2010 report, is growing. In the 1960s the biocapacity of most countries exceeded their ecological footprint, and the world had an ecological reserve of 0.63 gha in 1961 (Global Footprint Network, 2010). By 2007, the majority of countries and humanity as a whole were ecological debtors, with ecological footprints exceeding their biocapacities. This situation is a cause for concern. New Zealand is currently not in ecological deficit although it may not be long before, like so many countries around the world, it is, as peoples' lifestyles increasingly require more resources to sustain them and the population grows.

[6] Biocapacity includes built-up land

Part 2 - New Zealand and Wellington Information

This chapter provides background information for the time period and location selected for this study. The first section will cover the significance of the 1950s as the decade for which the ecological footprint of Wellingtonians will be calculated. Information relating to present day New Zealand and Wellington in the 1950s will briefly be discussed, with a more in depth discussion for Wellington in Section 4.1 (page 43). This information is provided to form a comparison between Wellington during the 1950s and present day New Zealand. The area studied within the Wellington region will also be defined and justified.

2.6 Significance of the 1950s

This section explains the reasons for selecting the 1950s as the time period for which the ecological footprint of Wellingtonians will be calculated. There are two key outcomes from this selection, the first being to understand whether the lifestyles of Wellingtonians were more sustainable in the 1950s through having a lower ecological footprint, and whether people perceived their quality of life to be good when compared with the present day.

The first reason for choosing the 1950s is that this time period is post World War II (WW2). WW2 officially ended in 1945 (The Library of Congress, 2009). Several economic changes occurred before, during and post WW2, and these had an impact on the economy in New Zealand and Wellington. A great boom occurred in New Zealand's economy prior to the end of WW2 and continued during the 1950s. This began in 1935 (Easton, 2010) following the depression but continued as stated above. Partly this was the result of 'very strong production during the Second World War, as people worked long hours and women worked outside the home as a part of the war effort' (Easton, 2010). This boom occurred throughout New Zealand and would have impacted on Wellington.

Following the end of the WW2 in 1945, growth in New Zealand's economy slowed as immediate post-war adjustments were made. This changed in 1950 (Easton, 2010) as strong growth occurred again, and continued until 1966 (Easton, 2010). This second boom in economic growth was the result of high export prices for pastoral exports and an increase in manufacturing which resulted in a growing labour force. This increase in economic activity came as a result of overseas economies growing, as the 'markets opened up for New Zealand's agriculture products' (Peden, 2009). New Zealand was exporting meat, wool and dairy products, primarily to the British market (Easton, 2010). The outcome of this period, and into the 1960s, was a buoyant time for farmers, as they had capital to invest back into the land through buying more machinery and livestock. The increase in production, demand, and exports meant that 'they developed their land, increased stock numbers, improved livestock productivity and enjoyed new prosperity' (Peden, 2009).

The growth in the labour force meant that unemployment was very low, and this encouraged people's spending. 'There was much personal investment in new homes, and in consumer goods such as whiteware' (Easton, 2010).

These changes in exports, manufacturing and the labour forces as a result of the economic boom worldwide and in New Zealand, indicate there would also have been a change in ecological footprint. Even though most of this information is relevant to New Zealand as a whole, this impacted on the Wellington area as well.

The second reason for the 1950s being the time period for this study is also in relation to the end of WW2. Wellington experienced, as did the rest of New Zealand, significant growth in the population at this period. This population increase was due to the post war 'baby boom' and immigration.

The 1950s saw increases in assisted immigration from countries like The Netherlands, Austria, Germany, Denmark and Switzerland (See Appendix K for further details), as people were displaced from their countries as they rebuilt and recovered after WW2. Following the end of WW2 New Zealand also experienced its own 'baby boom'. This started in 1946 when more than 41,000 babies were born (Morris, 2010) which was a record at that time. There was an upwards trend in the number of babies born each year from 1946 through the 1950s, for example in 1956 50,000 babies were born in New Zealand (Morris, 2010).

Wellington also experienced an increase in population in the 1950s. The 1951 New Zealand Census for 'Increase and Location of Population' (Statistics New Zealand, 1952c) stated that the Wellington city urban population was 124,555 in 1951 at the time of the census. The population of the Wellington region was 390,682. The 1956 New Zealand Census for 'Increase and Location of Population (Statistics New Zealand, 1957g) stated that the Wellington city population was 138,297 in 1956, an increase of 13,742. The Wellington region had a population of 429,184, a significant increase of 38,502. This is an indication that people were moving out of Wellington City and into the surrounding areas, which were developing with the demand for more housing in the region. Growth in the Wellington city population also occurred prior to the 1950s, as people returned from the war. The population grew from 117,981 in 1936 to 126,924 in 1945 according to the associated Population Census, an increase of 8,943 people.

There was a housing boom during the 1950s in Wellington and this was due to the population growth in and prior to the 1950s and the fact that the building of houses and the development of the city was very limited during the WW2. This housing boom resulted in the Wellington City Council building 'high-rise apartment blocks for single people and couples' (Maclean, 2009). In addition to this there was growth outside the Wellington City area with the development of Porirua. 'In the 1950s the government began to build a city at Porirua, the largest state settlement ever' (Maclean, 2009). This aimed to 'create a new society' (Maclean, 2009) as well as fulfil some of the housing demand in Wellington as the population increased.

Wellington airport was also developed further during the 1950s as the existing aerodrome was too small. This is another example of the growth that occurred in this period. The development commenced in the mid 1950s with the new airport being completed in 1959. Areas of Evans and Lyall Bays were reclaimed and houses were demolished in Rongotai, in order to extend and realign the runway (Morris, 2010).

These factors of immigration and the 'baby boom', along with an increase in exports, manufacturing and the labour force during the 1950s, all indicate that changes in consumption occurred and, consequently demand on the land and resources available in the Wellington area. If this is the case, this would indicate changes to the ecological footprint of Wellingtonians from the 1950s and onwards. Most countries' ecological footprints have tended to continue to increase, rather than reduce or stay the same, if no consumption and lifestyle changes are implemented.

More importantly these changes, which occurred before and during the 1950s, resulted in change of lifestyle throughout New Zealand. The lifestyles people led were, in many ways, similar to the lifestyles people lead currently and would be considered 'modern'. This is due to the following factors; health care services and education were readily available and of a high standard; agricultural practices were modern due to the demand from overseas so there was investment in farms and farming technology; several

modes of transport were accessible and affordable (ownership of private cars was becoming more common and public transportation included trains, trams and buses); and regular holidays were more common. There were also several changes within the home; modern appliances were available; women working as well as the husband was accepted; the population was well fed; unemployment levels were low and income levels were increasing with economic growth. However, the way in which these modern goods and services available in the 1950s were utilised, would have resulted in a lower ecological footprint compared with the present. For example, if families owned a vehicle, they would only have one, rather than the two or three cars people commonly own today. They also used their cars differently in the 1950s. Rather than driving them short distances frequently, to work or the supermarket for example; cars were used less frequently and typically at the weekends for trips out of town and for holidays. These actions result in a low ecological footprint from embodied energy (car), fuel use and distance travelled. Prior to this decade, circumstances and lifestyles were different, due to the depression, World Wars and the level of consumer technology available. The similarities between lifestyle, technology and services available are the key factors for the 1950s being selected for this study. There are also several differences between the 1950s and current lifestyle and these will be discussed in the following sections.

2.7 New Zealand, Past and Present

This section briefly discusses New Zealand in the 1950s and now, based on the most current information available, in relation to population and lifestyle. This information is used to form a comparison between New Zealand and Wellington in the 1950s and now. Statistical information was sourced from the New Zealand Census for 1951 and that for 1956. Current information will also be discussed to highlight how much development has occurred in the 51 years since the end of the 1950s.

Table 12: Population increase in New Zealand 1951-2006

Population Census Year	New Zealand	Difference	Percentage Increase
1951	1,939,472	-	-
1956	2,162,907	234,590	12%
2006	4,027,947	1,865,040	86%

Source: Statistics New Zealand, Population Census (1951, 1956 and 2006)

Table 12 shows the increase in the New Zealand population since 1951. These figures are for 'Usual Residents' (those people who usually live in New Zealand, excluding overseas visitors) (Statistics New Zealand, 2007). By 1956, New Zealand's population had reached over 2 million and by 2006 the population had almost doubled since 1956.

With regards to housing, in 1951 there were 494,012 permanent private dwellings with an average 3.61 people per dwelling (Statistics New Zealand 1952e). In 1956 there were 563,052 permanent private dwellings with an average 3.58 people per dwelling (Statistics New Zealand, 1957d). During these years there was an increase of 69,040 permanent private dwellings. In 2006, there were 1,454,175 private occupied dwellings (Statistics New Zealand, 2007), over double the amount in 1956.

Lifestyle and information in regard to the five ecological footprint categories are discussed in depth in Section 4.1 (page 43). These are discussed in relation to Wellington; however the lifestyles of Wellingtonians will be similar to those of the rest of New Zealand.

2.8 Defining the Wellington area

The Wellington Regional area, as defined by the regional council, includes Wellington city and all areas north as far as Otaki. This region is shown on the map in Appendix I. However, because this region is extensive and covers several different types of areas, including urban and rural, the focus of this study is urban Wellington. Consequently an area has been defined for this study which is smaller than the Wellington region and includes mainly urban areas.

The area selected has been defined by the Wellington City Council boundaries, and includes the Wellington CBD (central business district) and surrounding suburbs north to Tawa and Takapu Valley (see Figure 4). This excludes the Hutt Valley. It was decided that this area would be excluded because it is under a different city council and would result in the study being more complex and significantly larger.

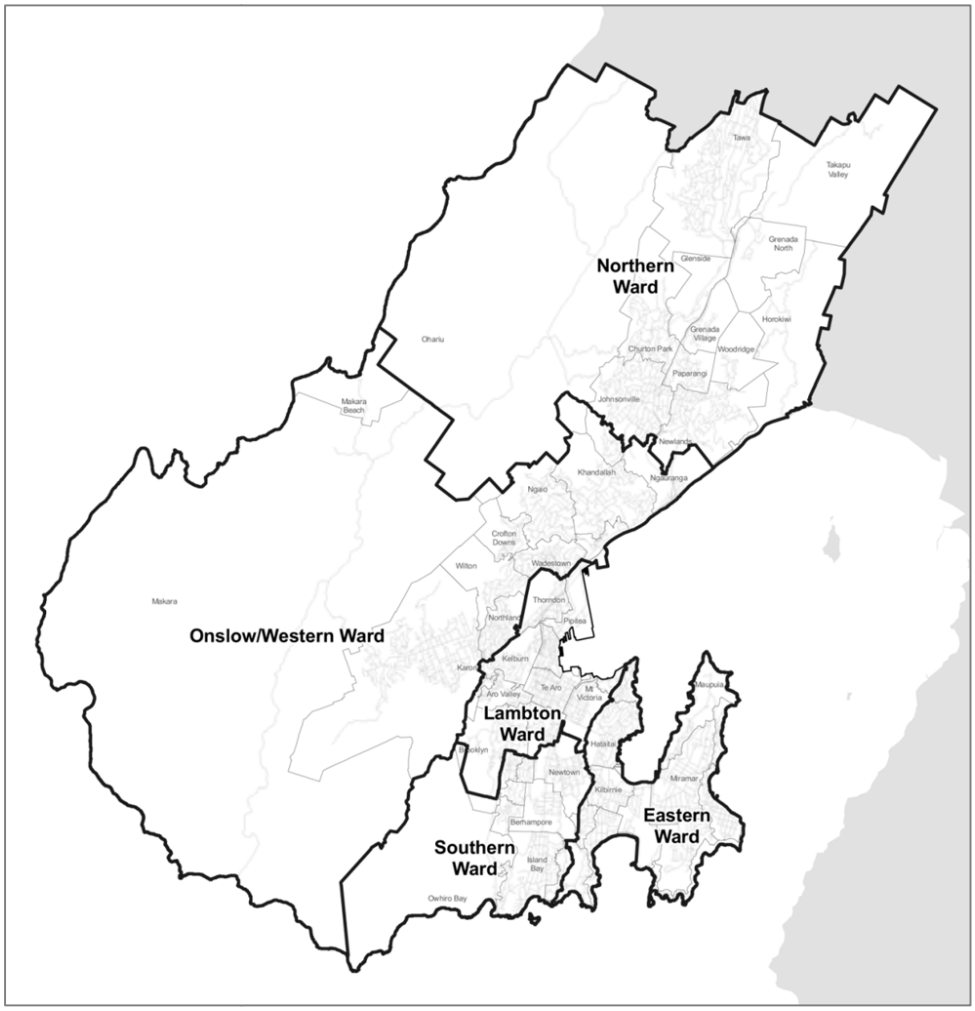

Figure 4: Wellington City Council area

Source: http://www.wellington.govt.nz/haveyoursay/elections/pdfs/allwellingtonwards.pdf

The area defined by the Wellington City Council is suitable because it is the area within which the tramways ran in the 1950s. Transportation is one of the categories considered for this study in terms of a resident's ecological footprint. Therefore, one of the main forms of public transportation that was then available to the residents in Wellington is included. Throughout this thesis when Wellington is referred to, this is the area that is meant, not the whole Wellington region.

Part 3 – Focus Group information

2.9 Focus Groups

Background information about focus groups is given in this part, describing what a focus group is and the advantages and disadvantages of this research method for surveying opinion.

Focus groups are commonly used to gather information from a small group of people who have a common characteristic. In the case of this research, the common characteristic is that the people lived in Wellington during the 1950s, and most still do. Focus groups 'encourage participants to share perceptions and points of view, without pressuring participants to vote or reach consensus' (Kruger et al, 2000). Focus groups are normally made up of 6-8 people at one time and 'most focus group applications involve more than one group, but seldom more than three or four groups' (Stewart et al, 2007). This enables trends and patterns to be identified. Stewart also states 'there are no general rules concerning optimal number of groups,' so unlike surveys the sample size can be determined by the research reflecting a suitable number of participants for the study. Vaughn et al (1996, pg 49) give a guide for two aspects that should be considered when selecting the number of groups, and therefore total participants; 'there should be a sufficient number of groups so that the findings tend to be repetitive and no new information is obtained, and there should be an adequate number of focus groups to reflect the range of participants who need to be interviewed to fully understand the topic.'

Focus groups are an effective method of data collection because compared with other forms of research, for example surveys, focus group discussions can be completed in a short time. Focus group discussions are typically 1.5 to 2 hours (Vaughn et at, 1996) and within this time period a significant amount of information can be collected. Other advantages of conducting a focus group according to Berg are that they:

- are highly flexible (in terms of number of participants, groups, duration);
- permit gathering of large amounts of information potentially from a large group of people in a short time;
- can generate important insight into topics that previously were not well understood;
- allow the researcher to better understand how members of the group arrive at, or alter, their conclusions about some topic or issue: this information can come from the moderator viewing the way people answer questions and their response to other people's answers;
- place the participants and moderator on an even footing;
- do not require complex sampling strategies.

There are also some disadvantages to conducting a focus group, and according to Berg these are that:

- the quality of the data is deeply influenced by the skills of the moderator to motivate and moderate the participants;
- focus groups lend themselves to a different kind of analysis than might be carried out with surveys or even individual interviews;
- the length or duration of each focus group should be kept brief (generally between 30-60mins) although longer focus groups do occur (Vaughn suggests between 1.5-2 hours);
- a limited number of questions can be used during the course of any focus group session: this allows for everyone to contribute, and typically throughout the entire session participants will each contribute 10mins to a focus group discussion;
- dominant personalities may overpower and steer the group's responses, and the moderator must be aware of this and try to avoid this situation;
- the researcher must be careful about how he or she uses (or attempts to generalise) information obtained from focus groups.

Focus group discussions were one of the methods of research used in this study, as they enabled discussion amongst a group of people of personal accounts of life in the 1950s. Statistical data can only provide so much information to build up a picture in relation to the 1950s. However, talking to people enabled the researcher to gather information for people's perceptions of the 1950s, and what their lifestyles and that of their families were like at the time. A group situation was chosen, instead of individual interviews, as discussion amongst people would help provoke memories. The set up of a focus group is also not as structured as an interview, with discussion keyed towards a topic generally, rather than answering specific questions. However, specific questions were used as preparation for these focus group interviews to ensure that the factual information needed was given. Vaughn et al (1996) suggest that ideally focus group discussions should consist of a group between of 6 to 12 members. They explain that 'fewer than 6 people may provide an insufficient number for a stimulating dialogue, and more than 12 are too many for all participants to get a chance to express their points of view' (Vaughn et al, 1996).

There are commonly three approaches or uses for focus groups according to Vaughn et al (1996); exploratory approach, clinical approach and phenomenological approach. An exploratory approach is used when investigating areas that are relatively unknown and to obtain 'prescientific knowledge' (Calder, 1977, pg 355). The clinical approach is related to clinical psychology, where the group set can be used to examine the 'emotions and unconscious motives' (Durgee, 1986, pg 58) when discussing a topic. Lastly, the phenomenological approach is used to understand an issue or topic from 'everyday knowledge and perception of [a] specific respondent subgroup' (Lindgreen & Kehoe, 1981). This is the most commonly used approach for focus group discussions and also the type of approach used for this research. The researcher has an initial knowledge of the topic and through this method is able to develop a more in-depth knowledge of the subject or clarify information from previous data.

A focus group consists of a moderator (or the person asking the questions) and the participants. These participants are selected based on a common characteristic that is required for the collection of the information. The moderator has several key roles, firstly the planning of the focus group. This planning stage can require a large amount of time, as the moderator must recruit participants, select topics or questions to be covered and familiarise themselves with the objectives of the study. Once this is complete, the next main role is to meet with the participants as they arrive and introduce them to each other. Following this the moderator will open the discussion and set up the rules of the focus group interview.

Throughout the focus group interview the moderator should maintain a comfortable environment so participants feel at ease and can share their opinions. Moderators must also control the topic; because the focus group essentially serves as a data source it is important that the moderator controls the topic of discussion. Unlike some data sources, there are no second chances with a focus group. If information is missed or a topic is not discussed the moderator cannot refer back to the focus group. This is because a focus group discussion is typically only run once, as if the moderator contacts a participant to discuss something mentioned or get further information, the collection of information is now by interview. The moderator is also responsible for ending the focus group discussion. In doing this he or she may wish to ask the participants for their final opinion or answers and summarise some of the main points discussed to allow the participants to contribute one last time before leaving.

Following the focus group meetings the data or ideas gathered must be analysed in order to find common ideas or patterns. The first step in this is to identify the big ideas, and these come from 'participants' words, ideas that occupied the focus group, intensity of participants' responses', as well as nonverbal communication' (Vaughn et al,1996). This information can form the basis of categories for which other information can be included. Data can then be analysed clearly in these categories for logical presentation later on in a report or verbal presentation.

2.10 Literature Review Chapter Summary

The literature review chapters have provided background information essential for understanding the chapters that follow and the study that was undertaken. These chapters have focused on three areas of the study, the methodology used to determine the ecological footprint, the study area and information specific to focus groups. What the ecological footprint is and how it is calculated for an average person for a specified population has been discussed. The area of Wellington defined for this study covers and relates to the Wellington City council boundaries. Brief background information was given in relation to both New Zealand and Wellington at present and in the 1950s in order to understand the differences and similarities between these periods. Lastly, information relating to focus group discussions was presented, describing why this method was used to obtain information from people who lived in Wellington in the 1950s.

The following chapter, Research Methodology, explains in more depth the process of the study. This includes information relating to the hypothesis of the study along with the research question which this study aims to answer. Following this is a description of the methodologies used in this study, covering what methodology was used to calculate the ecological footprint of Wellingtonians in the 1950s, and also the methodology used in the preparation and planning of the survey and focus group discussions and how these were undertaken.

3. Research Methodology

The literature review highlighted that there is widespread information relating to ecological footprint analyses with numerous examples of past calculated footprints for cities and countries with differing results. It is also clear, from published information, that there is a preferred methodology for calculating ecological footprints which has been tested and proven to be reliable. This is the methodology pioneered by Wackernagel and Rees in 1996. Bicknell (1998) went on to alter the methodology, making it relevant for use in New Zealand. The aim of this chapter is to explain the methodology used for this research. This is achieved through explaining several elements relevant to it. Firstly, the hypothesis for this research is stated and explained, based on the findings from the literature review discussed in the previous chapter. Then the ethics approval, granted for the collection of information from participants in the questionnaire and focus group discussions, is introduced. It then moves on to focus on the ecological footprint analysis, describing the method used for this study. The two main methodologies used for this research are discussed; the Bicknell methodology and the methodology used for the Canberra Ecological Footprint calculation (Close & Foran, 1998). The last section explains the survey methodology, discussing the process of administering the questionnaire and focus group discussions. Also presented is how the data and opinions collected will be used in relation to the calculated ecological footprint of Wellingtonians in the 1950s, and the reliability of the information.

3.1 Hypothesis

The ecological footprint of Wellingtonians in the 1950s did not overshoot the carrying capacity or biocapacity of the Wellington City area at that time.

Currently, the Wellington region's ecological footprint overshoots its carrying capacity or biocapacity and therefore is using more land than locally available to sustain the region's demands. This was determined through research into New Zealand's present ecological footprint, and Wellington's present ecological footprint. Wellington's 1950s (past) ecological footprint will be determined through the research conducted in this thesis and compared with the current (2006) footprint using the same methodology. Supplementary to this data, will be information gathered through a survey in the form of a questionnaire and group discussions with several focus groups consisting of individuals that resided in Wellington during the 1950s. This information will be related to the statistics gathered, to understand how participants perceived their lifestyle during this era, with particular emphasis given to lifestyle and quality of life.

3.2 Ethics Approval

Ethics approval was received on the 21st of June 2010 for the questionnaire and focus group questions. The ethics approval (see Appendix B) number for this research was No. 17719 and samples of the participants' information sheets and the outline of the questions can be found in Appendix A and Appendix D.

3.3 Research Methods

The methodology used for this research is the methodology modified for New Zealand by Bicknell (Bicknell et al., 1998) which is based on the methodology pioneered and used by Wackernagel and Rees in 1996. The purpose of the research was not to test the methodology or its accuracy in relation to the results. Instead, the aim of the research was to answer the research question proposed, which was, '*What was the*

Ecological Footprint of Wellingtonians in the 1950s?' This question was answered using tested methodologies that are trusted.

Initially, a literature review was carried out to understand the different methodologies used to calculate ecological footprints. The literature review also involved statistical research; this included finding data and statistics from the 1950s and the present. Two New Zealand Population censuses were complete during the 1950s, one in 1951, the second in 1956. These censuses included information specific to dwellings, age and marital status, jobs and incomes, and population. This data was used to find general information specific to New Zealand and Wellington during this period. Other information was gathered from the Ministry of Transport, Land Transport Agency, Statistics New Zealand, QV property information, the Food and Agriculture Organisation of the United Nations (FAO), Ministry for the Environment and Ministry of Economic Development. These were the main sources of data.

A 'bottom-up' or component approach was used to calculate the footprint of Wellingtonians in the 1950s and 2006. This approach was selected as it is commonly used to calculate the footprint of sub-national populations like regions or cities. Data is collected for an average person and summed together rather than at a national level and then divided between the sub-national population to find an average personal ecological footprint. It also provides a more detailed yet flexible analysis that is easily understood by the end-user.

Information was gathered and categorised into the five parts of an ecological footprint: housing, transport, food, consumer goods and services. This divided up the process of analysing the data and calculating the ecological footprint.

Following the review of published literature relating to Wellington in the 1950s, 1956 was the year selected during the 1950s, for calculating the ecological footprint of Wellingtonians. This year was selected as it enabled some in-depth information to be gathered from the Population Census. The literature review also highlighted a lack of information for some years in the 1950s, with some information not collected until the 1960s. This was the case for food consumption. Data was not collected by the FAO until 1961, so the data for this decade was extrapolated to estimate food consumption for 1956. If the ecological footprint was calculated for every year within the 1950s this would require a large amount of data and time consuming analysis, beyond the scope of this research. The depth and analysis of the 1950s ecological footprint was limited by the time and resources available. Therefore, it was assumed one year would give a sufficient amount of information and data to establish what Wellingtonians' consumption was in the 1950s and the associated lifestyle of residents.

Concurrently to the gathering and analysis of this data, the distribution and completion of the questionnaire followed by the focus group discussions was being carried out. This method enabled personal accounts and opinions regarding life in the 1950s to be gathered. This provided supplementary information to that already gathered from the New Zealand Census Statistics and other sources. This methodology is discussed further in the 'Focus Group Methodology' section of this chapter.

This study used both qualitative and quantitative research methods to gather the data and information needed to calculate the ecological footprint of Wellingtonians in the 1950s and the associated lifestyle.

3.4 Ecological Footprint Analysis Methodology

This section provides further detail in relation to the methodology used for this study. This study's methodology is based on established methodologies; the purpose of the research was to calculate the

footprint of Wellingtonians, not to test the methodology. Details of the methodologies used to calculate the footprint of Wellingtonians are explained, and this includes the Bicknell methodology and Canberra methodology. This is followed by a discussion on the specifics of the Wellington methodology and calculations, including data sources. This section also explains the reasons for using a 'bottom-up' analysis methodology for calculating the ecological footprint of Wellingtonians in the 1950s.

3.4.1 Bicknell's Methodology

In 1998, Bicknell (Bicknell et al., 1998) published a paper outlining a modified approach to the methodology developed by Wackernagel and Rees. It involved an adapted version of an input-output approach for application in New Zealand. This approach 'provides a consistent means of calculating an ecological footprint using data collected as part of the system of national accounts in most countries' (Bicknell et al., 1998, pg 149).

The Wackernagel and Rees methodology is considered to be the original methodology for calculating ecological footprints. By creating a consumption - land use matrix they aimed to provide a standardised system for data collection, analysis and the calculation of ecological footprints. This matrix consisted of five major consumption categories: housing, food, transport, consumer goods and services, and six major land categories: energy, built environment or degraded (referred to as consumed land in this study), garden, cropland, pasture (referred to as grazing land in this study) and forest land. Statistics are collected in relation to consumption and population to find an average person's annual consumption. Through this information 'land that is appropriated in the production and maintenance of every good and service consumed by a particular community' (Bicknell et al., 1998, pg 150) could be accounted for.

However, when using this methodology to calculate Canada's ecological footprint, data was collected from a wide variety of sources. A mixture of government publications with national averages were used for consumption and trade data. Productivity and yield values were based on world averages that were obtained from a range of studies. Some data spanned a long time period and may not have reflected the then current situation if not regularly updated. As a result their research 'cannot be easily reproduced or meaningfully compared across time or between populations' (Bicknell et al., 1998, pg 151). Using world averages can result in an inaccurate estimation of a population's ecological footprint. For example yield factors for crop production vary between countries. In 2006, the yield for apples in New Zealand was 36.42 tonnes/ha, while the world average was 13.52 tonnes/ha (FAOSTAT, 2006). This higher yield factor for New Zealand would result in a lower footprint for this product.

These issues led to Bicknell modifying this methodology, to create 'a more integrated approach to the calculation of an ecological footprint' (Bicknell et al., 1998, pg 151). This was through the use of established national databases that are commonly updated regularly in developed countries, where data is often collected on a yearly basis. Some New Zealand examples include Statistics New Zealand, Ministry of Transport and the Ministry for the Environment.

Bicknell's methodology uses economic value and productivity of the land required for goods and services. This is determined by calculating the amount of land per dollar needed to provide levels of consumption, expressed as hectares per dollar. Other methodologies, like Wackernagel and Rees', use energy values using an energy to land ratio, expressed as GJ/ha to produce resources. This methodology uses a 'top-down' approach 'the ecological footprint for the entire economy is converted to a per capita ecological footprint by dividing by the total population' (Bicknell et al., 1998, pg 153). This methodology is detailed further in the publication 'New methodology for the ecological footprint with an application to the New Zealand economy' (Bicknell et al., 1998).

The next section discusses the methodology used for the Canberra ecological footprint, this example was used as a precedent for this study and the presentation of the analysed results.

3.4.2 Canberra Methodology

As part of research undertaken by the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO), the ecological footprint of Canberra was estimated for the financial year 1993/1994. A methodology similar to that developed by Wackernagel and Rees was used. A consumption – land use matrix was used, with the same six land categories and five main consumption categories as those outlined by Wackernagel and Rees (See Table 13).

A 'top-down' approach was used to estimate Canberra's average per person ecological footprint. Consumption data was collected for Australia or Canberra and divided by the population to estimate the footprint of the citizens of Canberra. As with the calculation of many ecological footprints, a wide variety of sources were used for consumption data. However, most of it related to either local or national data, which is more accurate than using world averages in some cases. Where local data was available, for example 'land area covered by housing or the road transport fuel used in the ACT [Australian Capital Territory]' (Close & Foran, 1998, pg 16) it was used to provide the most accurate reflection of consumption in Canberra. National averages were used for some data, such as the consumption of food, or fuel for rail transport, because local data was not available. The year 1993/1994 was selected for this study as it provided the most up to date data at the time; this prevented using historical data or making assumptions.

Table 13: Canberra's Ecological Footprint Matrix

Source: Close & Foran, 1998, pg 12

Land Type	Food	Housing	Transport	Consumer Goods	Services
Consumed	Soil erosion, salinity, landfill	Land built over by houses	Roads, pavement, bike paths	Landfill, polluted sites	Built over for community centres, etc
Garden		Private gardens			Urban open spaces and sports fields
Crop	Food crops eg. fruit, veges, grains			Non-food crops eg cotton, tobacco	
Grazing	Grazing land for meat and dairy			Grazing land for wool production	
Forest	Food packaging	Construction materials		Packaging and production	Paper advertising, banking etc
Energy	Energy for machinery, fertiliser etc	Energy for building materials, heating etc	Energy to make & fuel vehicles and roads	Energy to produce goods	Energy to produce services

The embodied energy calculations, used to calculate the energy land component, for the Canberra ecological footprint used two different methods. The first method used energy analysis research for motor vehicles and building materials to estimate the embodied energy of these products. Embodied energy relates to the energy used to: mine/harvest the raw materials, manufacture and process the goods and services, and transport the goods and services to consumers (Close & Foran, 1998, pg 17).

The second method used energy intensity data for goods and services. 'Energy intensity is the amount of energy embodied in any commodities in proportion to its monetary value' (Close & Foran, 1998, pg 17). Energy intensity data is commonly available at a national level, and is calculated using 'input-output' patterns of production. This data is given as energy/value (for example GJ/$) of a good or service. To calculate the embodied energy of these products the amount of money spent within the consumption category is multiplied by the energy intensity figure.

The example used by Close & Foran is given below.

Expenditure x Energy Intensity = Embodied Energy

($A) (GJ/$) (GJ)

Source: Close & Foran, 1998, pg 17

The estimation of Canberra's ecological footprint started with the collection of data relating to resource consumption in Australia and ACT. Economic and expenditure data was collected to estimate the embodied energy in goods and services.

This was followed by the use of this data and information to estimate the ecological footprint for each consumption category and the related land types needed. Once the ecological footprints for these categories were calculated, they were summed together to find the total ecological footprint for Canberra, which was divided by the population to determine the average per person land area required to sustain the consumption of Canberra's population.

The methodology and presentation used in the Canberra report for the findings, were used as a precedent for the ecological footprint of Wellingtonians. However, the approach used for the Wellington footprint was a 'bottom-up' approach; this and the methodology used are discussed in the following section.

3.4.3 Wellington Methodology

This section discusses the specific methodology and process undertaken to calculate the ecological footprint of Wellingtonians for 1956 and 2006. It was important that the same methodology was used for both years, so the results were directly comparable.

Both the ecological footprint methodologies developed by Wackernagel and Rees, that altered by Bicknell and the Canberra methodology have been used as the main methodologies for calculating the ecological footprints of Wellingtonians for the two years assessed. The Wackernagel and Rees methodology was selected as it is the methodology most other published methodologies are based upon. There is also widely published information on their methodology including 'Our Ecological Footprint: reducing human impact on the earth'. There are also several examples of their methodology being used to estimate ecological footprints, for example the previously discussed Cardiff and Alberta footprint studies. The Canberra Ecological Footprint report (Close & Foran, 1998) is referred to throughout as well; this report was used as an example for some calculations and presenting results, and in addition was a source of data used in the calculations. These methodologies are not discussed in this section; however a brief summary is given in Section 2.2.

The proposed methodology was to use a 'bottom-up' approach or component based analysis (discussed in Section 3.4.3) to calculate the ecological footprint of Wellingtonians for both years. However, as data was collected, it became evident that the lack of information specific to Wellington city meant that national or regional data needed to be used and apportioned to the Wellington city population. An example of this is food consumption, as food data was only available for New Zealand, although it can be assumed that the

average consumption of a New Zealander can be applied to the Wellington population. Consequently, a hybrid 'bottom-up' and 'top-down' analysis was used, and all data was averaged to a per capita level before the ecological footprint was calculated for each footprint category, which is different to using a 'top-down' approach.

The data collection and analysis was completed in four steps; data collection, entering the data into spreadsheets and checking for errors, analysis and calculation from this data, and final results entered into tables. These steps and the processes involved are discussed below. It was important that the methodology was consistent for each category of the ecological footprint and for both years, for the research to be comparable and reproducible.

The first step, data collection, was carried out separately for 2006 and 1956 to ensure recorded data for both years remained separate. The aim was to complete the data collection stage prior to entering this data into spreadsheets and the analysis stage, however this was not possible, and data continued to be collected throughout the processing of the data. This was because records for some data were difficult to find, or data had already been collected but different sources of data were found as more research was conducted, that in some cases gave more accurate information. Data for 2006 was mostly collected first because most of this was in electronic form making it easier to access and find than data for 1956. Data was collected based on the five main categories of an ecological footprint (Housing, Transport, Food, Consumer goods, and Services). To ensure that all data needed was accounted for, data was collected for each category separately. As the data for each category was collected it was entered into Microsoft Office Excel spreadsheets, with the data source. Separate spreadsheets were allocated for each of the five main categories. This data was left unchanged, ensuring that the raw data could be referred back to throughout the analysis process. Once the majority of data for 2006 was complete and entered into spreadsheets, collection of data for 1956 commenced and followed the same process used for 2006. Since nearly all of the data needed for 2006 had been collected, this provided some sources for data from the 1950s. Collecting data for 1956 was a much slower process, as the majority of data was only available in printed form and some records were inadequate and more research was required. Also, unlike data collection nowadays, the published results were found in several formats, including data published in amongst text, which meant records from 1956 and adjacent years needed to be thoroughly read. Issues encountered collecting data are discussed in Chapter 6.

Once the majority of data required for each of the five main categories of the ecological footprint was collected, step two was begun. Step two involved ensuring the data collected was entered into the spreadsheets accurately and in the correct category. This step was conducted efficiently for 2006 as most data was transferred directly from electronic sources eliminating human error. Data collected for 1956 required more thorough checking due to the greater possibility of human error. At this stage data was also assigned the associated land use category (Consumed, Crop, Grazing, Garden, Forest, and Energy). Throughout this process examples of previously calculated ecological footprint reports were referred to, to ensure the correct types of data were being collected. Once this was complete for both 2006 and 1956, the data was checked to ensure all information that was available was included in these spreadsheets. An example of one of the spreadsheets can be found in Appendix H. Simultaneously, data continued to be collected for step one. No analysis of the data was made at this stage. Once this process was complete for all the data collected for both years, ten spreadsheets had been created, five for each year, one for each of the five main categories of the ecological footprint, and within each spreadsheet, data was divided into land use categories ready for analysis.

The third step was the analysis of the data and calculations of the components of each category of the ecological footprint. This step was completed for 2006 first, due to the quantity and accessibility of data. This step was completed in a new spreadsheet; this enabled the original data to be referred to as needed. As with the second step, each of the five categories of the ecological footprint was analysed and completed in turn. The analysis of the data prepared the data for the subsequent ecological footprint calculations, including averaging some data to a per capita figure, if required. Within each category the ecological footprints of the associated land use categories were calculated separately. This process was repeated until all land use categories within each of the five categories were calculated. The data analysis and calculations used for 2006 were then used as a template for 1956 to ensure the same process and calculations were done for both years. Once the ecological footprints were found for the land use categories, these figures were summed together within the associated ecological footprint category to find the resultant ecological footprint per person for the category.

The final step was to arrange the final results for presentation. New spreadsheets were created for each ecological footprint category for each year, thus ten new spreadsheets were created. Data tables were produced within these spreadsheets. Tables were created for each land use category, and the original data, calculated data and final ecological footprint results were transferred into these tables. These are the tables that are presented in Chapter 4. One table for each of the ecological footprint categories was produced to show the land use components that contributed to the overall ecological footprint for the associated category. Each of these tables was transferred into a new spreadsheet containing five tables related to the ecological footprint categories. This information was used to calculate the overall ecological footprint per person for the relevant year.

The next section explains the energy to land ratio for New Zealand's energy, this was calculated using primary data for primary energy sources, obtained for 1956 and 2006.

Energy to Land Ratio for New Zealand

In estimating an ecological footprint there are two main types of land category. The first is the actual land used (consumed, crop, grazing and forest land), built on or converted to produce the resources needed to sustain the population being studied. The second is energy land; this is the land area needed to produce the total energy required for the population's consumption of energy and energy related to goods and services, and this is based on GJ/ha. Wackernagel and Rees estimate an energy to land ratio of 100 GJ/ha (Wackernagel and Rees, 1996, pg 69) as a global value, based on a CO_2 absorption approach for fossil fuel use. This figure does not take into account the reduced impact of hydroelectricity generation. About a third of New Zealand's primary energy generation is from renewable resources such as hydroelectricity, geothermal and wind. Therefore, two energy to land ratios were used for New Zealand and applied to the Wellington footprint calculations. The first estimated the energy to land ratio for domestic energy, taking into account the renewable resources used to generate the primary energy. The second was for all other energy use and used a higher value of 150 GJ/ha from Bicknell. New Zealand's forests are highly productive, with Bicknell stating that due to methanol production from wood the energy to land ratio for fossil fuel in New Zealand may be 150 GJ/ha (Bicknell et al., 1998).

The energy to land ratio for domestic land was calculated using values used by Wackernagel and Rees and information for New Zealand's split of renewable and non-renewable primary energy sources. A productivity of 1000 GJ/ha (Wackernagel and Rees, 1996, pg 69) was applied to the percentage of renewable primary energy, the majority of which is hydroelectricity in New Zealand. In 1956, hydroelectricity accounted for 96% of renewable energy (Palmer, 1974, pg 35). In 2006, hydroelectricity accounted for 39% of renewable energy, 40% was geothermal (Wackernagel and Rees do not provide

information for geothermal) and 21% other renewables including solar hot water, electricity generation from wind, biogas and wood (Ministry of Economic Development, 2007). Wellington has one of the largest wind farms in New Zealand (the other is in the Manawatu) having enough capacity to power 70,000 average New Zealand homes (Meridian Energy, 2009), or all the houses within Wellington city. However, all of New Zealand's energy generation is connected to the national grid, so energy produced from the wind farm does not directly supply Wellington. Therefore, only hydro electricity is accounted for in the renewables energy to land ratio, because wind generation only accounts for a small percentage of the overall primary energy generation in New Zealand. If Wellington's wind farm directly supplied Wellington this would alter the productivity of Wellington's energy sources because the productivity of wind energy is 12,500 GJ/ha (Wackernagel and Rees, 1996, pg 69). The remaining percentage of primary energy, which is from non-renewable sources, was multiplied by 150 GJ/ha (Bicknell et al., 1998). These calculations and the results are discussed in the results for the corresponding years.

3.5 Questionnaire and Focus Group Methodology

The survey, which involved a questionnaire and focus group discussions, is discussed in this section. Several focus group discussions, consisting of people who lived in Wellington in the 1950s, were conducted for this research. These were formed to gather further information to supplement that found through the data and statistics available. This information enabled a better understanding of the lifestyles that people led in the 1950s and their perception of life in the 1950s in Wellington. Prior to the focus groups' meetings, the participants were sent a questionnaire to complete, some questions of which would not be raised in the focus group discussions. The following sections will discuss the process and development of the questionnaire and focus group discussions, and the method used to analyse and combine the results.

3.5.1 Developing the Survey

Through the literature review it was established that the use of a questionnaire and focus group discussions were suitable for this type of research. Originally, all information relating to people who lived in Wellington in the 1950s was to be gathered at the focus group discussions, although as the questions were developed, it became evident that there were several relevant factual questions that were better answered through a questionnaire. This is because the goal of the focus group discussions was to gather opinions in a group situation. Consequently, questions were divided into factual and opinion questions. The questionnaire was primarily factual questions, with some opinion questions, for example those relating to quality of life (See Appendix D for questionnaire). The development of the questionnaire and questions in the survey were based on three aspects; the 5 main categories of an ecological footprint (Housing, Transportation, Food, Consumer goods and Services), the Quality of Life survey conducted in New Zealand every two years (Nielsen, 2009), and the New Zealand Population censuses from the 1950s. These formed the basis for the categories, format and types of questions in the survey.

The questionnaire was divided into seven sections; General questions, Housing, Work, Transportation, Food (Grown and Bought), Consumer Goods (Household items, Services, General activities) and Quality of Life. The New Zealand Population censuses from 1951 and 1956 aided in determining what questions would be asked in each section and how questions would be asked to help ensure participants answered them as required. Similar questions were used to those asked in these censuses. Questions in the Quality of Life section of the survey were based on those asked in the Quality of Life survey conducted by the Ministry of Social Development (Nielsen, 2009). These questions were formatted differently to other

questions, with most questions providing a space for participants to give a written answer. These questions were similar to those used for the focus group discussions.

The focus group discussions contained the same people that completed the survey, and the purpose was to build on the information already gathered through the questionnaire. As mentioned, the focus group discussions aimed to get the participants to discuss their opinions of the 1950s in comparison to now. Open ended questions were formed for discussion at these group meetings (See Appendix E). These questions were categorised similarly to those of the questionnaire, and covered Housing, Transportation, Holidays, Food, Household items, Entertainment, and General questions.

3.5.2 Selection of participants

From the literature review, suggestions emerged relating to the number of participants in each group (page 28). For this survey it was decided a group of 5 - 6 people would be used per discussion, with 4 - 5 focus groups in total, meaning between 25 - 30 people were needed to form these groups. The focus groups were kept small due to the age of the participants, the number of questions being asked and the suggested length of each focus group of about 1.5 - 2 hours (Vaughn et al., 1996). The aim for this study was to keep each focus group discussion to 1.5 hours; this enabled 15 - 18 minutes of talking time per person.

Participants were found and selected through several different methods. The participants needed to have lived in Wellington for at least a year between 1950 and 1959, although they did not have to reside in Wellington currently. A range of ages was also sought.

The process of finding participants began with contacts already known to the researcher and supervisor. These people were contacted via either email, phone or in person. A flyer was also created to advertise the study (See Appendix C). This flyer was first distributed around the Victoria University Design and Architecture campus and later was placed in Wellington City Council libraries, Wellington City Council pools, and retirement villages (with independent living facilities). The objective was to get information about the study into the Wellington community.

The delivery of the flyers to several retirement villages was followed up with a phone call to the village managers. This was to arrange a time to meet with residents and discuss the research further. This resulted in three meetings being arranged with three different retirement villages in Wellington. Each visit was during prearranged morning teas, where the study was explained and interested people were given further information (cover letter, consent form and an envelope to post the signed copies back in, see Appendix A and B), and their details were collected. This was the best method of recruiting people, as any questions people had could be answered straight away and the research and their participation in it could be explained thoroughly. The majority of people that participated in the study were from the retirement villages visited.

People interested in participating (from the community) were sent out information packs, containing the cover letter, consent form and an envelope for return of the complete form, or this information was given in person (retirement village residents). Once the signed consent form was received the questionnaire was sent out, with instructions on completing it. Participants were given at least two weeks to complete the survey prior to their assigned focus group discussion. Information packs were sent or given out until the target number of people was reached (25 – 30 people). There were a total of 30 participants for the survey and 21 participants for the focus groups, as some people were unable to attend a focus group meeting. A

total of four groups were conducted, two of which were made up of only retirement village residents, and the other two a mix of people in the community and retirement villages.

3.5.3 Conducting the Focus Group Discussions

The first focus group discussion was held on the 3rd September at the Karori community centre, and this group contained five participants. The second was on the 6th September at one of the retirement villages, and this group contained eight participants. The third was on the 7th September with five people (one participant did not come). The fourth was on the 4th October at the Kilbirnie community centre with three people (two participants did not come). Another four people who could not participate in the focus group discussion filled in a questionnaire only.

The four focus group discussions were recorded using a Dictaphone, so information could be accurately referred to in the analysis. Notes were also taken throughout the discussions relating to information and observations that could not be recorded on the Dictaphone, for example people's reactions to questions and who tended to share their opinion the most or speak the most. The focus group discussions were set up to be informal to encourage discussion. Some strategies were used to ensure that everyone in the group got a chance to express their opinion. To set up a discussion the first set of questions were asked and discussed one at a time with a different person being nominated to provide the first answer and following this the discussion moved on to the next person in the group until everyone had had a chance to share their opinion. Following the first set, the group was asked the next question and anyone could answer it. The participants were allowed to provide any information they felt relevant, but if their discussion went off topic a question was asked to prompt them back. The discussion was allowed to flow so that no information that the participants thought relevant to the discussion was missed. Each question was given a time period, so that the discussion did not focus too much on one topic. All focus group discussions lasted approximately 1½ hours as intended. The completed individual questionnaires were collected at the conclusion of the focus group discussion.

3.5.4 Analysis of focus group and survey results

This section describes the processing and analysis of the questionnaire and focus group discussion information. As previously mentioned, hard copies of the complete questionnaires were collected at the focus group discussions, and each focus group discussion was recorded. The processing of the information from the questionnaires will be discussed first, followed by the recordings from the focus group discussions.

There are generally four standard steps to the analysis of data, and these apply to both the questionnaire and the focus group discussion dialogues. These steps are: entering the data; cleaning this data; analysing the data and presenting it. These steps will be discussed in more depth for both forms of survey.

Due to the questionnaire being in hard copy and answers hand written, the answers and information needed to be transferred to an electronic format for analysis. Information was entered into Microsoft Office Excel 2007 spreadsheets. This meant the data and information could easily be analysed, graphed and compared against Census data and the information discussed in the focus group discussions. An example of the spreadsheet can be found in Appendix H.

Firstly, all the information and data from the questionnaires was entered as it was found on the questionnaire, and no information was adjusted or removed at this stage. Once this was complete for all 30 surveys, the data and information was cleaned and this was completed in a separate spreadsheet. This

involved removing any unnecessary or irrelevant data, leaving only the information specific to the question asked. Also some answers were adjusted so the wording of the answers was consistent. For example for the question about the construction material of the walls of their house in the 1950s, some people wrote timber while others wrote wood and as a result answers given as wood were changed to timber. This was done on a separate spreadsheet to keep the original data so it could be referred back to.

The analysis of the data depended on the type of answer given. There were three types of answers given; written, numerical, and tick lists. Numerical answers were analysed in terms of the maximum, minimum and average, and this information was then either put into graphs or tables. The tick lists were analysed in terms of the number of people who selected each option, and again this information was put into graphs or tables, to determine percentages and numbers of people. Both numerical and tick list data was compared with the number of people that answered each question, as some questions either did not apply to people or they did not complete a question. Written answers were analysed in a similar way to the focus group discussion dialogues. Key or main answers were found for each written answer and these formed categories or themes. The written answers were used in comparison with the data from the questionnaires and information from the focus group discussions. In addition, the questions asked in the focus group discussions aimed to expand on these written questions. The results and analysed data from the questionnaires can be found in Section 4.7 and Appendix E.

The information and opinions collected from the focus group discussions were analysed using a similar method to that of the written answers in the questionnaire. Vaughn et al. (1996) describe in their book the five steps to analysing data collected from focus group discussions. These are; identifying the big ideas, unitising the data, categorising the units, negotiating categories and identifying themes and use of theory. This process was followed for analysing the information gathered in the four focus group discussions. However, prior to the analysis audio material from each focus group discussion needed to be transferred to written format. Each recording from a focus group discussion was typed out directly as a transcript with all discussion included, whether irrelevant or unnecessary. The person speaking was also identified, if possible, and noted next to each statement or discussion. This information could then be related back to their questionnaire and was useful to see who influenced the group discussion or spoke often. Once the four transcripts were typed out, the main or big ideas were identified from each question and for each group. These were identified through group consensus on an idea or opinion raised. This also removed any information that was not relevant to the question. The next step was to unitise the data. This was done by identifying the units of information that formed the basis for the defining categories. Some categories were formed prior to the focus group discussion, and these related to the questions asked, for example housing, transport, and food. The fourth step was to complete steps one to three for all information provided and for each category. For each question the answers or information that were discussed in all groups were indentified. This was repeated for similar information or answers to questions that were raised by three, two or only one group. This was then used to complete step five, identifying themes and use of theory and from this commonalities were found between the groups' information. This information was summarised (See Appendix G for an example of the transcript analysis) and presented in tables relevant to the questions being asked. These can be found in Section 4.7.3 (page 144). The aim of this analysis was to determine consensus within each of the focus groups, based on the participants agreeing or disagreeing with information being discussed. This analysis was used to establish consensus between the focus groups.

The results from this analysis are discussed, in Chapter 5, in relation to the ecological footprint of Wellingtonians in the 1950s. A comparison is made to determine if there is a relationship between the ecological footprint of residents and the associated lifestyle and perceived quality of life and what the relationship is.

4. Results

Part 1 – Life in the 1950s

This chapter presents the research findings. Points from a continued literature review are discussed with results from the ecological footprint calculations and the questionnaire and focus group discussion findings. The results have been divided into categories. Firstly, information about Wellington in the 1950s and at present including population, lifestyle, resources and services is presented. The results of the ecological footprint calculation for New Zealand, as calculated by the Ministry for the Environment follow. This provides a comparison for Wellington's present ecological footprint. Following this are the results of Wellington's present footprint as calculated by the Ministry for the Environment (2003), with a discussion on the present lifestyle of people in Wellington. The subsequent section discusses the findings for the ecological footprint of Wellingtonians in the 1950s. These results are separated into the subcategories of the five main parts of an ecological footprint: food, housing, transportation, consumer goods and services. This is followed by a discussion of the lifestyle of Wellingtonians in the 1950s. The final sections focus on the findings from the questionnaire and focus group discussions. From this information a comparison is made between the opinions and information given by the participants and the findings from the data and information for the ecological footprint and lifestyle of Wellingtonians in the 1950s. Last is a discussion suggesting changes that could be implemented to reduce the current ecological footprint of Wellington to a more sustainable level.

4.1 Wellington in the 1950s

Wellington is the capital city of New Zealand, located at the southern end of the North Island. Table 14 shows the population of Wellington city and Wellington region between 1950 and 1959 (See Appendix J for a map of Wellington city in the 1950s). The population of Wellington city increased during this time, although the region's population increased more as suburbs on the outskirts of the city were developed due to the demand for housing.

Table 14: Wellington population 1950s

Area	1951	1956	Increase/Decrease	Percentage change
Wellington City	133,414	138,297	+4,883	4%
Wellington Region	216,398	234,198	+17,800	8%

Source: Statistics New Zealand, 1957g, Increase and location of population

4.1.1 News highlights from the Dominion Post for the 1950s

In their publication of a century of news from 1907 - 2007, the Dominion Post (Wellington's local newspaper) covered major news stories of the 1950s. Wellington experienced turmoil, tragedy, and change during this time. Turmoil came in the form of the Waterfront disputes in 1951 (The Dominion Post, 2007). Waterfront workers and unionists were on strike for 151 days from February until July, the result of a culmination of decades of unrest on the wharves. The economy was strengthening after the war and as a result the waterfront workers demanded higher wage increases to reflect this. The strike was not limited to Wellington as protests and strikes occurred around the country, including in the Waikato and Auckland.

This was followed by tragedy when the Tangiwai Rail Disaster occurred on Christmas Eve 1953. This involved the express train from Wellington to Auckland, and 166 people were killed when the train was

swept into the river by a torrent of water from Mount Ruapehu's Crater Lake. The lake's side collapsed, resulting in water rushing down the side of the mountain into the Whangaehu River.

1954 saw several significant events. It was during this year the royal tour of New Zealand occurred. The Queen visited the capital for the first time. Large crowds turned out to catch a glimpse of the Queen as she attended many events and drove through town. The same year, New Zealand was celebrating its first Trans-Tasman flight from Christchurch to Melbourne. International air travel was rare and expensive with most overseas travellers enduring long sea voyages. Wellington was also coming to terms with a changing youth culture. Lower Hutt youths had formed 'gangs' known as the 'milk bar cowboys' and motorcycle 'gangs'. These consisted of youths that had nothing else to do at the weekends. Their activities led to a police inquiry, termed the Mazengarb inquiry.

The following sections provide more detailed information on Wellington during the 1950s with regard to the five main categories of an ecological footprint: food, housing, transport, consumer goods and services.

4.1.2 Food

Wellington today is well known for its cafe and dining culture, however this was not the case in the 1950s. People commonly ate at home. This was partially due to the lack of places to eat out, but also because of cost, and New Zealand's culture for home cooked meals and baking. Lunches in the 1950s consisted of a packed lunch with fresh fruit rather than a bought lunch, and dinners were a standard meat and three vegetables. New Zealand was well known for its home baking culture during the 1950s. From the 1960s there was a decline in home baking due to an increase in women in the paid workforce and the convenience of commercially made biscuits and cakes available in supermarkets. At the start of the 1950s large vegetable gardens were also usually found in people's front and back yards, providing households with fresh vegetables year round. Since then home grown vegetables are less commonly found due to the decreasing size of sections and the availability of fresh and frozen vegetables in supermarkets.

The 1956 Population Census had questions relating to potato and vegetable production from household gardens. Figures 5 to 8 show the results from these questions.

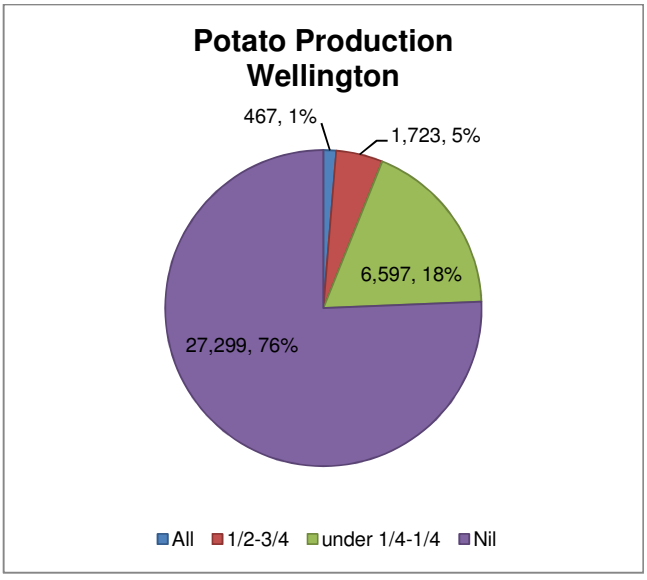

Figure 5: Household potato production in Wellington

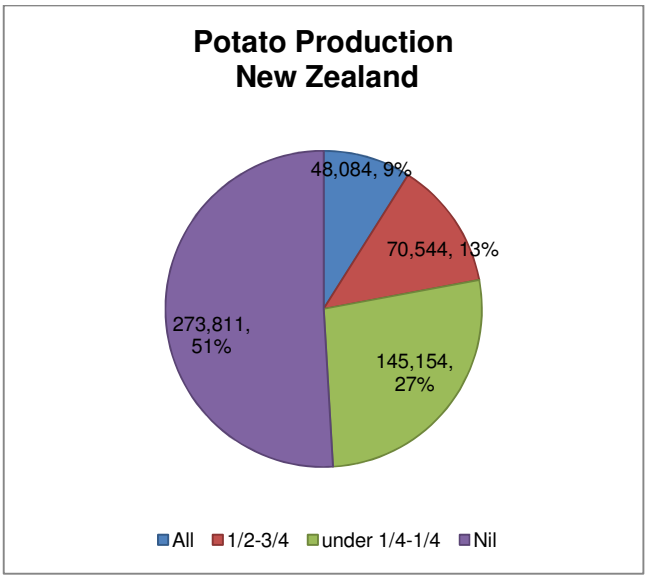

Figure 6: Household potato production in New Zealand

Figure 5 and Figure 6 show potato production for Wellington and New Zealand respectively. 76% of Wellingtonians and 51% of New Zealanders (purple) produced no potatoes at home. Only 24% of Wellingtonians produced potatoes compared with 49% of all New Zealanders. The majority of people that did produce potatoes (green) produced 25% or below of the total they ate, being respectively 18% of Wellingtonians and 27% of New Zealanders. This is followed (red) by 5% of Wellingtonians and 13% of New Zealanders who produced between 50% and 75% of their total potato consumption. The blue band represents the small number who grew all their potatoes.

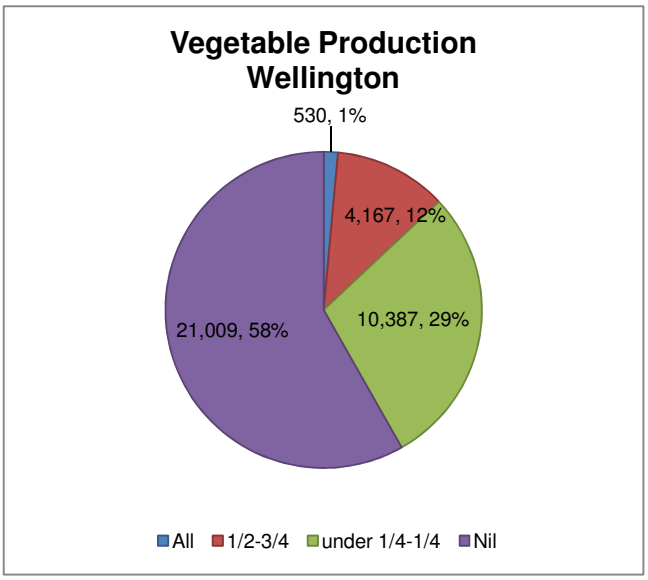

Figure 7: Household vegetable production in Wellington

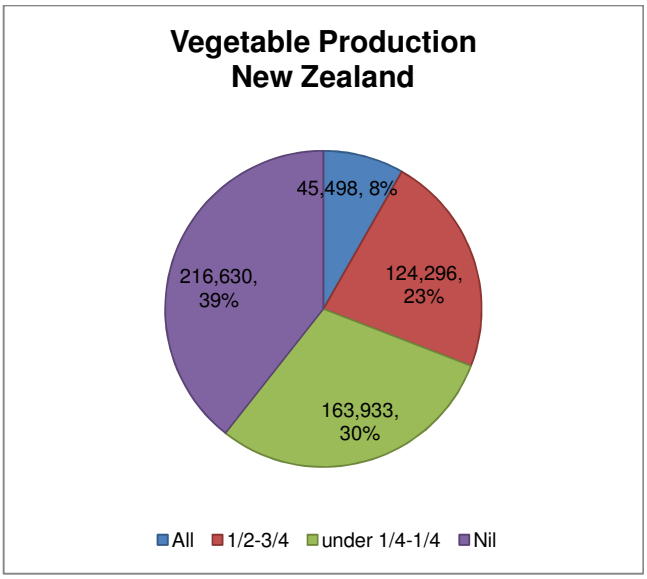

Figure 8: Household vegetable production in New Zealand

More people produced vegetables in comparison to potatoes. However, 58% of Wellingtonians and 39% of New Zealanders did not produce any. 61% of New Zealanders and 42% of Wellingtonians produced some vegetables and the majority of these produced 25% or below of their total consumed, amounting to 29% of Wellingtonians and 30% of New Zealanders. 23% of New Zealanders and 12% of Wellingtonians produced 50% - 75% of all household vegetables.

The Census also included questions relating to poultry; fowls, ducks and geese. The total number of poultry in the Wellington region (only data available for Wellington) was 590,924 in 1956; of this 94% were fowls. Of the people that owned fowls, 67% owned between 1-12 fowls with the average number of fowls being 9.2. This question has since been removed from the Census along with the questions on garden production, probably because of the declining interest in growing food at home. See Appendix L for further information.

Purchased food was bought from grocers, butchers, greengrocers, fruiterers, bakeries and dairies and, in the late 1950s, self service grocers. Until the 1960s towns and suburbs had small clusters of these shops. A list of food items was taken to the grocers, where the grocer would collect the items for customers. This was the case until the late 1950s. In Wellington the first self service grocer, Wardells on Willis Street, opened in 1956 (Walrond, 2010). Customers selected items from shelves and paid for them at the front counter. This was essentially a small version of the present day supermarkets. Supermarkets started to emerge in the 1960s and became common in the 1970s. The arrival of supermarkets brought an end to most grocers, butchers, bakeries and fruiterers, because food items sold at these stores could all be purchased in one stop at the supermarket.

During the 1950s, the corner dairy was commonly visited for small items such as milk. Milk and bread were purchased daily and delivery was offered by grocers and some butchers. A law introduced in 1945 led to the 40 hour week (Walrond, 2010) and this meant grocers could no longer open on Saturdays, although diaries were permitted to be open in the evenings and on Saturday. Vegetables and fruit were purchased from greengrocers and fruiterers to supplement what people grew in their gardens. It was common for these stores to sell fresh local produce, and people typically bought items daily. This practice would have affected Wellingtonians' ecological footprint for food.

Changes to the eating out culture occurred during the 1950s, as before this decade there were very few tea rooms and limited places to dine out. Milk bars had been in Wellington since the 1930s (Ministry for Culture and Heritage, 2009). Tea rooms closed in the afternoon, and pubs at 6pm, with restaurants commonly closing at 10pm and alcohol was not served with food until 1961 (Ministry for Culture and Heritage, 2007a). The 1950s saw the introduction of the modern cafe and coffee houses, which were influenced by the increase in numbers of Dutch immigrants. These changes bought about 'a more sophisticated culture of food, cooking and dining out' (Ministry for Culture and Heritage, 2007a) from the late 1950s, which is still evident in Wellington today.

4.1.3 Housing

By 1956, there were 36,764 houses in Wellington city with the average household size being 3.8 occupants per dwelling, compared to the national average of 3.58 occupants per dwelling (Statistics New Zealand, 1957d). The main types of housing available in Wellington were private houses, flats and boarding houses or hostels. Renting was the most common form of tenure in Wellington (35%) followed by buying on time payment (26%), then owned without a mortgage (23%) (Statistics New Zealand, 1957d). Wood was the most common outer wall for private dwellings throughout New Zealand, then brick, proprietary wall board of asbestos type, rough cast on wood lath and plaster, and concrete (Statistics New Zealand, 1957d). Houses typically had between 4-6 rooms and 2-3 bedroom homes were the most common. However, changes were happening, 'by the late 1950s, the bungalow/cottage had jettisoned its timber weatherboard/corrugated-iron claddings in favour of brick-veneer walls and tiled roofs: the Brick and Tile 'Style'. In the public mind, timber had gradually become a second-rate building material; bricks were seen as stronger and maintenance free' (Cull, 1994).

For the first time, the 1956 Population Census asked questions relating to household amenities: piped water, hot water service, bath or shower, flush toilet, refrigerators, electric washing machines and means of cooking. Figures 9 to 14 show the results from the 1956 Population Census for New Zealand. Data was not available separately for Wellington city.

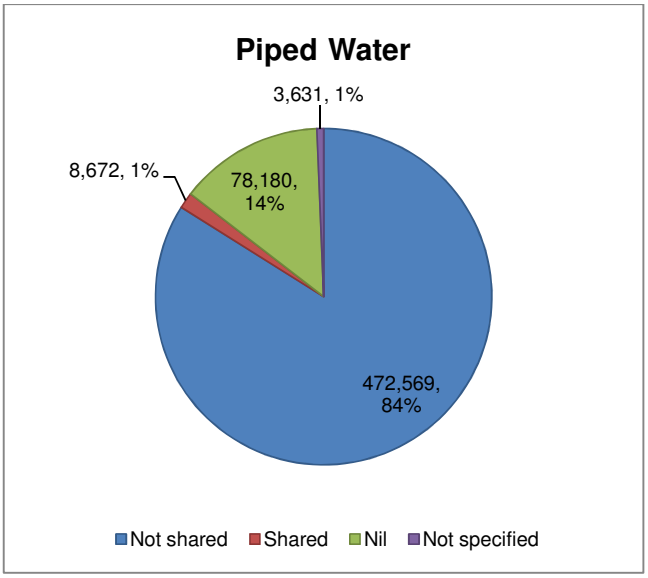

Figure 9: Availability of piped water to New Zealand houses

Figure 9 shows that the majority (84%) of New Zealanders had piped water in their houses by 1956, while 14% of households still lacked this amenity.

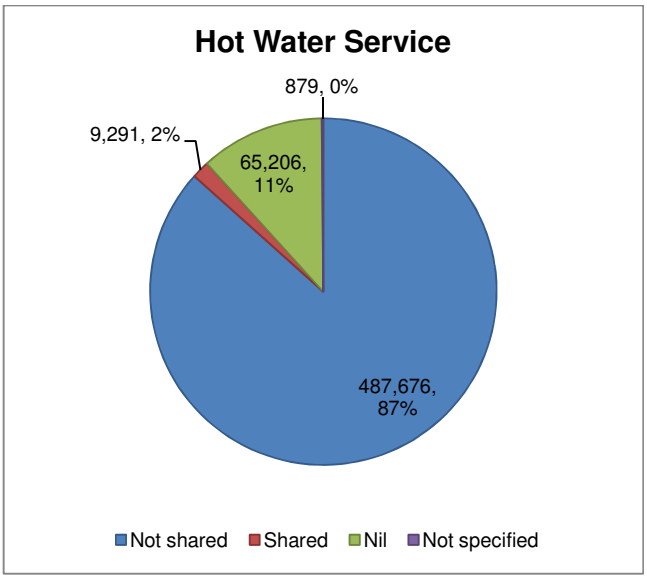

Figure 10: Availability of hot water in New Zealand houses

87% of New Zealanders had a hot water service by 1956, as shown above in Figure 10. 2% had access to shared hot water and 11% had no hot water connected.

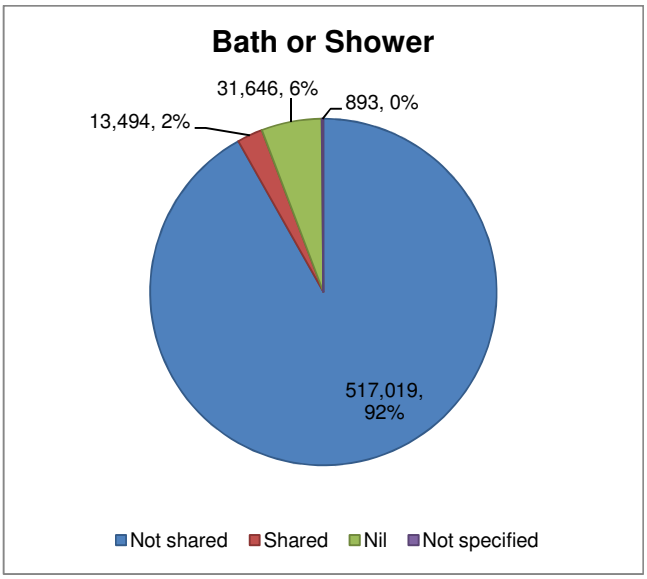

Figure 11: Number of installed baths or showers in New Zealand houses

Figure 11 illustrates 92% of New Zealanders had either a bath or shower that was not shared by 1956, although showers were less common than baths. 2% had access to a shared bath or shower and 6% of people had neither bath nor shower.

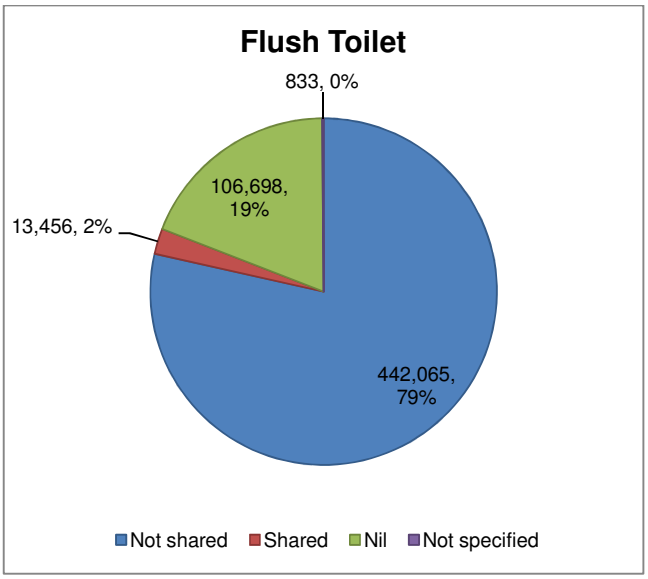

Figure 12: Number of flush toilets installed in New Zealand houses

79% of New Zealanders had a flush toilet in their dwelling, while 19% did not, and 2% had access to a shared flush toilet.

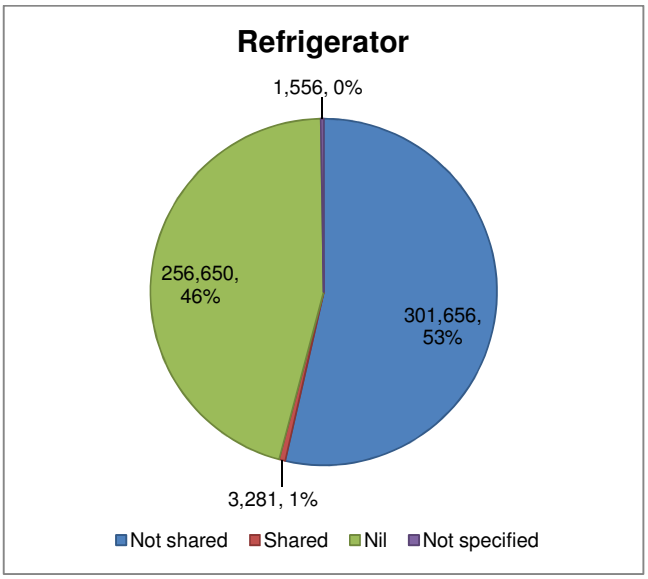

Figure 13: Number of refrigerators in New Zealand houses

Figure 13 shows that 53% of New Zealanders had a refrigerator in their dwelling, 1% had access to a shared refrigerator and 46% of people did not have one. People also commonly had a food safe, which was a metal box placed outside on the cool side of the house to keep food cool.

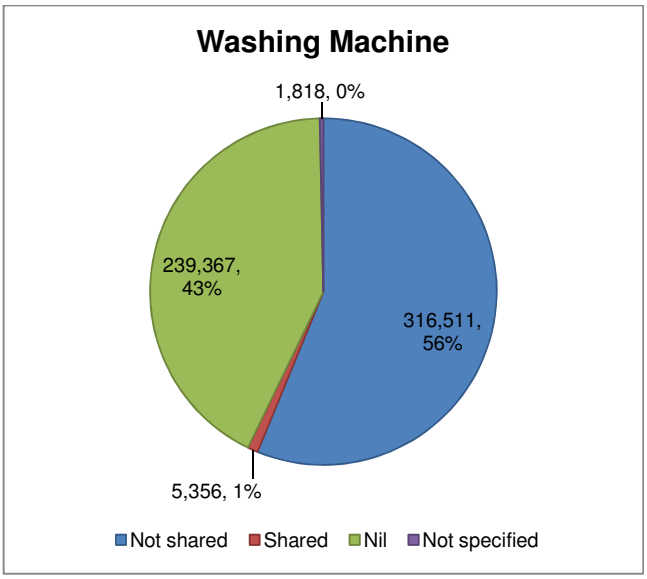

Figure 14: Number of washing machines in New Zealand houses

Over half (56%) of New Zealanders had a washing machine by 1956, although the electric washing machine became more common during the 1960s. The copper was still common in the 1950s. These were large 60 litre tubs that were placed in the wash house (normally detached from the house in the back yard). A fire was lit underneath to heat up the water, and clothes were boiled with homemade soap (Isaacs et al., 2007). 43% of people did not have a washing machine and 1% had a shared one.

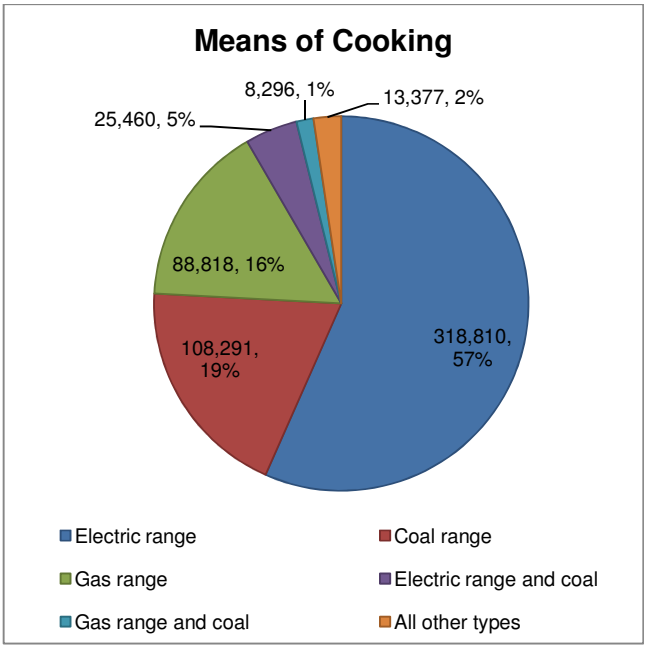

Figure 15: Means of cooking in New Zealand houses

By 1956, 57% of New Zealanders were cooking with electric ranges or ovens. These replaced coal, wood or coke ranges, which had been common in homes up until this time. 19% still had a coal, wood or coke range, and 15% had a gas range or stove in their house.

The New Zealand government introduced state houses in the 1930s, the first house being built in 1937 (Ministry for Culture and Heritage, 2007b). These were low cost houses provided by the government for

the poorest New Zealanders and those who otherwise could not afford market rents. In 1951, the government introduced a scheme whereby the tenants could buy their homes. Tenants were able to purchase their homes with a 5 percent deposit; they had a 3 percent mortgage rate, and a maximum purchase period of 40 years (Ministry for Culture and Heritage, 2007b). Over 3,500 New Zealanders purchased their houses during the first year of the scheme. There was also an increase in the number of state houses built in the mid 1950s, due to the demand for housing nationwide.

4.1.4 Transportation

Public transportation was well utilised during the 1950s, with the most common form being electric trams. Shank's pony (walking) was another widely used form of transport, with Wellington being a very walkable city, due to its compact nature. Diesel buses and electric trains were other forms of public transport available; diesel buses eventually took over with the last tram taken out of service in 1964.

The Wellington tramways that existed in the 1950s ran within the Wellington city area used for this study. The Wellington tramway was officially opened in 1878 (Lawes, 1966), operating steam and horse drawn trams. The city terminal for this service was located near the government buildings in Thorndon, where the current railway station exists. The original route covered much of the inner city.

In 1904, the first electric tram ran from Newtown to the north side of the Basin Reserve, and all horse drawn trams were withdrawn two months after this. Shortly after this, lines were opened throughout the city, including to the Botanic Gardens, Aro Street, Thorndon, Wallace Street, Berhampore and Oriental Bay. Double decker trams also known as 'Big Bens' were used throughout the city until the 1950s during peak times. 'Big Bens' were last used in 1954. The last tram way opened in 1940 and this was the Bowen Street deviation from Lambton Quay to Tinakori Road (See Figure 16 for the 1940s tram route).

Changes to the Wellington tramway system started in 1949 with the closure of the Wadestown line. Following this were changes to the Northland service. Originally, the trams ran during the week and Saturday, with buses running Sunday afternoon. Then the Saturday service was replaced with buses, and eventually in March 1950 the weekday trams were reduced to just morning and afternoon services to cover peak demand. Other times were serviced with buses. In 1954, the last tram ran to Northland, and all services to this area were then replaced with diesel buses. In 1957, the Miramar tram route was replaced with diesel buses.

During the height of the Wellington tram system there were 11 tram routes throughout Wellington. These routes provided a comprehensive coverage of the city. The trams ran until 1964, and the last line to be closed was the Thorndon to Newtown Park Zoo branch. Below is a map of the tramway as it was in 1940, when the last line opened, although from this point on the service was reduced and slowly replaced by diesel buses.

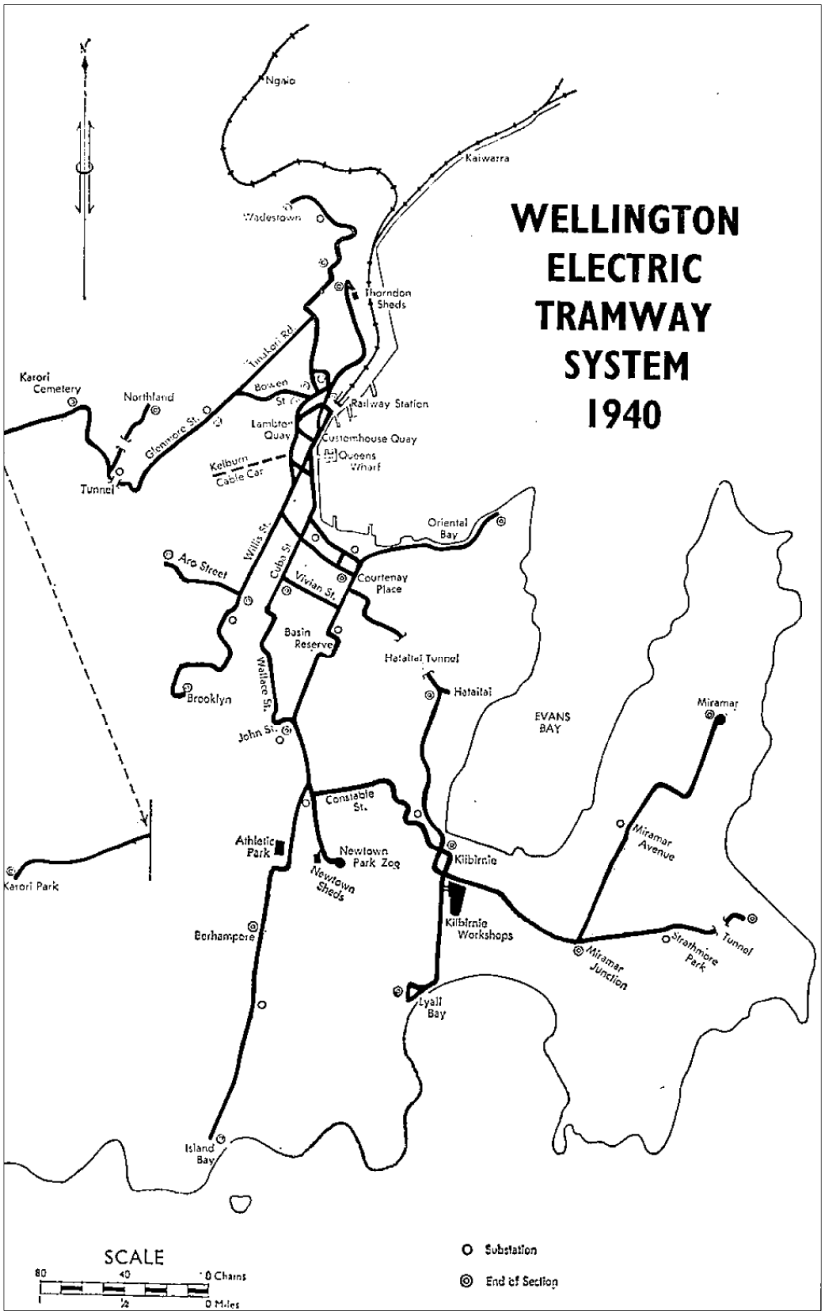

Figure 16: Wellington Tramway System in 1940

Source: Lawes, 1996, Wellington Tramway Memories

Both diesel and electric trolley buses ran in Wellington during the 1950s, and are still operational today. Trolley buses were first introduced in 1924 by the Wellington City council and discontinued in 1934 due to lack of patronage but reintroduced in the 1950s. Petrol buses were operational from 1926, although diesel buses replaced these in 1934. The buses in Wellington were privately owned and operated until 1946, when the council took them over, as replacements for the unprofitable trams (Humphris, 2010a).

Commuter trains were also a popular form of transport for longer distance travel within Wellington and along the North Island Main trunk line. Electrified railways were first introduced to Wellington in 1938 on the line between Wellington and Johnsonville and these replaced steam trains. The electrified railway was

extended to Paekakariki in 1940 and then to Paraparaumu in the 1980s (Atkinson, 2010). The other railway link was the Hutt Valley lines. These were electrified in the 1950s as they had become busy and well used lines for people travelling to and from work. These commuter rail services have remained largely unchanged since the 1950s. In 2009, the Wellington commuter trains had the highest use of any in New Zealand (Humphris, 2010b).

Wellington's harbour ferries were discontinued in 1948 due to low patronage (Humphris, 2010c), but they were reinstated in 1989. The original ferry service crossed the harbour to Days Bay, although in 1901 the ferry also stopped in Miramar, Seatoun and Karaka Bay. New services to Petone and Somes Island were added in 1989. This ferry service is still operational. In addition to the local ferries, interisland ferries travelled between Wellington and Lyttelton (Christchurch), and also between Wellington and Picton. The Wellington to Lyttelton ferry service was discontinued in 1976 (Humphris, 2010c) as people favoured the Wellington to Picton route. This service is still running and is a popular alternative to air travel between the islands.

Air travel was expensive and limited during the 1950s and both domestic and international air travel were rare until the 1960s. Wellington airport was expanded during the 1950s. Work was begun in the mid 50s in Rongotai to extend the runway, and was complete in 1959 (Maclean, 2009) just before air travel became more widely available. Data for 1955 shows that there were 123,100 international passenger arrivals or departures to New Zealand. In 1961 there were 238,900, almost double and by 1969 there were 568,100 passenger arrivals or departures (Ministry for the Environment, 2007, Transport: current pressures and trends). Two thirds of passengers travelling to or from New Zealand were by sea in 1950 (Ibid).

Privately owned transport increased during the 1950s, and this was largely influenced by the suburbs and houses that were built. The decline in public transport, especially the tram services, led to people purchasing cars in the late 1950s. During the 1950s more houses included a driveway and garage. Suburbs in Wellington city, along with most urban centres in New Zealand, were also expanding further from the town centres and were not as well serviced by public transport. This meant owning a car gave families greater freedom to travel. Families commonly only owned one vehicle, if any, whereas presently it is more common to own two vehicles. In 1950, there were 0.21 cars per person, by the end of the decade in 1959 there were 0.31 cars per person. In 2005, there were 0.74 cars per person (Ministry of Transport, 2005).

Bicycles were also frequently owned in Wellington, although the hilly nature of the city deterred many from cycling around it, especially since bicycles still had limited gears; 2, 3 and 4 speed bicycles were common (Mackay, 2010).

4.1.5 Consumer Goods

Demand for modern consumer goods increased during the 1950s due to their increased availability and the post war economic boom. As previously discussed, over half of all New Zealanders owned a fridge, washing machine and electric oven by 1956, respectively replacing food safes, coppers and coal ranges. The cost of living increased during the 1950s and this was 'bought about partly by the increasing desire for material goods' (Ministry of Culture and Heritage, 2007c). Other items that were commonly owned were a radio, telephone, vacuum cleaner and several small kitchen appliances, for example electric toasters and kettles, all of which had become more readily available. However, TV did not come to Wellington until mid 1961 (Ministry of Culture and Heritage, 2010) and microwaves were not available until the 1980s.

'Modern' consumer goods were more readily available as manufacturing of goods increased in New Zealand and imports were unlicensed resulting in cheap products arriving from overseas. People were also experiencing pay rises due to the economic boom, and had money available to buy the consumer goods that were becoming popular.

4.1.6 Services

This section briefly covers the availability and quality of public services available to New Zealanders during the 1950s. Services discussed include health, education, recreation, financial and communication services. In 1950 the National Party was in government, prior to this the Labour Party was in government from 1930 until 1950 (Goldsmith, 2010). The National government strove to recover New Zealand from the difficult times during World War II and improve services available to the public.

As previously discussed, in Section 2.6, New Zealanders were living what would be considered a 'modern' lifestyle in the 1950s. This was partly due to the availability and high standard of health care and educational services. This is further justified by an increase in health during the 1950s (Wilson, 2009). Wellington hospital, in Newtown, was operational during the 1950s, providing free public health care, including emergency services and surgery. Local doctors' clinics and dental surgeries were found in the main suburbs offering these services at a cost to the public.

Prior to the 1950s, in 1944 the government passed a law to make education compulsory up to 15 years of age (Phillips, 2009). As a result people entering the workforce would have a minimum level of education, thus increasing the knowledge and skills of people in workplaces. Both state and private schools were available during the 1950s, with state school offering low cost education with the majority of costs covered by the government.

Sporting and leisure activities have always been an integral part of New Zealand society. More people embraced such activities after the war with more freedom to do so. Most of the activities people participated in during the 1950s were free or low cost because money was limited. Examples of such activities include children and teenagers in suburban areas gathering in the streets and parks to play cricket and football. Others who lived in the hilly suburbs raced trolleys and bicycles down the steep streets (Schrader, 2010). 'The pictures' (cinema) was also a popular past time. Trips to 'the pictures' were often a weekly activity with parents or friends. Going to the cinema was a relatively inexpensive activity, whereas live theatre and concert performances were seen as activities for the wealthy. Shopping trips into town with parents were often seen as special occasions. This meant scrubbed faces and donning best clothes for trips to the department stores and tea rooms.

By the mid 1950s the Post Office Savings Bank controlled approximately 80% of New Zealand's personal savings market (Tripe, 2010). Other financial institutes were established from 1950 – for example building societies and financial companies opened up the market and provided customers with services banks could not offer. Changes occurred within other financial sectors, one example being life insurance companies starting to include the fire and general insurance market. Lending and mortgages also changed with insurance companies starting to invest increasing amounts of capital reserve in mortgages. These changes established the integrated financial services industry of today (Henderson, 2010). Several changes also occurred in taxes during the 1950s. By 1950 income tax was 26% of earnings, having increased from 15% during the Labour Party's time in government 15% of this tax was a war surtax, introduced to help fund the war (Goldsmith, 2010), but this was eliminated by the National Party in the 1950s. After, tax remained practically unaltered during the 1950s, apart from some insignificant adjustments. The Pay As You Earn (PAYE) income tax system was introduced in 1958 (Goldsmith, 2010),

and this meant tax was deducted fortnightly directly from wages and salaries. Previously, income tax was due in a lump sum at the end of each year. In 1957, Labour was elected into parliament and in 1958 they introduced the 'black budget' which increased company tax by adding taxation dividends on top of direct tax already collected from companies. This resulted in company income being double taxed until the 1980s. Other changes included taxes almost doubling for beer and cigarettes (referred to as 'sin tax') which was not received well by the average working man and sales tax on cars and petrol increased (Goldsmith, 2010).

Letters, telephone calls and radios were vital forms of communication during the 1950s. Communication during the 1950s was dominated by post, and every year 87 letters and postcards per person were sent, with an additional 8 million telegrams for the whole population (Ministry for Culture and Heritage, 2011). Letters were an important mode of communication with people overseas, because toll calls were expensive and not everyone had telephones. Even though telephones were available, they were relatively rare in New Zealand; there was approximately one phone for every five people and party lines existed in country districts serving up to ten customers each (Ministry for Culture and Heritage, 2011). There were often arrangements between neighbours to use their phones in emergencies if one did not have a phone in their house. Radio was state controlled but provided people with news and entertainment, and families would often gather around the radio and listen to stories being read. As previously mentioned there was no TV in Wellington until 1961 (Ministry for Culture and Heritage, 2010).

4.2 Wellington at present

This section contains information on Wellington at present, covering population, map of the area, and quality of life. Some information is sourced from the most recent New Zealand Census conducted in 2006. Census surveys are conducted every five years in New Zealand and one was due to be conducted in March 2011; however it did not go ahead because of the Christchurch earthquake. Despite this data from it would not have been available for this research as it is not publically available until a year after its completion.

Figure 17: Wellington City 2006

Source: http://www.wellingtonmap.co.nz/WELLINGTON%20MAP%202006%20small.gif

The main findings from the 2006 Census of Wellington show the population for the Wellington Region (See Appendix I) was 448,959 (Statistics New Zealand, 2007) and the Wellington City population was 179,466 (Statistics New Zealand, 2007). The latter has since been estimated to have reached 195,500 (Wellington City Council, 2010). Around 70% of the population are European, approximately 12% are Asians, and the remainder Maori and Pacific Peoples (Statistics New Zealand, 2007). The majority of people living in the Wellington region are professionals (27%) or managers (17%) by occupation. The median personal income for Wellington City is about $32,000, and for other areas of the region ranges between $22,000 and $27,000. The most common means of travel to work was by private vehicle (39%), followed by walking/jogging (15%) and public bus (14%) (Statistics New Zealand, 2006). In the Wellington Region there were 168,846 privately occupied dwellings and 68,706 in Wellington City.

4.3 Quality of Life Survey

Every two years, since 2004 a 'Quality of Life Survey' has been conducted by Nielsen in conjunction with the Ministry of Social Development in 12 cities around New Zealand including Wellington, surveying a total of 7,500 residents throughout the country. The most recent survey results, for 2008, are discussed in this section and provide an insight into the quality of life in modern Wellington as perceived by a selection of Wellington residents. A subsequent survey has since been completed for the year 2010; however, results are not released to the public till 2011 so were unavailable for this research. Selected at random from the New Zealand electoral role, 513 people in the Wellington region were surveyed for this study. The survey consisted of several categories of questions covering; quality of life; health and well being; crime and safety; community, culture and social networks; council processes; built environment; public transport; and lifestyle – its work and study aspects. Further information on the survey and the questions asked can be found in the Nielsen, 2009 report. The 'Quality of Life Survey' questions were used as a guide for the questionnaire and the focus group discussion topics for this research. The resulting questions can be found in Appendix D and Appendix E, and are discussed further in Section 3.5.1 (page 38).

Overall, the city was rated positively for most aspects surveyed. Of the Wellington residents surveyed, 94.6% (Nielsen, 2009, pg 4) rated their overall quality of life positively, and of this group, 33.4% rated it extremely good and 61.5% rated it good. The results for satisfaction with life in general showed that the majority (89.4%) of Wellingtonians rated 'themselves as having a positive emotional wellbeing, with a rating of very happy (35.3%) or happy (54.4%)' (Nielsen, 2009, pg 4).

There were two main questions on crime and safety, one questioning participants about crime issues in their area and the other on how safe residents felt in several locations during the day and at night. Dangerous driving was considered to be the most commonly perceived crime issue of Wellington residents, with 62.8% (Nielsen, 2009, pg 4) of people stating this to be an issue. Secondly, car theft or damage to vehicles was considered an issue by 56.6% (Nielsen, 2009, pg 4) of participants. Unsafe people in the area and vandalism were also mentioned as issues by 42.7% and 36.0% (Nielsen, 2009, pg 4) of participants respectively. In terms of safety, participants were asked how safe they felt in their homes, neighbourhood and the city centre during the day and at night. Participants' answers showed that 98.7% (Nielsen, 2009, pg 5) of residents felt safe in their houses during the day and 97.9% after dark. When walking alone in their neighbourhood, 77.8% (Nielsen, 2009, pg 5) of residents felt safe after dark. 98.0% of people felt safe in their city centre during the day and 69.2% felt safe after dark.

Questions in relation to the community showed that 58.9% (Nielsen, 2009, pg 5) of Wellington residents believe that having a sense of community is an important part of the local neighbourhood. However, only 51.0% of participants felt a sense of community in their neighbourhood. In regard to appearance of the city, 81.8% (Nielsen, 2009, pg 6) of residents either strongly agreed or agreed they felt a sense of pride in the way the city looked and felt at the time of the survey. This was mainly as the result of Wellington being a good place to live and having a good lifestyle according to the participants. People who did not feel a strong sense of pride stated the city needed improvements or was not appealing, as the main reason. Almost half (49.2%) (Nielsen, 2009, pg 178) of Wellington residents surveyed agreed that rubbish on the streets had been a problem over the past twelve months prior to the survey, while 68.6% (Nielsen, 2009, pg 181) of Wellington residents agreed graffiti and tagging had been an issue over the same period of time.

Most residents had some involvement in social networks in Wellington. The majority of people belonged to a family social network (82.2%) or a network of people from work or school (67.2%) (Nielsen, 2009, pg 121). Other groups people were involved in were hobby or interest groups (40.8%) and online communities for example Facebook (38.4%).

In relation to the built environment and public transportation the majority of residents' responses were positive. 92.3% (Nielsen, 2009, pg 6) of residents stated they had easy access to a local park or green space in the city or their local area. In regard to public transportation, residents were questioned on its being safe (86.3% agreed), easy to get to (81.6% agreed), frequent (62.9% agreed), affordable (62.1% agreed) and reliable (54.2% agreed), showing residents' perceptions of public transportation in Wellington were mainly positive (Nielsen, 2009, pg 7).

Lifestyle questions focused on the work/life balance of residents. 72.7% (Nielsen, 2009, pg 236) of Wellingtonians in paid employment were happy with their work/life balance. Similarly, 72.5% (Nielsen, 2009, pg 240) of residents were satisfied or very satisfied with the quality and quantity of leisure time they had. Almost all residents (90.0%) felt they had enough money to cover the cost of everyday living. Out of these people 23.3% (Nielsen, 2009, pg 244) stated they had more than enough money, 39.3% had enough money and 27.4% had just enough.

A similar quality of life survey, by ShapeNZ for the Business Council for Sustainable Development, showed comparative results to the Ministry of Social Development survey. Wellington came out ahead of the other main cities in New Zealand surveyed, with 83 percent of respondents rating their quality of life as 'good or better,' with 68 percent of respondents rating their quality of life as 'very good' or 'excellent.' This result was followed by the North Shore (67%), Auckland (66%), Dunedin (66%), Christchurch (60%), Hamilton (53%), Manukau (52%) and Waitakere (50%) (ShapeNZ, 2010).

4.4 New Zealand's Footprint

New Zealand's modern ecological footprint has been calculated by three different organisations or people: the Ministry for the Environment (MFE), World Wildlife Fund (WWF), and Bicknell. The MFE estimated that New Zealand's ecological footprint for the year 1997/1998 was 3.08 ha or 8.35 gha per person, the latter taking into account New Zealand's land productivity is 2.5 times the global average (MFE, 2003, Executive Summary). The WWF, who publish the Living Planet report, estimated New Zealand's ecological footprint was 4.9 gha per person for 2007. Bicknell estimated for 1991 the EF was 3.49 ha or 8.75 gha per person with land productivity accounted for. These studies are discussed in more depth in Section 2.5 (page 15).

4.5 Wellington's Modern Footprint and Lifestyle

This section describes the results of the most recent ecological footprint of Wellingtonians for the year 2006, based on the most recently available data. The subsequent part, Section 4.6, will present the results of the ecological footprint for Wellingtonians in the 1950s, for the year 1956. Each section will separate the overall ecological footprint into the five main categories as determined by Wackernagel and Rees: Food; Housing; Transport; Consumer Goods; and Services. Canberra's Ecological Footprint (Close & Foran, 1998) report was referred to for methods of data collection and calculations. This report used a top down analysis, as opposed to the hybrid top down/bottom up analysis used for the Wellington calculation. The consumption patterns and lifestyle of New Zealanders and Australians are somewhat similar and thus the Canberra report formed a useful checking mechanism throughout the calculations. The overall ecological footprint is calculated from this information and compared nationally and globally to other ecological footprints. Wellington's present (2006) and past (1956) ecological footprints are compared to determine where changes and increases may have occurred and what factors may have contributed to these. Both ecological footprints are also compared to lifestyle. This is to determine if a high footprint equates to a better quality of life compared with a lower ecological footprint.

4.5.1 Household and commercial energy to land ratio – 2006

This calculation takes into account the generation of energy through renewable resources: hydroelectricity, geothermal and wind. As previously discussed Wackernagel and Rees' figure of 100 GJ/ha is generally applied as a substitution for the use of fossil fuels, however 150 GJ/ha was used for this research to account for higher productivity of New Zealand's forests, compared to the world average. From BRANZ housing research energy end uses in New Zealand houses were identified and this information provided energy use values for an average household and a percentage breakdown of electricity, gas, solid fuel and LPG use (BRANZ, 2010). The energy to land ratio of 150 GJ/ha was applied to the gas, solid fuel and LPG values. The ecological footprint associated with the production of electricity was calculated separately.

The Energy Data file for New Zealand (Ministry of Economic Development, 2007) analyses electricity generation by fuel type for 2006. Electricity generation is primarily from renewable resources in New Zealand, 66% of electricity generation is from renewables and the remaining 34% is from fossil fuel sources. Hydroelectricity is the largest component of renewable electricity generation, accounting for 84% (Figure 19). Gas is the largest component of non renewable electricity generation. The New Zealand governments' aim is to return to 90% renewable electricity generation by 2025. During the 1950s 89% of electricity came from renewable resources, mainly hydro (Bertram et al., 2009). This percentage has

reduced due to increased generation of electricity from gas which begun production in the 1970s (Palmer, 1974).

Therefore, the following calculation was made to estimate the energy to land ratio for New Zealand's domestic and commercial electricity use (household operation and service buildings operation):

(0.66*1000) + (0.34*150) = 711 GJ/ha

This ratio was only applied to the domestic household and service buildings electricity use. The energy to land ratio for fossil fuels of 150 GJ/ha was applied to fossil fuel sources.

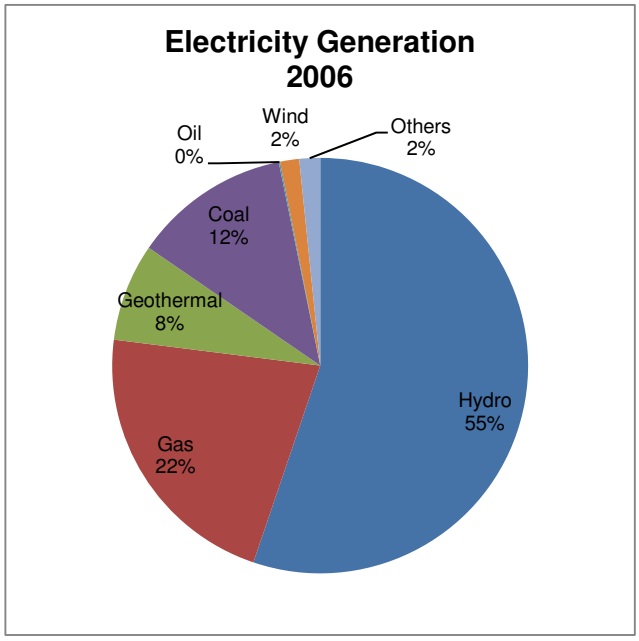

Figure 18: Electricity generation in New Zealand 2006

Source: Ministry of Economic Development, 2007, pg 100

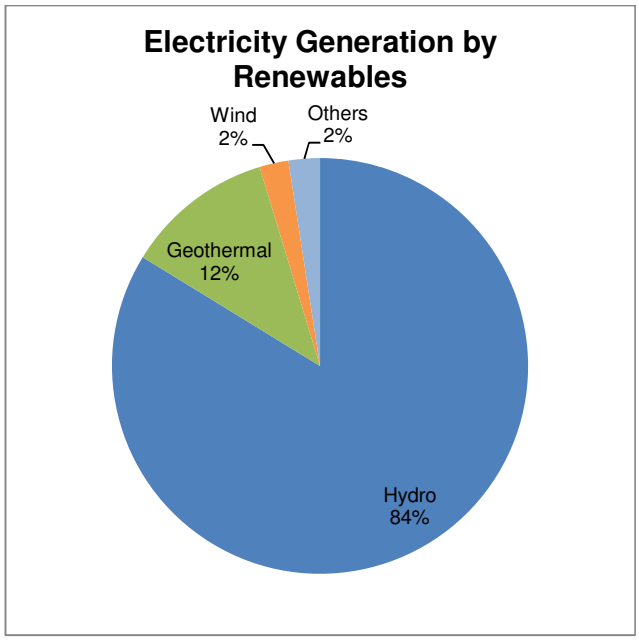

Figure 19: Electricity generation in New Zealand by renewable resources

Source: Ministry of Economic Development, 2007, pg 100

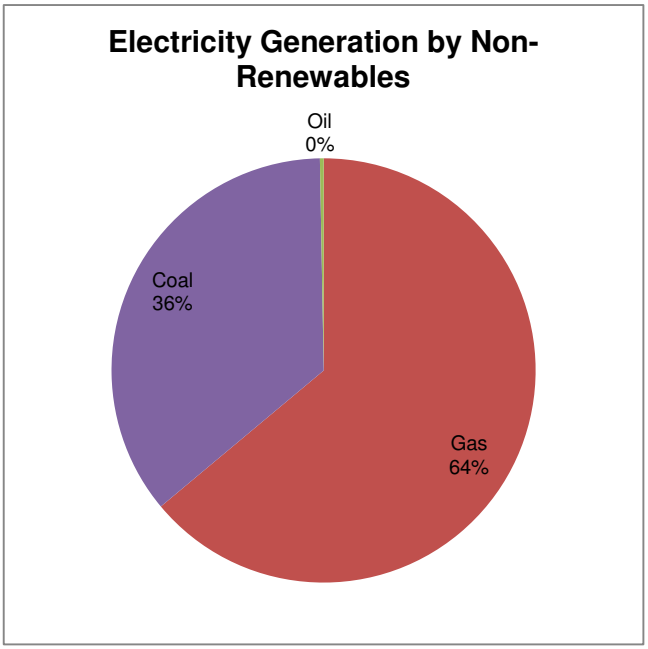

Figure 20: Electricity generation in New Zealand by non-renewable resources

Source: Ministry of Economic Development, 2007, pg 100

4.5.2 Summary of results

Wellingtonians' ecological footprint for 2006 was 6.03 gha per person (2.41 ha not accounting for NZ land productivity), and the land area of Wellington city is 290,000 ha. This available land gives a biocapacity of 1.62 ha per person, for the population of 179,466 people in 2006. From the ecological footprint result it is clear that Wellington is in ecological deficit. The ecological footprint of 2.41 gha per person is almost 50% over the available land area. However, this value is not comparable globally, because it does not account for the higher productivity of New Zealand's land. Allowing for this, results in an ecological footprint of 6.03 gha per person. This is 270% over the biocapacity of Wellington. Therefore, if everyone in the world lived the lifestyle of a Wellingtonian, 3.7 planets would be needed to sustain human consumption for a year. The following information and discussions show the components of this footprint.

4.5.3 Food

This section calculates the current food footprint for Wellingtonians. This footprint is divided into land for fruit, vegetables and grains, and animal products. Each of these categories has several components that equate to the overall food footprint: consumed land, crop and grazing land, forest land and energy land. Each component will be discussed and calculated separately to provide a detailed build up of the food footprint associated with Wellingtonians' food consumption in 2006.

Wellington City's Ecological Footprint for Food is 0.77 ha per person.

Summary

The food footprint for Wellingtonians in 2006 was 0.77 ha per person or 137,681 ha for the population, making 48% of the available land. Grazing land was the largest component of this footprint, accounting for 0.63 ha. The food footprint is 32% of the overall footprint, and is the largest component.

Statistics

Wellington population 2006 – 179,466
New Zealand population 2006 – 4,047,947
Land Area – 290,000 ha

Data Sources

- Food and Agriculture Organisation of the United Nations (FAO)
- Statistics New Zealand
- Ministry for the Environment

Consumed Land

Consumed land for food is land degraded as the result of unsustainable farming practices. There are 13,205 ha of agricultural land as detailed in the Agricultural Census for Wellington city (Statistics New Zealand, 2007). This equates to 4.5% of the total land area available (290,000 ha). Wellington is primarily an urban city with little farmed land. No information was available on how much of this land is degraded. However, the total available agriculture land has a footprint of 0.07 ha per person in Wellington and it is likely only a small percent of this land is degraded. Agricultural land is also degraded over time, but it is assumed here that consumed land for food is an insignificant part of the food footprint.

Crop Land

Crop land is land used to produce fruit, vegetables, grains, beverages and other types of crops for human consumption. The data for this was obtained from the Food and Agriculture Organisation of the United Nations (FAO: FAOSTAT, 2006). Data was only available for New Zealand, and was subsequently averaged out to a per capita amount consumed. Food supply data was available as kg/capita/year; calculations were carried out for both the overall food supply (consumption) for New Zealand (given in tonnes) and the per capita consumption. The overall food supply resulted in a higher footprint figure; however the per capita consumption was based on a population of 4,153,000 for New Zealand in 2006, although the 2006 census stated a population of 4,027,947. In order to be consistent the census figure was used throughout. As a result it was decided to use the overall food supply for New Zealand and from this calculate the per capita consumption. Land imported through the imports of crops, was not taken into

account because the aim of this study is to calculate the average ecological footprint of Wellingtonians, therefore imported and exported land is counted as local land.

Fruit

Table 15: Estimated ecological footprint for fruit

Fruit	New Zealand consumption (2006)	Average per capita	Yield	Ecological footprint per person
	tonnes[1]	kg	kg/ha[2]	ha
Apples	36,662.95	9.10	36,420	0.0002
Bananas	75,750.98	18.81	17,513	0.0011
Citrus - other	11,785.00	2.93	10,500	0.0003
Coconuts	8,194.00	2.03	17,513	0.0001
Dates	1,451.25	0.36	17,513	0.0000
Fruits - other	120,428.25	29.90	20,000	0.0015
Grapefruit	3,068.76	0.76	20,000	0.0000
Grapes	80,581.50	20.01	8,180	0.0024
Lemons and limes	4,535.00	1.13	14,286	0.0001
Oranges and Mandarins	88,361.00	21.94	12,727	0.0017
Pineapples	16,408.27	4.07	17,513	0.0002
Tomatoes	98,282.82	24.40	123,489	0.0002
Total	**545,509.78**	**135.43**	**N/A**	**0.0080**

1 FAOSTAT, 2006, Food Supply - Crops Primary Equivalent – Food supply quantity (tonnes)
2 FAOSTAT, 2006, Production – Crops – Yields

An estimated 135 kg of fruit was consumed by Wellingtonians in 2006, this equates to a footprint area of 0.0080 ha per person.

Vegetables

Table 16: Estimated ecological footprint for vegetables

Vegetables	New Zealand consumption (2006)	Average per capita	Yield	Ecological footprint per person
	tonnes[1]	kg	kg/ha[2]	ha
Beans	8,735.00	2.17	6,705.80	0.0003
Cassava	2,871.88	0.71	23,610.80	0.0000
Olives	1,441.00	0.36	23,610.80	0.0000
Peas	12,125.90	3.01	7,078.60	0.0004
Pimentos	237.00	0.06	23,610.80	0.0000
Potatoes	233,157.85	57.89	43,758.30	0.0013
Sweet potatoes	16,116.00	4.00	12,000.00	0.0003
Vegetables, other	512,601.89	127.26	23,610.80	0.0054
Total	**787,286.52**	**195.46**	**N/A**	**0.0078**

1 FAOSTAT, 2006, Food Supply - Crops Primary Equivalent – Food supply quantity (tonnes)
2 FAOSTAT, 2006, Production – Crops – Yields

An estimated 195 kg of vegetables were consumed per capita in 2006, equating to 0.0078 ha per person.

Grains

Table 17: Estimated ecological footprint for grains

Grains	New Zealand consumption (2006)	Average per capita	Yield	Ecological footprint per person
	tonnes[1]	kg	kg/ha[2]	ha
Barley	882.71	0.22	5,884.20	0.0000
Cereals, other	11,785.00	2.93	2,833.30	0.0010
Maize	9,350.40	2.32	11,533.70	0.0002
Oats	7,074.27	1.76	4,536.10	0.0004
Rice (milled)	38,325.58	9.51	7,020.20	0.0014
Rice (paddy)	57,459.64	14.27	7,020.20	0.0020
Rye	545.00	0.14	7,081.60	0.0000
Wheat	312,270.17	77.53	6,896.30	0.0112
Total	**437,692.77**	**108.66**	**N/A**	**0.0163**

1 FAOSTAT, 2006, Food Supply - Crops Primary Equivalent – Food supply quantity (tonnes)
2 FAOSTAT, 2006, Production – Crops – Yields

It is estimated 109 kg of grains were consumed per person in 2006, requiring 0.0163 ha of land per person.

Beverages

Table 18: Estimated ecological footprint for beverages

Beverages	New Zealand consumption (2006)	Average per capita	Yield	Ecological footprint per person
	Tonnes[3]	kg	kg/ha[4]	ha
Beer	320,856.00	79.66	N/A[2]	0.0000
Beverages, Alcoholic	12,918.00	3.21	N/A[2]	0.0000
Beverages, Fermented	872.00	0.22	N/A[2]	0.0000
Wine	35,132.00	8.72	8,200	0.0011
Coffee	16,645.61	4.13	1,982[1]	0.0021
Tea	2,312.00	0.57	1,322[1]	0.0004
Total	**388,735.61**	**96.51**	**N/A**	**0.0036**

1 Coffee data for Vietnam yield and Tea yield for Indonesia; these are the main countries from which New Zealand imports these products. FAOSTAT, 2006, Trade – TradeSTAT – Detail trade flows.
2 Ingredients for these products are accounted for in the grains and other foods (sugar and sweeteners) footprint.
3 FAOSTAT, 2006, Food Supply - Crops Primary Equivalent – Food supply quantity (tonnes)
4 FAOSTAT, 2006, Production – Crops – Yields

An estimated 97 kg of beverages were consumed per person in 2006, resulting in an ecological footprint of 0.0036 ha.

Other foods

Table 19: Estimated ecological footprint for other foods

Other foods	New Zealand consumption (2006)	Average per capita	Yield	Ecological footprint per person
	tonnes[3]	kg	kg/ha[4]	ha
Oil crops	22,847.36	5.67	672.30	0.0084
Pulses	24,760.90	6.15	2,877.00	0.0021
Spices	2,359.00	0.59	5,357.10	0.0001
Sugar and Sweeteners	234,432.72	58.20	89,465.00[1]	0.0007
Treenuts	14,479.20	3.59	2,018.10[1]	0.0018
Vegetable oils	40,630.94	10.09	672.30	0.0150
Honey	6,307.00	1.57	N/A[2]	0.0000
Total	**345,817.12**	**85.85**	**N/A**	**0.0281**

1 Australian data used, no values available for New Zealand and a percentage of these items are imported from Australia. FAOSTAT, 2006, Production – Crops – Yield (Australia).

2 No associated land because bees make honey from other crops.

3 FAOSTAT, 2006, Food Supply - Crops Primary Equivalent – Food supply quantity (tonnes)

4 FAOSTAT, 2006, Production – Crops – Yields

Other foods, including oil crops, spices, sugar and honey, amount to 86 kg per person or an ecological footprint of 0.0281 ha per person.

Total Crop Land

Table 20: Estimated ecological footprint for crop land

Food type	Ecological footprint per person	Ecological Footprint for Wellington City
	ha	ha
Fruit	0.0080	1,426.84
Vegetables	0.0078	1,407.51
Grains	0.0163	2,926.46
Beverages	0.0036	642.91
Other food crops	0.0281	5,046.39
Total	**0.0638**	**11,450.11**

Table 20, shows the results for each food type group relating to crop land. In total, 622 kg of produce associated with cropland was consumed per capita in 2006. The ecological footprint per person for crop land is 0.0638 ha or 11,450 ha for the population, making approximately 4% of the land available.

Grazing land

Grazing land is the land needed for production of animal products: meat and meat products, poultry and eggs and dairy products. The data was obtained from the FAOSTAT (FAOSTAT, 2006, Production and Food Supply); New Zealand values were averaged out to a per capita amount.

Meat and Meat products

Table 21: Estimated ecological footprint for meat and meat products

Meat and meat products	New Zealand consumption (2006)	Average per capita	Yield	Yield	Ecological footprint per person
	tonnes[4]	kg	kg/Animal	kg/ha[5]	ha
Bovine Meat	106,941.08	26.55	173.7	451.62[1]	0.0588
Meat, other	16,005.37	3.97	173.7	1789.11[2]	0.0022
Mutton and Goat meat	96,290.00	23.91	11.1	114.33[2]	0.2091
Offal	22,057.00	5.48	0.0	N/A[3]	0.0000
Pigmeat	90,629.00	22.50	67.0	690.1[2]	0.0326
Animal fats	58,750.00	14.59	0.0	N/A[3]	0.0000
Total	**390,672.45**	**96.99**	**N/A**	**N/A**	**0.3027**

1 2.6 animals per hectare, based on monitored Lower North Island farms (MAF, 2007)

2 10.3 animals per hectare, based on monitored Lower North Island farms (MAF, 2007a)

3 Offal and other animal fats are surplus parts of the animal, so are already accounted for in meat cropland

4 FAOSTAT, 2006, Food Supply – Livestock and Fish Primary Equivalent – Food supply quantity (tonnes)

5 FAOSTAT, 2006, Production – Livestock Primary – Yield

In 2006, 97 kg of meat and meat products were consumed per capita; this results in an ecological footprint of 0.3027 ha per person.

Poultry and Eggs

Table 22: Estimated ecological footprint for poultry and eggs

Poultry and Eggs	New Zealand consumption (2006)	Average per capita	Yield	Yield	Ecological footprint per person
	tonnes[3]	kg	kg/Animal	kg/ha[4]	ha
Poultry Meat	146,070.29	36.26	17.41	232.41[1]	0.1560
Eggs	43,058.08	10.69	16.94	226.12[2]	0.0473
Total	**189,128.37**	**46.95**	**N/A**	**N/A**	**0.2033**

1 Based on 43 m^2 per 1 kg of chicken meat (Vale & Vale, 2009, pg 40)

2 Based on 240 eggs per hen (Egg Producers Federation of NZ (Inc), 2010)

3 FAOSTAT, 2006, Food Supply –Livestock and Fish Primary Equivalent – Food supply quantity (tonnes)

4 FAOSTAT, 2006, Production – Livestock Primary – Yield.

Poultry and eggs accounted for 47 kg of food consumed per person; the ecological footprint of these products is estimated to be 0.2033 ha.

Dairy products

Table 23: Estimated ecological footprint for dairy products

Dairy Products	New Zealand consumption (2006)	Average per capita	Yield	Ecological footprint per person
	ttonnes[1]	kg	kg/ha[2]	ha
Butter, Ghee	39,496.00	9.81	890.00	0.0110
Cheese	14,816.00	3.68	890.00	0.0041
Cream	504.00	0.13	890.00	0.0001
Milk, excluding butter	383,080.00	95.11	1,759.00	0.0541
Total	**437,896.00**	**108.71**	**N/A**	**0.1222**

1 FAOSTAT, 2006, Food Supply – Livestock and Fish Equivalent Primary – Food supply quantity (tonnes).

2 FAOSTAT, 2006, Production – Livestock Primary – Yield.

Dairy products had an estimated ecological footprint of 0.1222 ha; 109 kg of these products were consumed per capita in 2006.

Total Grazing land

Table 24: Estimated ecological footprint for grazing land

Food type	Ecological footprint per person	Ecological Footprint for Wellington City
	ha	ha
Meat and meat products	0.3027	54,325.22
Poultry	0.2033	36,487.32
Dairy products	0.1222	21,921.96
Total	**0.6282**	**112,734.50**

The total ecological footprint associated with grazing land is estimated to be 0.6282 ha per person for Wellington in 2006. A total of 252.66 kg of products associated with grazing land was consumed per person in 2006. The Wellington footprint for these products is 112,724.5 ha, which equates to 39% of the total available land. This is about 10 times the amount of land needed to produce the food associated with crop land.

Forest land

Forest land is the area of land needed to produce the packaging needed for food.

According to the Ministry for the Environment through the New Zealand Packaging Accord 2004-2009, New Zealanders were consuming 20 kg of paper for packaging per person in 2006 (Ministry for the Environment, 2008). The New Zealand packaging Accord was started in 2004 and aimed to reduce the amount of packaging waste ending up in landfills.

Only a small percentage of this paper packaging is for food packaging, it is therefore assumed this is accounted for in the energy intensity associated with the processing and manufacturing of food. This is discussed in the following section.

Energy land

Energy land for food is the embodied energy associated with agricultural activity and chemicals used for producing food, such as fertilisers. The embodied energy of food is estimated through expenditure and energy intensity information. Limited data is available for agricultural chemicals used for food production in New Zealand; therefore it was assumed that agricultural chemicals were accounted for in the food manufacturing energy intensity data. The energy intensity figures are from the Energy and Economy report for 1997-2006 (Statistics New Zealand, 2008) and household food expenditure was gathered from the Household Economic survey: Year end 30 June 2007 (Statistics New Zealand, 2007).

Table 25: Estimated ecological footprint for energy land for food

Embodied energy	Annual household expenditure	Annual expenditure per person	Energy intensity	Embodied Energy	Ecological Footprint per person	Ecological footprint for Wellington
	$	$	GJ/$	GJ	ha	ha
Fruit and vegetables	956.80	293.17	0.0048	1.4072	0.0094	1,683.64
Meat, poultry and fish	1,196.00	366.46	0.0048	1.7590	0.0117	2,104.55
Eggs and dairy	603.20	184.82	0.0048	0.8872	0.0059	1,061.42
Bread and cereals	832.00	254.93	0.0048	1.2237	0.0082	1,464.03
Processed foods	4,082.00	1,250.74	0.0048	6.0036	0.0400	7,182.90
Total	**7,670.00**	**2,350.12**	**N/A**	**11.2806**	**0.0752**	**13,496.54**

Table 25 shows the ecological footprint associated with the embodied energy of the food consumed by Wellingtonians. It is estimated that 11.28 GJ was embodied in the food consumed per person. The ecological footprint per person is 0.0752 ha or 13,496.54 ha for the total population, about 5% of the available land.

Wellington's Ecological Footprint for Food

Table 26: Estimated total ecological footprint for food

Food footprint	Energy	Consumed	Crop land	Grazing land	Total Ecological Footprint per person	Ecological Footprint for Wellington
	ha	ha	ha	ha	ha	ha
Fruit, vegetables and grains	0.0094	-	0.0638	-	0.0732	13,133.75
Animal products	0.0658	-		0.6282	0.6940	124,547.40
Total	**0.0752**	**0.0000**	**0.0638**	**0.6282**	**0.7672**	**137,681.15**

The food footprint for Wellingtonians was 0.7672 ha or 137,681 ha for the city's population. This is a significant land area, almost 50% of the available 290,000 ha. The largest component of the food footprint is the grazing land used for production of meat and meat products, while crop land is 10% of the grazing land area.

4.5.4 Housing

The following information relates to the 2006 ecological footprint for housing in Wellington. The housing footprint is made up of two components: construction/maintenance and operation. This footprint estimates the land needed for housing, including houses and sections. Forest area is calculated based on construction materials needed for housing. Energy land is estimated from operational energy and embodied energy.

Wellington City's Ecological Footprint for Housing is 0.12 ha per person.

Summary

The housing footprint for Wellingtonians in 2006 was 0.12 per person or 21,033 ha for the population, 7.3% of the available land. Energy land was the largest component of this footprint, accounting for 0.07 ha. The housing footprint is the smallest component of the overall ecological footprint, and is 5% of the total.

Statistics

Wellington population 2006 – 179,466
New Zealand population 2006 – 4,047,947
Land Area – 290,000 ha

Data Sources

- Statistics New Zealand
- BRANZ
- QV
- Ministry for the Environment
- Wellington City Council

Consumed Land

Consumed land for the housing footprint is the land covered by houses; this land cannot be used for any other purpose.

Land covered by housing

The land area covered by housing in Wellington city was calculated using the number of houses in Wellington multiplied by the average floor area of houses in New Zealand. The number of existing houses in Wellington in 2006 was 68,901 (Statistics New Zealand, 2010). This equates to 2.6 people per house. The 2006 Census gave a similar occupancy rate of 2.57 people per house. The total number of houses contains several dwelling types: 64.7% (44,595) were separate or detached houses, 35.2% (24,220) were two or more flats/units townhouses/apartments or houses joined together and 0.1% (86) were other private dwellings (Statistics New Zealand, 2010).

An estimation of the average house size in Wellington was found through QV property information. This was determined through averaging the floor area of all single storey houses within the Wellington City area; from this an average of 145 m^2 was found. This was compared with information from the Household Energy End-use Project (HEEP). BRANZ conducted research on 393 houses around New Zealand to determine the energy end uses for homes in New Zealand. The average floor area from these houses was 121.5 m^2 (BRANZ, 2010). Limited published information was found on average house sizes in New

Zealand or Wellington City. QV collects national and local data on properties, although the majority of this information is not publicly accessible.

By multiplying the number of houses by the average floor area, the total area covered by houses is 1,000 ha. This equates to 55.67 m^2 or 0.0056 ha per person, based on the Wellington population.

Housing construction waste

An estimated 3.156 tonnes (Ministry for the Environment, 2009) of solid waste is disposed of into New Zealand landfills every year, or the equivalent of 783.5 kg per person. Of this 27% is construction waste (rubble and timber), which equates to about 1 million tonnes per year. This includes both residential and non-residential waste. This averages to approximately 248 kg/person/year or 44,555 tonnes total for Wellington City.

Wellington recently had two landfills: Northern and Southern. The Northern landfill covered 4.5 ha of land and was closed in 2006 (Wellington City Council, 2006). The Southern landfill is still operating and covers a total of 885 ha near Happy Valley (Wellington City Council, 2004, pg 10).

The New Zealand average was compared with the 2004 Solid Waste Analysis Protocol (SWAP) figures for the Northern and Southern Landfills in Wellington. During winter 2002 and summer 2003 (most recent results) an estimated 47,687 tonnes (Ministry for the Environment, 2004) of construction waste was disposed of at Wellington's Northern and Southern landfills, slightly higher than the national average. A total of 208,504 tonnes of solid waste entered the land fill during this year or 1,161.8 kg/person.

It is estimated that 65% of all construction activity is residential, based on the number of building consents per year (Statistics New Zealand, 2007c). This equates to 173 kg of residential construction waste per person or 30,996 tonnes for Wellington City. Residential construction waste accounts for 15% of the total solid waste.

To estimate the land area required per year for residential construction, the land area needed for Wellington's total waste was calculated. To determine the land area required for the solid waste, manufacturing and resource extraction waste must be accounted for. The Canberra Ecological Footprint report states that 'for every tonne of waste at consumer level, there are 5 tonnes created in the manufacturing process and a further 20 tonnes of resource extraction waste' (Close & Foran, 1998, pg 32). Table 27 shows the results for the land area required for solid waste. This is 0.1240 ha per person or 22,247 ha for Wellington city, this equates to approximately 8% of the available land. Therefore, it is assumed 15% of this land is required for residential construction waste or 0.0186 ha per person.

Table 27: Estimated land required for solid waste

Solid Waste	Wellington's waste	Waste per Person	Total Land Area	Land Area per Person
	Tonnes	Tonnes	ha	ha
Household Waste	208,504	1.16	889.91	0.0050
Manufacturing Waste (x5)	1,042,520	5.81	4,449.56	0.0248
Resource Extraction Waste (x20)	4,170,080	23.24	17,798.25	0.0992
Total Waste	**5,212,600**	**29.05**	**22,247.81**	**0.1240**

Ecological footprint for consumed land by housing in Wellington

The total consumed land per person is 0.0242 ha; about 77% of this land is required for waste as the result of construction. Consumed land for housing equates to 1.5% of the total land available.

Table 28: Estimated ecological footprint for consumed land

Land consumed for housing	Ecological footprint Wellington city	Ecological footprint per person
	ha	ha
Housing	999.06	0.0056
Waste	3,337.17	0.0186
Total	**4,336.24**	**0.0242**

Garden Land

Garden land is the area of an average house section not covered by the house. This is not classed as consumed land as the land can be productive, for example if vegetables are grown in the garden.

The average section size in Wellington city is 629 m^2 according to QV (via phone discussion, no public records). Therefore, the average garden area can be estimated by calculating the average section less the size of an average house (145 m^2). This gives an average garden land area per section of 484 m^2. The total area in the Wellington city covered by garden land is 3,334.8 ha. This equates to 185.8 m^2 or 0.0186 ha per person.

Table 29: Ecological footprint for garden land

Land for gardens	Number of dwellings	Average garden area	Ecological footprint Wellington city	Ecological footprint per person
	#	m^2	ha	ha
Garden land	68,901	484.0	3,334.81	**0.0186**

Forest Land

Forest land is estimated through the volume of timber used in the construction of an average sized house. To estimate this land area the volume of timber per house is needed for both a timber house with a timber floor and a timber house with a concrete slab. The number of each type of construction is also needed. Taking this information and multiplying it by the mean annual harvest increment (MAI) for New Zealand, gives the land area needed to grow the timber required for housing in Wellington.

The average floor area of a New Zealand house, as calculated by the QV is 145 m^2. The Canberra Ecological Footprint report found that the amount of timber needed was 21 m^3 (Close & Foran, 1998) for a timber frame house with a timber floor, and 17-18 m^3 for a timber frame house with a concrete floor. These values are for a house with a floor area of 180 m^2. Therefore, these values were adjusted to reflect the average for a New Zealand house; this resulted in a value of 16.9 m^3 for a timber house with timber floors and 14.5 m^3 for a timber house with concrete floors.

About 88% of New Zealand houses are timber frame with concrete floor slabs and 12% are timber frame with timber floors (Page, 2009, pg 35). Applying these percentages to Wellington indicates approximately 8,268 houses are timber frame with timber floors and 60,632 houses are timber frame with concrete floors.

The mean annual harvest increment (MAI) for New Zealand forests is 25 m^3/ha/year (Evergreen Forests Limited, 1996) based on Radiata Pine, which is most commonly used in house construction. This value is higher than most other countries in the world.

It is assumed an additional 39% of timber will be used for maintenance, repairs and alterations over the 50 year life of a house (Close & Foran, 1998). The lifetime of a house is assumed to be 50 years, as this is the minimum stated in the New Zealand Building Code Clause B2 Durability (Department of Building and Housing, 2010, pg 3).

Given this information the table below estimates the timber volume over the minimum 50 year life of a house and the forest land used in the construction of Wellington houses.

Table 30: Estimated ecological footprint for forest land

Forest land	Estimated timber volume	Number of houses	Timber volume in houses (50 years)	Total timber volume (50 years)[1]	Land area needed (50 years)	Annual ecological footprint per person
	m^3/house	#	m^3	m^3	ha	ha
Timber frame with timber floor	16.9	8,268.12	139,869.03	194,417.95	7,776.72	0.0009
Timber frame with concrete slab	14.5	60,632.88	879,176.76	1,222,055.70	48,882.23	0.0054
Total	**N/A**	**68,901.00**	**1,019,045.79**	**1,416,473.65**	**56,658.95**	**0.0063**

1 Includes additional timber for maintenance and alterations.

Note Each column has been rounded for this table.

The estimated forest land needed for the housing stock is 0.0063 ha per person or 1,133 ha for Wellington. This equates to less than 1% of the available land in Wellington. This area is minimal because the forest land needed is divided over the 50 year life assumed for houses.

Energy Land

There are four main components to the energy land category for housing:

- Household operational energy which includes the running of appliances, heating and lighting;
- Embodied energy from the raw materials used to construct houses;
- Energy required for the maintenance of houses over their lifespan of 50 years;
- The energy required for demolition and disposal of the building materials at the end of house life.

Household operational energy

The household operation energy for Wellington homes was estimated from the HEEP study. No Wellington city data was available, only information for the Wellington region, therefore these values were used. The Wellington region HEEP houses used 10,860 kWh of energy annually; this equates to 39.82 GJ per house or 15.29 GJ per person. For household energy by fuel type refer to Figure 21.

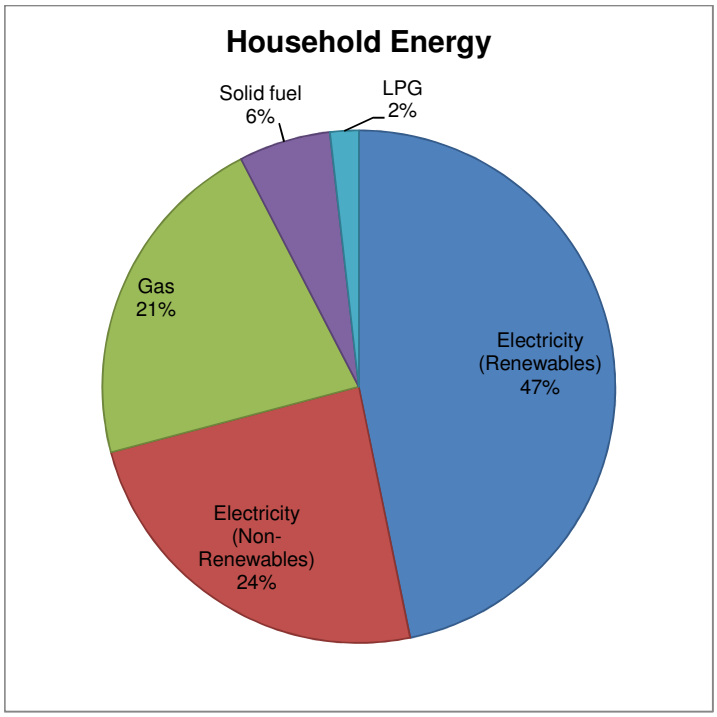

Figure 21: Household energy by fuel type

Data source: BRANZ, 2010, pg 311

New Zealand's electricity generation has a high percentage of renewable. Hydro generation accounts for 55% a further 11% comes from other renewables; geothermal, wind and biomass. The remaining 34% is from fossil fuelled plants; oil, coal and gas (Ministry of Economic Development, 2007). 71% of household energy comes from electricity (BRANZ, 2010), of this household energy 47% is from renewable sources. The ecological footprint per person for household energy use is 0.045 ha and 8,059 ha for the city's population or just over 2.8% of the land area available.

Table 31: Estimated ecological footprint for operational energy

Fuel type	Wellington energy consumption per household	Average energy consumption per person	Ecological footprint per person	Wellington Ecological Footprint
	GJ	GJ	ha	ha
Electricity	28.22	10.83	0.0152	2,734.72
Gas	8.57	3.29	0.0219	3,935.63
Solid fuel	2.30	0.88	0.0059	1,058.32
LPG	0.72	0.28	0.0018	330.72
Total	**39.81**	**15.28**	**0.0449**	**8,059.39**

Embodied energy in construction, maintenance and demolition of houses

Embodied energy for housing is related to three stages of a house; the construction, maintenance and demolition at the end of its life. The embodied energy relates to the energy needed to carry out these stages. Each of these stages will be discussed separately along with the associated embodied energy and ecological footprint.

Construction energy

The initial embodied energy for a house comes from the construction, and relates to the embodied energy of the materials used, the construction process and transportation to site. The construction embodied energy intensity of a light timber frame house (most common construction type) in New Zealand was assumed to be 1.799 GJ/m^2 (Mithraratne et al., 2007, pg 161). This figure is based on embodied energy intensity figures for building elements. It was assumed the life of a house was 50 years.

Maintenance energy

Maintenance energy is the energy associated with maintenance work that occurs during the building's minimum 50 year life. Over 50 years the embodied energy increases by 1.187 GJ/m^2 (Mithrarathne et al., 2007, pg 161). This figure was calculated through the difference in embodied energy between year 0 and year 50, for an average New Zealand house.

Changes in embodied energy occur in the walls, roof, electrical work, plumbing and the finishes, as these are typically the elements of a house that people would upgrade or alter during 50 years (see Figure 22).

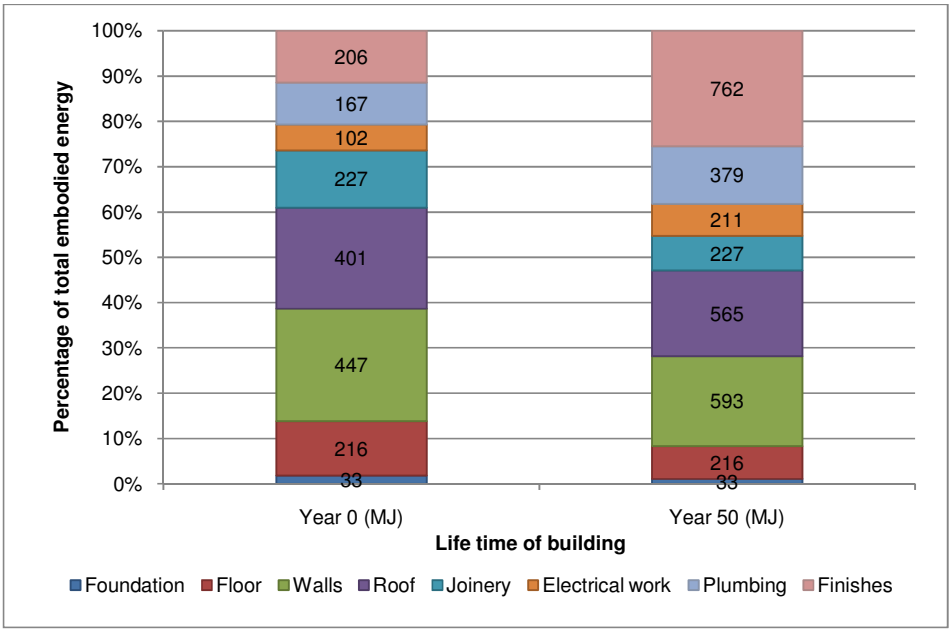

Figure 22: Embodied energy over 50 year life of house

Source: Mithraratne et al, 2007, pg 161

Demolition and disposal energy

Adalberth established that the energy associated with the demolition of a house at the end of its life, in this case 50 years, was 10 kWh/m^2 (Adalberth, 1997, pg 327) or 0.040 GJ/m^2. This figure was used to estimate the demolition energy of an average Wellington house. Disposal of the building was established to be 30 kWh/m^2 (Adalberth, 1997, pg 327) or 0.12 GJ/m^2.

Overall embodied energy

Table 32 shows the estimated embodied energy per house and the associated ecological footprint per person. From these calculations the estimated proportions of embodied energy at each step of a house's life are:

- 57% for the construction of the building;
- 38% for maintenance and alterations;
- 5% for demolition and disposal at the minimum 50 year life.

The ecological footprint associated with the embodied energy of housing is 0.0232 ha per person or 4,169 ha for the Wellington population, which equates to just over 1% of the available land.

Table 32: Estimated embodied energy for an average house

Embodied energy	Embodied energy (50 years)	Embodied energy per person	Ecological footprint per person	Wellington Ecological Footprint
	GJ/m^2	GJ/year	ha	ha
Construction	1.799	2.003	0.0134	2,396.42
Maintenance	1.187	1.322	0.0088	1,581.19
Demolition	0.036	0.040	0.0003	47.96
Disposal	0.108	0.120	0.0008	143.87
Total	**3.13**	**3.485**	**0.0232**	**4,169.43**

Wellington's Ecological Footprint for Housing

Table 33: Total estimated ecological footprint for housing

Housing	Energy	Consumed	Garden	Forest	Total	Total Wellington
	ha	ha	ha	ha	ha	ha
Construction and maintenance	0.0232	0.0242	0.0186	0.0063	0.0723	12,973.65
Operation	0.0449				0.0380	8,059.39
Total	**0.0682**	**0.0242**	**0.0186**	**0.0063**	**0.1172**	**21,033.04**

Wellington's total ecological footprint for housing is shown above. This is 0.1172 ha per person or 21,033 ha for the city; this is about 7% of the land area available in Wellington.

4.5.5 Transport

This section estimates the current transport footprint for Wellington. The transport footprint is divided into three categories: private transport, public transport and transportation of goods. There are two land types for the transportation footprint: consumed land for roading and transport infrastructure, and energy land related to the energy required to manufacture and operate the transport modes available.

Wellington City's Ecological Footprint for Transport is 0.47 ha per person.

Summary

The transport footprint for Wellingtonians in 2006 was 0.47 ha per person or 83,715 ha for the population, 30% of the available land. Energy land was the largest component of this footprint, accounting for 0.46 ha. The transport footprint accounts for 19% of the overall ecological footprint.

Statistics

Wellington population 2006 – 179,466
New Zealand population 2006 – 4,047,947
Land Area – 290,000 ha

Data Sources

- Land Transport New Zealand
- Wellington City Council
- Ministry of Transport
- Statistics New Zealand

Consumed Land

Consumed land for transport, is the land covered by transport infrastructure: paved surfaces (roads, cycleways and footpaths) and land covered by the Wellington airport and railway station.

Paved surfaces

The estimated area of land covered by sealed roads in Wellington is 406.5 ha. There are 1,242 km of urban road lanes and 113 km of rural road lanes. The average lane width is assumed to be 3 m (Land Transport New Zealand, 2006).

There are 23.1 km (Land Transport New Zealand, 2006) of cycleways in Wellington, with an assumed width of 0.8 m. This equates to 1.85 ha of land covered by cycleways.

The Wellington City Council states there are 814 km (Wellington City Council, 2010) of footpaths with an average width of 3 m (Wellington City Council, n.d), resulting in 244.2 ha covered in footpaths.

Airport and Railway station

The Wellington airport covers 110 ha (Infratil Assets, 2006) of land in Rongatai, Wellington and the railway station covers an estimated 28 ha of land (McCracken, 2008).

Table 34: Consumed land for transport

Transport Infrastructure	Total area	Area per person
	ha	ha
Roads	406.50	0.0023
Cycleways	1.85	0.0000
Footpaths	244.20	0.0014
Wellington Airport	110.00	0.0006
Wellington Railway Station	28.00	0.0002
Total	**790.55**	**0.0044**

From this information, it is estimated that the consumed land for transport in Wellington is 0.0044 ha per person or 790.55 ha for the Wellington population. This equates to 0.3% of the available land.

Energy Land

There are three components of energy land: fuel used for transport, embodied energy from the manufacturing, maintenance and disposal of vehicles and embodied energy for transport infrastructure (roads, cycleways, footpaths and the airport and railway station buildings).

Data on travel was collected from the New Zealand Household Travel Survey (Ministry of Transport, 2009). Data was available for both Wellington City and Region; however the city data had some missing information so the regional data was used. The values for Wellington region (km/person/year) were similar to the figures given for Wellington city.

Energy use for Transport

In 2006, a total of 130 PJ of energy was used for Transport and Storage in New Zealand (Statistics New Zealand, 2008) and the average Wellington region household spent $125.90 per week on transportation costs (Statistics New Zealand, 2007).

Table 35: Distances travelled and energy used

Wellington region travel	Type	km/person/year	Energy use total	Energy used per person	Ecological footprint per person
		km	MJ/km[1]	GJ/person	ha
Passenger vehicles (driver)	*Petrol/Diesel*	7,600	3.19	24.24	0.1616
Passenger vehicles (passenger)	*Petrol/Diesel*	3,710	1.60	5.92	0.0394
Pedestrian	*N/A*	320	0.90	0.29	0.0019
Cyclist	*N/A*	51	0.65	0.03	0.0002
Bus (total 290km)	*Trolley Buses (62)*	112	2.61	0.29	0.0019
	Diesel Buses (161)	178	3.50	0.62	0.0042
Motorcycle		42	1.40	0.06	0.0004
Other (assumed to be Wellington trains)	*Electric*	49	0.59	0.03	0.0002
Total land travel		12,062	N/A	N/A	N/A
Domestic flights[2]		575	3.60	2.07	0.0138
International flights		4,000	1.60	6.40	0.0427
Total		**16,637**	**N/A**	**39.95**	**0.2664**

1 Vale & Vale, 2009, pg 111

2 Vale R. (2010) personal communication, Dec 7th 2010.

The ecological footprint relating to the fuel used for transport in Wellington is 0.2664 ha per person or 47,803 ha for the Wellington population. Land needed for fuel for transport is equivalent to 16.5% of the total area available. Therefore, this area of the ecological footprint has a significant effect on the overall footprint of the city.

Freight

Energy use for freight is also accounted for. Table 36 shows the estimated ecological footprint for freight in Wellington. This calculation is based on the total tonne-km for New Zealand, as statistics for Wellington were not available. Energy use for freight has an ecological footprint of 0.0995 ha per person or 17,855 ha for Wellington, 6% of the available land.

Table 36: Estimated energy use for freight

Freight	New Zealand[1]	Per capita	Energy use[2]	Energy	Ecological Footprint
	tonne-km	tonne-km	MJ/tonne-km	GJ	ha
Road	18,800,000,000	4,667.39	2.92	13.63	0.0909
Rail	3,900,000,000	968.24	0.72	0.70	0.0046
Coastal Shipping	4,000,000,000	993.06	0.36	0.36	0.0024
Air	100,000,000	24.83	9.70	0.24	0.0016
Total	**26,800,000,000**	**6,653.51**	**N/A**	**14.92**	**0.0995**

1 Ministry of Transport, Freight and the Transport industry: Freight volume, 2009

2 Vale & Vale, 2009, pg 43

Embodied Energy in Vehicles

Embodied energy for vehicles is the energy used in the manufacturing and maintenance process. This section estimates the embodied energy for Wellington's vehicle fleet and the associated ecological footprint. Only regional road vehicle fleet numbers were available from the Ministry of Transport. An estimation of the embodied energy per vehicle was obtained from Canberra's Ecological Footprint Report. It was assumed the life of an average vehicle is 10 years.

Manufacturing embodied energy

The Canberra Ecological Footprint report uses an estimated value of 100 GJ of embodied energy for passenger vehicles and light commercial vehicles, 50 GJ for motorcycles, 300 GJ for heavy goods vehicles and buses and 25 GJ for other types of vehicles. Table 37 below shows the calculations for the manufacturing embodied energy of Wellington's vehicle fleet.

Table 37: Estimated manufacturing embodied energy for vehicles

Motor vehicle fleet	Number[1]	Embodied energy per vehicle[2]	Total embodied energy	Embodied energy per year per person	Ecological footprint per person
		GJ	GJ	GJ/year/person	ha
Light passenger vehicle	255,301	100	25,530,100	5.69	0.0379
Light commercial vehicle	28,310	100	2,831,000	0.63	0.0042
Motorcycle	9,642	50	482,100	0.11	0.0007
Heavy goods	6,676	300	2,002,800	0.45	0.0030
Bus	683	300	204,900	0.05	0.0003
Other (trailer and caravans)	21,999	25	549,975	0.12	0.0008
Total	**322,611**	**N/A**	**31,600,875**	**7.04**	**0.0469**

1 Ministry of Transport, 2010

2 Canberra's Ecological Report data

The estimated ecological footprint for manufacturing embodied energy is 0.0469 ha per person or 8,421 ha for the Wellington population. This is approximately 3% of the available land.

Maintenance and Disposal

In addition to the embodied energy for the initial manufacturing of a vehicle, there is embodied energy associated with maintenance during the vehicle's life and disposal. It is assumed that the lifetime of a vehicle is 10 years.

These values are often expressed as percentages of the overall embodied energy of a vehicle. The Canberra Ecological Footprint report uses the following values, which are used for this report:

- 58% for manufacturing;
- 40% for maintenance and repair;
- 2% for disposal of the vehicle.

Table 38: Estimated embodied energy for vehicle fleet

Overall embodied energy of motor vehicle fleet	Total energy (10 years)	Total energy (1 year)	Per person energy	Ecological footprint per person
	GJ	GJ	GJ	ha
Manufacturing	31,600,875.00	3,160,087.50	7.04	0.0469
Maintenance and Repair	21,793,706.88	2,179,370.69	4.85	0.0324
Disposal	1,089,685.34	108,968.53	0.24	0.0016
Total	**54,484,267.22**	**5,448,426.72**	**12.14**	**0.0809**

From the previous calculations, it was estimated that energy embodied in the manufacturing process equates to a footprint of 0.0469 ha per person. Using the Canberra Ecological Footprint percentages, this accounts for 58% of the overall embodied energy of a vehicle, excluding the operation of the vehicle. Therefore, maintenance and repair result in an ecological footprint of 0.0324 ha per person, 40% of the total embodied energy. The ecological footprint for disposal is 0.0016 ha per person, 2% of the overall embodied energy.

The overall embodied energy of the motor vehicle fleet in Wellington is 0.0809 ha per person or 14,519 for the Wellington population, which equates to 5% of the total land area available.

Embodied Energy of Transport Infrastructure

This section estimates the embodied energy of the transport infrastructure in Wellington. This includes transport buildings; Wellington airport and railway station, and paved areas; roads, pavements, cycle ways, airport runway and paved area surrounding the railway station.

From the consumed land calculations, the areas covered by each of these items are shown below in Table 39.

Table 39: Estimated area covered by transport infrastructure

Transport Infrastructure		Total area
		ha
Paved areas	Roads	406.50
	Cycleway	1.85
	Footpaths	244.20
	Wellington Airport runway	23.22
	Wellington Railway Station platforms	0.48
Subtotal		676.25
Buildings (total floor areas)	Wellington Airport terminal	4.20
	Wellington Railway Station building	0.60
Subtotal		**4.80**

It is assumed for the paved areas that the embodied energy is 7,140 MJ/m^3 (Alcorn, N.D). The depth of the roading material and other paved areas (excluding the railway station platforms) is assumed to be 0.07m (sealed top layer only) (Wellington City Council, 2006). The depth of the railway station platform is assumed to be 0.5m.

The embodied energy for the buildings was estimated using values from the Canberra Ecological Footprint report. These were 6 GJ/m^2 for the Wellington airport terminal building (assumed as a mixed use building, using the value for a shopping mall/restaurant) and 11 GJ/m^2 for the Wellington railway station (assumed to be an office building). Table 40 below shows the estimated embodied energy values for the construction elements of transport infrastructure.

Table 40: Estimated embodied energy in construction of transport infrastructure

Embodied energy for transport infrastructure		
Buildings	Paved areas	Total
GJ	GJ	GJ
472,000	3,394,624	3,866,624

From this calculation it is assumed, like housing, that construction accounts for 57% of the overall embodied energy, maintenance accounts for 38%, 1.15% is demolition and 3.45% is disposal at 50 years for buildings and 15 years for paved areas.

The above calculation estimates the embodied energy in construction (buildings and paved areas) is 3,866,624 GJ, which equates to 0.0088 ha per person. Therefore, maintenance of the transport infrastructure is 0.0058 ha, demolition is 0.0002 ha and disposal is 0.0005 ha per person. The total ecological footprint associated with the embodied energy of transport infrastructure is 0.0153 ha per person or 2,746 ha for Wellington city, less than 1% of the available land.

Table 41: Estimated total embodied energy in transport infrastructure

Energy Use	Total energy (50 years)	Total energy (1 year)	Energy per capita	Ecological Footprint per person	Wellington Ecological Footprint
	GJ	GJ	GJ	ha	ha
Construction	3,866,624	235,748	1.31	0.0088	1,571.66
Maintenance	2,577,750	157,166	0.88	0.0058	1,047.77
Demolition	78,011	4,756	0.03	0.0002	31.71
Disposal	234,033	14,268.98	0.08	0.0005	95.13
Total	**6,756,417**	**411,939.13**	**2.30**	**0.0153**	**2,746.26**

Total Ecological Footprint for Transport in Wellington

The overall ecological footprint for transport in Wellington is estimated to be 0.4665 ha per person or 83,715 ha for Wellington. This is almost 30% of the land available in Wellington. Table 42, divides the transport footprint into private, public and goods transport. Private transportation accounts for 74% of the overall footprint, followed by goods transport at 21%, and the remaining 5% is public transportation.

Table 42: Estimated ecological footprint for transport

Transport footprint	Energy	Consumed Land total	Ecological Footprint per person	Wellington Ecological Footprint
	ha	ha	ha	ha
Private transport	0.3409	0.0036	0.3446	61,838.26
Public transport	0.0216	0.0000	0.0216	3,883.19
Goods transport	0.0995	0.0008	0.1003	17,993.94
Total	**0.4621**	**0.0044**	**0.4665**	**83,715.39**

4.5.6 Consumer Goods

This section discusses the estimated ecological footprint for consumer goods purchased by Wellingtonians. The consumer goods footprint consists of four land types: consumed land, crop land, forest land and energy land. Each of these land types will be discussed and calculated separately to determine the overall consumer goods footprint.

Wellington City's Ecological Footprint for Consumer Goods is 0.71 ha per person.

Summary

The consumer goods footprint for Wellingtonians in 2006 was 0.71 per person or 127,831 ha for the population, 44% of the available land. Grazing land is the largest component of this category, accounting for 0.49 ha. The consumer goods footprint is 30% of the overall ecological footprint.

Statistics

Wellington population 2006 – 179,466
New Zealand population 2006 – 4,047,947
Land Area – 290,000 ha

Data Sources

- Ministry for the Environment
- Food and Agriculture Organisation of the United Nations (FAO)
- Statistics New Zealand

Consumed Land

Consumed land for consumer goods is the land associated with solid waste produced each year. According to the SWAP results 208,504 tonnes of solid waste entered the Wellington landfills during 2002/2003 (Ministry for the Environment, 2004). This would require approximately 22,247 ha of landfill area for Wellington's total solid waste. A recorded 47,678 tonnes was construction waste, and the remaining 160,817 tonnes comprised paper, plastic, glass and other waste generally associated with consumer goods.

The landfill area required for 160,817 tonnes of waste is 17,160 ha or 0.0954 ha per person. It was assumed that taking out the construction waste the remaining waste was primarily consumer goods waste. Consumer goods waste accounts for almost 6% of the available land.

Table 43: Estimated ecological footprint for consumer goods waste

Solid waste		Waste	Waste	Ecological Footprint
		Tonnes	Tonnes per person	ha
Construction	Residential	30,996.55	0.17	0.0186
	Non-Residential	16,690.45	0.09	0.0099
	Total	47,687.00	0.27	0.0285
Consumer Goods		160,817.00	0.90	0.0954
Total		**208,504.00**	**1.16**	**0.1240**

Crop and Grazing Land

Crop land for consumer goods is land needed to produce tobacco and cotton (note crop land for alcohol is included in food tables, page 65). Grazing land is the land required for wool producing sheep. Some data was obtained from the FAO database for New Zealand's consumption of these products and yield values (FAOSTAT, 2006 – Production – Livestock Primary – Wool, greasy). The majority of New Zealand's tobacco is imported from Australia, so Australian yield values were used. New Zealand imports its cotton from Pakistan; subsequently yield values for Pakistan were used. The yield for sheep's wool is an average of 34 kg/ha for greasy wool (range of 15 – 69 kg/ha) (Court, 1996). Clean wool weighs 70% (Close & Foran, 1998) of the weight of greasy wool. 70% of the wool produced in New Zealand is exported. 30% remains in New Zealand, half of which is used for carpets, rugs or other finished products locally and the rest is used for yarn for clothing (Nicol & Saunders, 2009).

Table 44: Estimated crop and grazing land for consumer goods

Land use type	Consumer good	New Zealand Consumption (2006)	Average per capita	Yield	Ecological Footprint
		Tonnes	kg	kg/ha	ha
Crop land	Tobacco	698	0.173	2,758.60[1]	0.0001
	Cotton	11	0.003	642.00[2]	0.0000
Total		N/A	N/A	N/A	0.0001
Grazing land for wool	Greasy wool	224,700	55.785	34.00[3]	1.6407
	Clean wool (70%)	157,290	39.050	23.80	1.6407
	Wool for consumer goods (30%)	47,187	11.715	23.80	0.4922
Total		**N/A**	**N/A**	**N/A**	**0.4922**

1 Australian data from FAO

2 Pakistan data from ICAC, Cotton World Statistics, pg 49

3 Australian wool yield data (15 – 69 kg/ha, average 34 kg/ha) (Court, 1996)

Forest Land

The forest land required has been estimated using the total amount of paper that entered the landfills in Wellington according to the SWAP database. This paper waste has not been categorised into use, as there is only information for packaging. Therefore, the forest land for office paper and food packaging is included in this calculation. 42,576 tonnes of paper (Ministry for the Environment, 2004) entered the landfills for the year 2002/2003, the most recent data available. This equates to 237 kg/person.

It is estimated that there are 6.25m^3 of wood per tonne of paper; this was calculated using the following information. 4 tonnes of wood are needed to produce 1.4 tonnes of paper (Paper Round Australia, N.D, pg 3). Therefore, 2.875 tonnes of wood are required to make 1 tonne of paper. The average density value for medium density Radiata pine in New Zealand is 460 kg/m^3 (RPBC, 2003). The ecological footprint is 0.0593 ha per person or 10,644 ha for Wellington, almost 4% of the land available.

Table 45: Estimated ecological footprint of forest land for paper waste

Forest land	Quantity for Wellington	Quantity per person	Yield	MAI	Volume of paper	Ecological Footprint
	tonnes	kg	m^3/tonne paper	m^3/ha/year	m^3	ha
Paper	42,576.11	237.24	6.25	25	1.48	**0.0593**

Energy Land

Energy land needed for consumer goods is estimated through average expenditure for consumer goods and the energy intensity related to each category. Energy intensity data was sourced from Statistics New Zealand: Energy and the Economy: 1997-2008 report. Household weekly expenditure was sourced from Statistics New Zealand: Household Economy Survey, which gave average weekly expenditure for Wellington.

Table 46: Estimated ecological footprint for energy land for consumer goods

Consumer Goods	Average weekly expenditure per household	Average annual expenditure per household	Average annual expenditure per person	Energy intensity	Embodied energy	Ecological footprint per person
	$	$	$	GJ/$	GJ	ha
Tobacco and Alcohol	31.40	1,632.80	495.74	0.0048	2.38	0.0159
Clothing and footwear	31.60	1,643.20	498.90	0.0040	2.00	0.0133
Household contents and services	54.70	2,844.40	863.60	0.0011	0.95	0.0063
Communication	34.60	1,799.20	546.26	0.0003	0.16	0.0011
Recreation and culture	119.60	6,219.20	1,888.23	0.0008	1.51	0.0101
Miscellaneous goods and services	95.30	4,955.60	1,504.59	0.0008	1.20	0.0080
Other expenditure	125.30	6,515.60	1,978.22	0.0008	1.58	0.0106
Total	**492.50**	**25,610.00**	**7,775.54**	**N/A**	**9.79**	**0.0652**

The average weekly expenditure on consumer goods in Wellington is almost $500/week/household. The expenditure per person annually is $7,776, and it is estimated that 9.79 GJ are embodied in these products. This equates to an ecological footprint of 0.0652 ha per person, 11,708 ha for Wellington and 4% of the available land.

Total Ecological Footprint for Consumer Goods in Wellington

Table 47 shows the overall ecological footprint for consumer goods. This was 0.7123 ha per person for 2006 or 127,831 ha for Wellington, 44% of the available land. The majority of this is grazing land associated with consumer goods, and consumed land for waste from consumer goods.

Table 47: Estimated ecological footprint for consumer goods

Consumer Goods	Consumed Land	Crop Land	Grazing Land	Forest Land	Energy Land	Ecological Footprint per person
	ha	ha	ha	ha	ha	ha
Tobacco and Alcohol					0.0159	0.0159
Clothing and footwear					0.0133	0.0133
Household contents and services					0.0063	0.0063
Communication					0.0011	0.0011
Recreation and culture					0.0101	0.0101
Miscellaneous goods and services					0.0080	0.0080
Other expenditure					0.0106	0.0106
Consumer waste	0.0954				-	-
Tobacco and Cotton		0.0001			-	-
Total	**0.0954**	**0.0001**	**0.4922**	**0.0593**	**0.0652**	**0.7123**

4.5.7 Services

This section discusses the estimated ecological footprint for services in Wellington. The services footprint consists of three land types: consumed land, garden land and energy land. Each of these land types will be discussed and calculated separately to determine the overall services footprint.

Wellington City's Ecological Footprint for Services is 0.35 ha per person.

Summary

The services footprint for Wellingtonians in 2006 was 0.35 per person or 62,545 ha for the population, 22% of the available land. Energy land was the largest component of this footprint, accounting for 0.32 ha. The services footprint accounts for 14% of the overall ecological footprint for Wellington.

Statistics

Wellington population 2006 – 179,466
New Zealand population 2006 – 4,047,947
Land Area – 290,000 ha

Data Sources

- Colliers International Research
- Wellington City Council
- Ministry of Economic Development
- Statistics New Zealand

Consumed Land

Consumed land associated with services is the land covered by commercial and public buildings, essentially all non residential buildings in Wellington. According to Colliers International Research, this is 319.82 ha for Wellington City (Colliers International Research, 2010). The ecological footprint for consumed land is shown in the table below.

Table 48: Land area covered by commercial and public buildings

Ecological Footprint for Wellington	Ecological Footprint per person
ha	ha
319.82	**0.0018**

An addition to the land covered by service buildings is the waste from the construction of these buildings. From previous calculations it was determined that 65% of all construction activity is residential, with the remaining 35% from non-residential construction. The SWAP database recorded that 47,678 tonnes of construction waste ended up in the Wellington landfill for the year 2002/2003. Therefore, 16,690 tonnes is from non-residential construction or 93 kg per person, this equates to 0.01 ha per person.

Table 49: Estimated land needed for non-residential construction waste

Solid waste		Waste	Waste	Ecological Footprint
		tonnes	tonnes per person	ha
Construction	Residential	30,996.55	0.17	0.0186
	Non-Residential	16,690.45	0.09	0.0099
	Total	47,687.00	0.27	0.0285
Consumer Goods		160,817.00	0.90	0.0954
Total		**208,504.00**	**1.16**	**0.1240**

The total consumed land for services is 0.0117 ha per person or 2,100 ha for Wellington, 1% of the land available.

Garden Land

Garden land is land occupied by parks and green spaces. This is considered reversibly built land because the land could be redeveloped and used for other purposes. There is 3,000 ha (Wellington City Council, 2011) of parks and reserves in the Wellington City Council area. The table below shows the ecological footprint for garden land in Wellington.

Table 50: Estimated ecological footprint for garden land

Ecological Footprint for Wellington	Ecological Footprint per person
ha	ha
3,000	**0.0167**

Energy Land

Energy land for services is similar to the energy land component of the housing footprint. This includes the operational energy for the commercial and public buildings and embodied energy. The embodied energy component includes, construction, maintenance and disposal and the embodied energy in the services.

Energy used for operation of service buildings

The energy used by service (non-residential) buildings was obtained from the Energy Data file for 2006 (Ministry of Economic Development, 2007). This information is for New Zealand as there is currently no published energy data available for Wellington.

Figure 23 shows the distribution of primary energy use for service buildings (commercial and industrial energy use). The majority of primary energy used is electricity followed by gas.

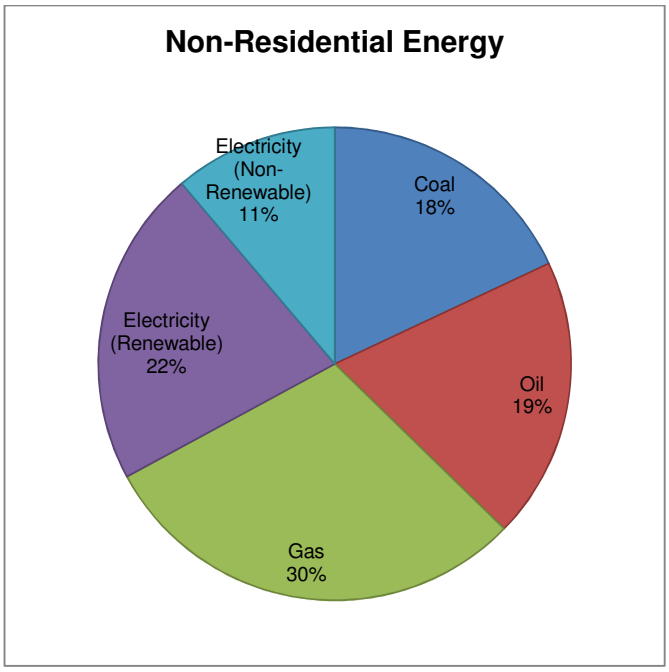

Figure 23: Non-residential energy use distribution

Source: Ministry of Economic Development, 2007

A total of 195 PJ of primary energy was used by service buildings in New Zealand in 2006; 83 PJ is electricity generated from non renewable sources and 83 PJ of gas, while the rest consisted of coal, oil, and electricity from renewable sources. These figures were averaged to a per capita amount, to give an estimated 48.5 GJ per person for total primary energy use. This equates to 0.1526 ha per person or 27,563.32 ha for Wellington, or 9.5% of the land available.

Table 51: Estimated operational energy for service buildings

Fuel type	New Zealand Consumption	Average energy consumption per person	Ecological Footprint per person	Wellington Ecological Footprint
	GJ	GJ	ha	ha
Coal	20,200,000	5.01	0.0334	6,000.10
Oil	21,600,000	5.36	0.0358	6,415.95
Gas	33,400,000	8.29	0.0553	9,920.96
Geothermal	9,700,000	2.41	0.0000[2]	0.00
Other[1]	27,200,000	6.75	0.0000[2]	0.00
Electricity	83,400,000	20.71	0.0291	5,226.31
Total	**195,500,000**	**48.54**	**0.1536**	**27,563.32**

1 Other renewables includes wind, biogas and wood.

2 Generation of electricity not end use, end use accounted for in Electricity component.

Embodied Energy of Service Buildings

As previously discussed in the housing section embodied energy relates to three stages of a building; the construction, maintenance, demolition and disposal at the end of its assumed 50 year lifetime. The embodied energy is the energy associated with these stages. Each of these stages will be discussed separately along with the associated embodied energy and ecological footprint.

Construction energy

The initial embodied energy for a building comes from the construction, and relates to the embodied energy of the materials used, the construction process and transportation to site. The construction embodied energy intensity values for commercial and public buildings were those used in the Canberra Ecological Footprint report.

These are categorised as follows:

- Shopping malls, small shops, restaurants, clubs 6 GJ/m^2
- Schools, colleges, universities 10 GJ/m^2
- Offices, hostels, hospitals, laboratories 11 GJ/m^2
- Warehouses, industrial buildings 5 GJ/m^2

(Close & Foran, 1998, pg 125)

It was assumed the life of a commercial or public building is 50 years, as for housing. Construction energy is assumed to be 57% of the total embodied energy of the buildings.

Table 52 shows the total floor areas for each building type. The combined floor area for commercial and public buildings in Wellington is 7,996,188 m^2. Total embodied energy for construction is 59,274,528 GJ over 50 years. This figure is used to determine the overall embodied energy of a building and the maintenance, demolition and disposal components.

Table 52: Floor area of commercial and public buildings

Building Type	Floor area[1]	Average Embodied Energy[2]	Total Embodied Energy
	m^2	GJ/m^2	GJ
Accommodation	183,998	11	2,023,978
Commercial	3,747,128	5	18,735,640
Educational	107,288	10	1,072,880
Medical	660	11	7,260
Industrial	605,236	5	3,026,180
Office	2,342,188	11	25,764,068
Public	444,470	11	4,889,170
Religious	91,008	10	910,080
Retail	474,212	6	2,845,272
Total	**7,996,188**	**N/A**	**59,274,528**

1 Colliers International Research, 2010

2 Close & Foran, 1998, pg 125

Maintenance energy

Maintenance energy is the energy associated with maintenance work that occurs during a building's minimum 50 year lifetime. Maintenance energy is assumed to be 38% of the overall embodied energy of the building, as for housing. Maintenance energy occurs as the result of changes to walls, roof, electrical work, plumbing and the finishes in a building. These are elements of a building that are typically upgraded throughout its life.

Demolition and disposal energy

This is the energy associated with the demolition and disposal of the building at the end of its assumed 50 year lifetime. Through the housing calculations it was determined that this equates to 5% of the overall embodied energy of a building, 1.15% for demolition and 3.45% for disposal.

Overall embodied energy

Table 53 shows the estimated embodied energy for the service buildings in Wellington and the associated ecological footprint. The assumed percentages for each stage are the same as in the housing calculation:

- 57% for the construction of the building;
- 38% for maintenance and alterations;
- 5% for demolition and disposal.

The ecological footprint, as a result of embodied energy for service buildings, is 0.0770 ha per person, 13,809 ha for Wellington and 4.8% of the available land in the city.

Table 53: Estimated embodied energy for service buildings

Embodied energy	Embodied energy (50 years)	Total energy (1 year)	Embodied energy per person	Wellington Ecological Footprint	Ecological footprint per person
	GJ	GJ	GJ	ha	ha
Construction	59,274,528	1,185,491	6.61	7,903.27	0.0440
Maintenance	39,516,352	790,327	4.40	5,268.85	0.0294
Demolition	1,195,890	23,918	0.13	159.45	0.0009
Disposal	3,587,668	71,753	0.40	478.36	0.0027
Total	**103,574,438**	**2,071,489**	**11.54**	**13,809.93**	**0.0770**

Energy Embodied in Services

This is the energy associated with the services. This is calculated in the same way that the energy land for consumer spending was, through multiplying the energy intensity values associated with the service by the amount of expenditure for each service. Energy intensity data was sourced from the Statistics New Zealand: Energy and the Economy report. Expenditure for each service was estimated by averaging the total annual expenditure for New Zealand, because there is no information available for Wellington.

Table 54: Estimated ecological footprint for expenditure on services

Service	National annual expenditure[1]	Average expenditure per person	Energy intensity[2]	Embodied energy	Ecological Footprint per person
	$ (million)	$	GJ/$	GJ	ha
Central government administration and defence	5,188	1,288.00	0.0012	1.55	0.0103
Local government administration	1,888	468.73	0.0014	0.66	0.0044
Education	6,426	1,595.35	0.0009	1.44	0.0096
Health and community services	8,971	2,227.19	0.0008	1.78	0.0119
Cultural and recreational services	3,593	892.02	0.0008	0.71	0.0048
Personal and other community services	2,425	602.04	0.0008	0.48	0.0032
Communication services	4,652	1,154.93	0.0003	0.35	0.0023
Property services	9,970	2,475.21	0.0009	2.23	0.0149
Tourism[3]	10,264	2,548.20	0.0012	3.06	0.0204
Business Service	13,623	3,382.12	0.0002	0.68	0.0045
Finance and insurance	10,092	2,505.49	0.0002	0.50	0.0033
Total	**77,092**	**19,139.28**	**N/A**	**13.42**	**0.0895**

1 Statistics New Zealand, National Accounts: Year ended March 2009

2 Statistics New Zealand: Energy and the Economy: 1997-2008

3 Statistics New Zealand: Tourism Satellite Accounts: 2006, Domestic Spending on Tourism

National expenditure for both public and private spending in New Zealand totalled $77 billion for 2006, and this excludes wages. Wages are excluded as this would result in double counting, because wages are then spent on consumer goods and services which have already been accounted for. This total was averaged to $19,139 per person. The resultant ecological footprint is 0.0895 ha per person or 16,061 ha for Wellington, approximately 5.5% of the land available.

Total Ecological Footprint for Services in Wellington

The overall ecological footprint for services in Wellington is estimated to be 0.3485 ha per person or 62,535 ha for Wellington. This equates to over 22% of the land available within the city. Table 55 below shows the results from the calculations in this section.

Table 55: Estimated ecological footprint for services

Service	Consumed Land	Garden land	Energy land	Ecological Footprint per person
	ha	ha	ha	ha
Central government administration and defence			0.0103	0.0103
Local government administration			0.0044	0.0044
Education			0.0096	0.0096
Health and community services			0.0119	0.0119
Cultural and recreational services			0.0048	0.0048
Personal and other community services			0.0032	0.0032
Communication services			0.0023	0.0023
Property services			0.0149	0.0149
Tourism			0.0204	0.0204
Business Service			0.0045	0.0045
Finance and insurance			0.0033	0.0033
Service buildings - operation			0.1536	0.1536
Service buildings - construction, maintenance, disposal			0.0770	0.0770
Total	**0.0117** (page 88)	**0.0167** (page 88)	**0.3200**	**0.3485**

4.5.8 Wellington's Ecological Footprint for 2006

This section discusses Wellington's overall ecological footprint for the year 2006. This draws together the calculations for the ecological footprints for each of the five main categories: housing, transport, food, consumer goods and services. The overall ecological footprint is discussed in relation to each category and its contribution to the total. The six land type categories are discussed in regard to their percentage of the overall ecological footprint.

The ecological footprint of Wellingtonians in 2006 was **2.41 ha** per person (432,792 ha for the population) or **6.03 gha** per person (taking into account the fact that New Zealand's land is 2.5 times more productive than the global average), which is 1,081,990 ha for the population. Wellington has a land area of 290,000 ha and a biocapacity of 1.62 ha per person, given the population of 179,466 people. From this it is clear Wellington is in ecological deficit, meaning the population requires more land to produce the resources required than there is available. The footprint of 2.41 ha per person is using almost 150% of the land available. The 6.03 gha per person (able to be compared with global values) ecological footprint is using 370% of the land available. This means that if everyone in the world lived the lifestyle of an average Wellingtonian of 2006 then 3.7 planets would be needed to sustain this lifestyle every year.

The table below shows the calculated results for the five main categories of an ecological footprint.

Table 56: Estimated total ecological footprint

Category	Ecological Footprint	Wellington Ecological Footprint
	ha	ha
Housing	0.12	21,033
Transport	0.47	83,715
Food	0.77	137,681
Consumer Goods	0.72	127,831
Services	0.35	62,057
Total	**2.41**	**432,796**
Total gha (accounting for land productivity)	**6.03**	**1,081,990**

Below is the separation of the overall ecological footprint with respect to how much each category contributed to the total. This shows that food accounts for 32% of the total ecological footprint, the largest portion. This is due to the 0.63 ha per person needed for grazing land for animals; this could be reduced if the population reduced its consumption of meat and meat products. Consumer goods account for 30% of the total land, and grazing land is the largest component of this footprint which is the land needed to produce the wool used for consumer products in New Zealand. Transport land is 19% of the overall footprint; again energy land is the main component of this footprint. This is followed by services, which accounts for 14% of the overall footprint. Energy land contributes the largest area to the services footprint with 0.32 ha per person required. Lastly, housing is the remaining 5% of the overall footprint; energy land makes up a significant portion of this footprint component.

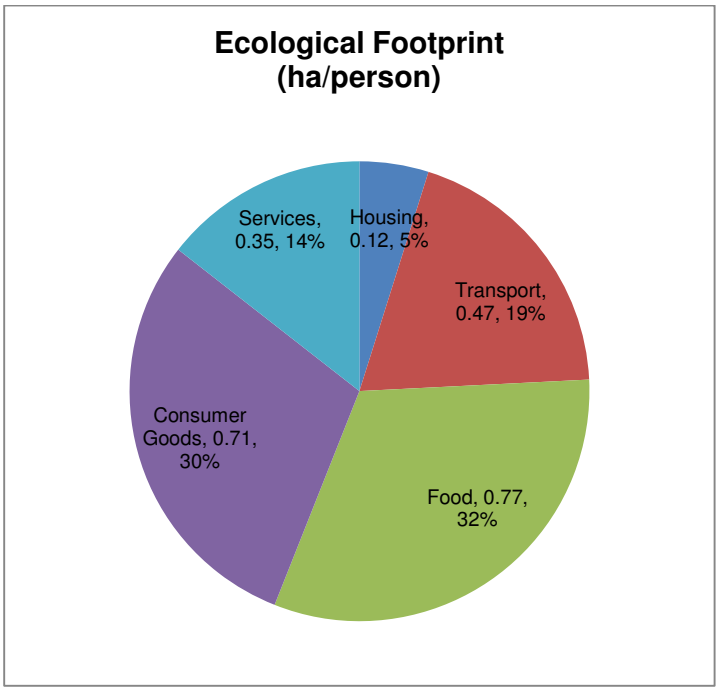

Figure 24: 2006 Ecological Footprint of Wellingtonians

The table below shows the land category components of the overall ecological footprint for Wellington in 2006. The blank spaces are land categories that do not apply to that component of the footprint. It is clear from this information that grazing land is the largest component of the overall ecological footprint.

Table 57: Land category components of the overall ecological footprint

Land type	Food	Housing	Transport	Consumer goods	Services	Total
	ha	ha	ha	ha	ha	ha
Consumed	0.00	0.02	0.00	0.10	0.01	**0.14**
Garden		0.02			0.02	**0.04**
Crop	0.06			0.00		**0.06**
Grazing	0.63			0.49		**1.12**
Forest		0.01		0.06		**0.07**
Energy	0.08	0.07	0.46	0.07	0.32	**0.99**
Total Land	**0.77**	**0.12**	**0.47**	**0.71**	**0.35**	**2.41**

Figure 25 shows the percentages for each land use type. Grazing land contributes 46% to the overall footprint mainly from the food footprint. This is followed by energy land at 41%, mainly from the transport and services footprints. Consumed land is 6% of the total footprint and this primarily comes from the waste component of the consumer goods footprint. Forest land and crop land both contribute 3% to the overall footprint. The majority of forest land is associated with paper waste in the consumer goods footprint. Crop land is mainly the land needed to grow the fruit, vegetables and grains consumed by the average Wellingtonian. Lastly, garden land is 1% of the overall footprint, half of which is from the housing footprint (sections) and the other half from the services footprint (parks and greens spaces).

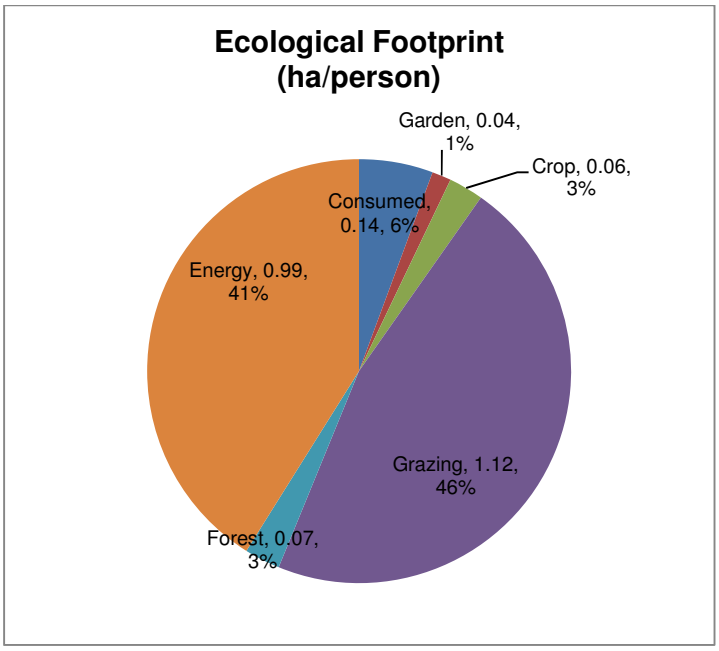

Figure 25: Land use components of the overall ecological footprint

Part 3 – Ecological Footprint of Wellingtonians in 1956

4.6 Wellington's Past Footprint and Lifestyle

This section discusses the calculated results for the ecological footprint of Wellingtonians during the 1950s, for the year 1956. The selection of this year was based on information available in the Population Census 1956 and other records; it also provided a 50 year time span between the two ecological footprint calculations. As in the preceding section, the ecological footprints of the five main categories are discussed separately, followed by discussion of the overall ecological footprint. The resultant ecological footprint for Wellingtonians in the 1950s is then compared with the modern (2006) ecological footprint. In addition, this information is compared with the lifestyle and quality of life in the 1950s, as perceived and described by the participants in the focus group discussions and published information on Wellington in the 1950s.

4.6.1 Household and commercial energy to land ratio – 1956

As previously discussed for the 2006 ecological footprint, this is the land required to generate the energy needed in relation to the consumption of resources. The energy to land ratio for domestic and commercial electricity in 2006 was 711 GJ/ha (accounting for renewable electricity generation). The energy to land ratio for fossil fuels was 150 GJ/ha (accounting for the higher productivity of New Zealand forests) and this value is also used for the 1956 calculation, although the electricity energy to land ratio is different. In 2006, 66% of electricity generation came from renewable resources the remaining 34% came from fossil fuels. In 1956, a greater percentage of electricity was generated from renewable resources. New Zealand's electricity was 89% renewable, with a large percentage of this being hydro (See figures below). Since the 1970s the percentage of electricity generated from renewable resources has decreased with the increase in gas production. In 2006, the percentage had dropped by almost a third to 66% (Ministry of Economic Development, 2007).

Therefore, the following calculation was made to estimate the energy to land ratio for New Zealand's domestic and commercial electricity use (household operation and service buildings operation):

(0.89*1000) + (0.11*150) = 906.5 GJ/ha

This ratio was only applied to the domestic household and service buildings' electricity use. The energy to land ratio for fossil fuel of 150 GJ/ha was applied to fossil fuel sources.

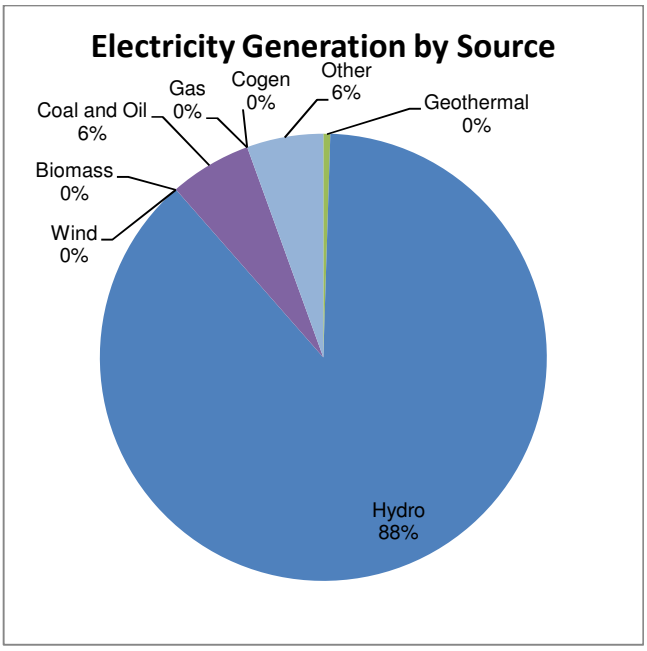

Figure 26: Electricity generation by source in 1956

Source: Bertram et al., 2009, pg 374

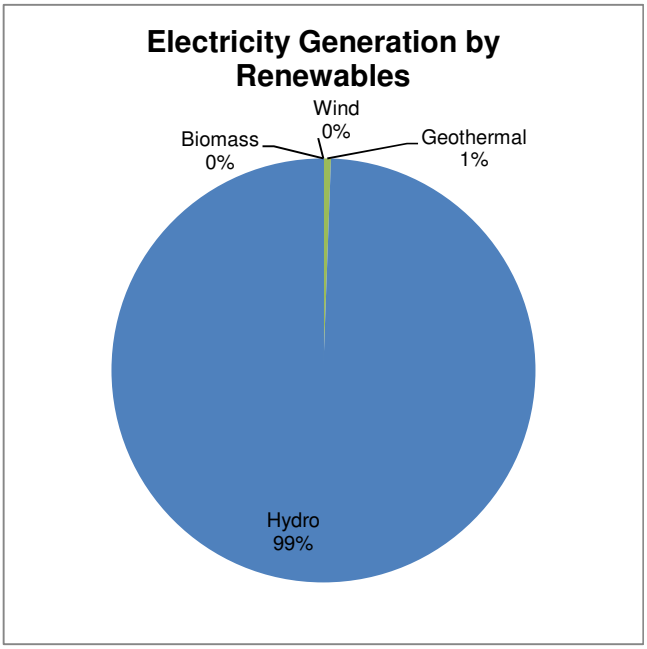

Figure 27: Electricity generation from renewables in 1956

Source: Bertram et al., 2009, pg 374

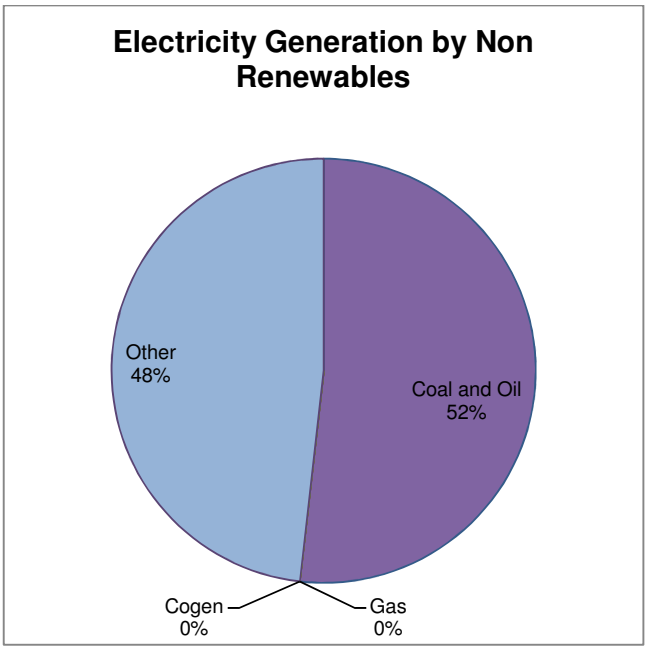

Figure 28: Electricity generation from non renewables in 1956

Source: Bertram et al., 2009, pg 374

4.6.2 Summary of results

Wellingtonians' ecological footprint for 1956 was 1.68 ha per person, and the land area of Wellington was 290,000 ha. The available land area results in a biocapacity of 2.10 ha per person for the population of 138,297 in 1956. From the ecological footprint result it is estimated that Wellington was in ecological reserve. This is because the city's population was only using 80% of the land area available to produce the resources consumed by the population. Wellington had 20% or 58,196 ha of land surplus to the land area required. However, this figure is not globally comparable because New Zealand's land has a higher productivity factor than the global average. When taking this into account the ecological footprint is 4.19 gha per person (2.5 times the local footprint). This is 100% over the biocapacity of Wellington. If everyone lived the lifestyle of a Wellingtonian in the 1950s, we would need 2 planets to sustain the consumption of the global population for a year.

4.6.3 Food

This section calculates the 1956 food footprint for Wellingtonians. This footprint is divided into land for fruit, vegetables and grains, and animal products. Each of these categories has several components that equate to the overall food footprint: consumed land, crop and grazing land, forest land and energy land. Each component will be discussed and calculated separately to provide a detailed analysis of the Wellington food footprint in 1956. The FAO food consumption data collection commenced in 1961 and prior to this limited information is available. Therefore, the decade from 1961 to 1971 was analysed and extrapolated back to estimate the food consumption for 1956. The average yearly increase in food consumption was calculated for this decade; this average was subtracted from the 1961 data to estimate the 1960 consumption, and this was repeated until an estimation of the 1956 food consumption levels were calculated (see Appendix M). These calculations were compared against the food consumption data provided in the Consumers' Price Index 1955. The information provided in the CPI is based on groceries bought, and therefore provided a better representation of food consumption in 1956. Footprint calculations were completed for both data sources to analyse how different or similar the results were. The FAO resulted in a slightly higher footprint as opposed to the CPI information. However, the calculation based on the FAO data for the 1960s is an estimate. The CPI provides a less detailed breakdown of food consumption and only reflects what was purchased. The CPI in only accounting for food purchased ignores the fact that some produce was grown at home. Home grown produce is accounted for in the garden land footprint. It was therefore decided to use the CPI data for this calculation, even though not all food items are listed in the CPI, for example chicken has no data, and this could result in a slight under estimation of the actual food footprint.

Wellington City's Ecological Footprint for Food is 0.75 ha per person.

Summary

In 1956, the food footprint for Wellingtonians was 0.75 ha per person or 103,267 ha for the population, accounting for 36% of the available land. Grazing land was the largest component of this footprint at 0.66 ha. The food footprint is the largest component of the overall footprint, accounting for 44% of the total footprint.

Statistics

Wellington population 1956 – 138,297
New Zealand population 1956 – 2,174,062
Land Area – 290,000 ha

Data Sources

- Food and Agriculture Organisation of the United Nations (FAO)
- Reserve Bank of New Zealand
- Consumers' Price Index 1955

Consumed Land

Consumed land for food is land degraded as the result of unsustainable farming practices. The 2006 footprint disregarded this component of the footprint as agricultural land was only a small percentage of

the land available in Wellington, because it is mainly urban in character. Therefore, for this calculation it is assumed consumed land is zero ha per person.

Crop Land

This is the land area needed to produce the fruit, vegetables, grains, beverages and other types of crops consumed by the population. New Zealand consumption data was obtained from the CPI for 1955; this provided an average per capita consumption value. The consumption figures for seasonal fruit and vegetables were given for each month, while non seasonal produce was given as an average per year. Land imported through the imports of crops was not taken into account, because the aim of this study is to calculate the average ecological footprint of Wellingtonians, therefore imported and exported land is counted as local land.

Fruit

Table 58: Estimated ecological footprint for fruit

Fruit	Average per capita (1955)	Yield	Ecological footprint per person
	kg[1]	kg/ha[2]	ha
Non Seasonal			
Bananas	13.61	6,620	0.0021
Oranges	7.21	2,063	0.0035
Sultanas	2.90	6,620	0.0004
Dates	1.04	6,620	0.0002
Prunes	0.44	6,620	0.0001
Apricots dried	0.27	6,620	0.0000
Peaches canned	3.32	6,620	0.0005
Pineapples, canned	1.93	6,620	0.0003
Non Seasonal total	**30.72**	**N/A**	**0.0070**
Seasonal			
Apples, dessert	9.46	20,243	0.0005
Apples, cooking	5.41	20,243	0.0003
Apricots	4.35	6,620	0.0007
Grapefruit	3.32	21,115	0.0002
Lemons	0.86	10,095	0.0001
Peaches	4.67	6,620	0.0007
Pears	3.47	6,620	0.0005
Plums	2.39	6,620	0.0004
Raspberries	1.58	6,620	0.0002
Strawberries	2.02	6,620	0.0003
Tree tomatoes	1.22	32,718	0.0000
Tomatoes	9.07	32,718	0.0003
Seasonal total	**47.81**	**N/A**	**0.0041**
Total	**78.53**	**N/A**	**0.0111**

1 CPI, 1955

2 FAOSTAT, 1961-1971 – Production – Crops –Yield

An estimated 79 kg of fruit was consumed and this equates to 0.0111 ha/person annually. This is higher than the figure for 2006 (0.008 ha), even though less fruit was consumed. This is due to the lower yield values for 1956; agricultural systems were less productive due to levels of technology and knowledge.

Vegetables

Table 59: Estimated ecological footprint for vegetables

Vegetables	Average per capita (1955)	Yield	Ecological footprint per person
	kg[1]	kg/ha[2]	ha
Non Seasonal			
Onions	4.76	10,366	0.0005
Potatoes	54.43	16,622	0.0033
Peas, canned	4.37	3,888	0.0011
Peas, quick frozen	1.87	3,888	0.0005
Non Seasonal total	**65.43**	**N/A**	**0.0053**
Seasonal			
Beans, stringless	0.66	7,438	0.0001
Beans, runner	0.90	7,438	0.0001
Brussel sprouts	0.90	10,366	0.0001
Cabbage	11.80	10,366	0.0011
Carrots	6.46	10,366	0.0006
Cauliflower	8.45	10,366	0.0008
Kumaras	4.47	18,502	0.0002
Lettuce	4.65	10,366	0.0004
Parsnip	3.51	10,366	0.0003
Peas	5.55	3,888	0.0014
Pumpkin	7.66	10,366	0.0007
Silverbeet	1.94	10,366	0.0002
Swedes	4.93	10,366	0.0005
Seasonal total	**61.88**	**N/A**	**0.0067**
Total	**127.31**	**N/A**	**0.0121**

1 CPI, 1955

2 FAOSTAT, 1961-1971 – Production – Crops – Yield.

An estimated 127 kg of vegetables were consumed per person equating to 0.0121 ha. This is a higher ecological footprint than 2006, even though fewer vegetables were consumed; again this is the result of lower yield values for vegetables.

Grains

Table 60: Estimated ecological footprint for grains

Grains	Average per capita (1955)	Yield	Ecological footprint per person
	kg[2]	kg/ha[3]	ha
Bread	44.00	3,358[1]	0.0131
Flour	16.44	3,358	0.0049
Block cake	6.58	3,358[1]	0.0020
Biscuits	9.07	3,358[1]	0.0027
Oatmeal	3.06	2,286	0.0013
Breakfast cereal	2.35	2,750	0.0009
Rice	2.27	2,944	0.0008
Total	**83.77**	**N/A**	**0.0256**

1 Assumed weight is mostly from flour.

2 CPI, 1955

3 FAOSTAT, 1961-1971 – Production – Crops – Yield.

It is estimated 84 kg of grains were consumed per person, less than the amount consumed in 2006. This results in an ecological footprint of 0.0256 ha per person, double the footprint for 2006.

Beverages

Table 61: Estimated ecological footprint for beverages

Beverages	Average per capita (1955)	Yield	Ecological footprint per person
	kg	kg/ha	ha
Tea	2.81	1,322	0.0021
Coffee	0.23	1,982	0.0001
Aerated water	17.69	N/A	0.0000
Total	**20.73**	**N/A**	**0.0022**

1 Coffee data for Vietnam yield and Tea yield for Indonesia (FAOSTAT, 1961-1971 – Trade – TRADESTAT, Detailed Trade Flows); these are the main countries from which New Zealand imports these products.

2 CPI, 1955

3 FAOSTAT, 1961-1971 – Production – Crops - Yield

Note Alcohol could not be purchased in diaries or local shops.

An estimated 21 kg of beverages were consumed, resulting in an ecological footprint of 0.0022 ha, smaller than the 2006 footprint (96 kg, 0.0036 ha).

Other foods

Table 62: Estimated ecological footprint for other foods

Other foods	Average per capita (1955)	Yield	Ecological footprint per person
	kg	kg/ha[5]	ha
Sugar	29.94	89,465[1]	0.0003
Honey	2.09	0[2]	0.0000
Baking powder	0.45	N/A	0.0000
Cocoa	0.61	5,357	0.0001
Jam[3]	0.79	6,620/89,465	0.0001
Marmalade[4]	0.45	2,065/89,465	0.0001
Salt	4.76	N/A	0.0000
Pepper	0.06	5,357	0.0000
Vinegar	1.84	672	0.0027
Miscellaneous groceries	7.89	N/A	0.0000
Total	**51.92**	**N/A**	**0.0034**

1 Australian data used; no data available for New Zealand and a percentage of these items are imported from Australia (FAOSTAT, 1961-1971 – Trade – TRADESTAT – Detailed Trade Flows).

2 No associated land because bees make honey from other crops.

3 Weight assumed to be half fruit (plum) and half sugar.

4 Weight assumed to be half fruit (oranges) and half sugar.

5 FAOSTAT, 1961-1971 – Production – Crops - Yield

An estimated 52 kg of other foods were consumed, resulting in an ecological footprint of 0.0034 ha per person.

Total Crop Land

Table 63: Estimated ecological footprint for crop land

Food type	Ecological footprint per person	Ecological Footprint for Wellington City
	ha	ha
Fruit	0.0111	1,539.37
Vegetables	0.0121	1,669.15
Grains	0.0256	3,543.59
Beverages	0.0022	309.95
Other food	0.0034	467.05
Total	**0.0544**	**7,529.12**

The estimated crop land needed to produce crops consumed by Wellingtonians in 1956 is 0.0544 ha or 7,529 ha for the population which is 2.6% of the land available. The ecological footprint per person is similar to the 2006 value of 0.0638 ha.

In total, 362 kg of produce associated with cropland is estimated to have been consumed per capita, 70% less than the 622 kg was consumed per person in 2006.

Grazing land

Grazing land is land needed for production of animal products: meat and meat products, poultry and eggs and dairy products. The data was obtained from the CPI for 1955.

Meat and Meat products

Table 64: Estimated ecological footprint for meat and meat products

Meat and meat products	Average per capita (1955)	Yield	Ecological footprint per person
	kg[2]	kg/ha[3]	ha
Beef	27.99	452	0.0620
Mutton	30.16	114	0.2638
Pork	2.25	114	0.0196
Tripe	2.72	N/A[1]	0.0000
Sheep's liver	1.77	N/A[1]	0.0000
Sheep's tongue	7.90	N/A[1]	0.0000
Sausage, beef	11.79	114	0.1032
Ham	0.78	114	0.0068
Bacon	3.63	114	0.0317
Total	**88.98**	**N/A**	**0.4871**

Note Yield values used are 'modern' New Zealand yield values

1 Offal and other animal fats and products are surplus parts of the animal, so are already accounted for in meat cropland

2 CPI, 1955

3 FAOSTAT, 2006, Production – Livestock Primary – Yield

It is estimated that 89 kg of meat was consumed per person, almost 10kg less than the 2006 consumed amount (96 kg). This results in an ecological footprint of 0.4871 ha per person, higher than the 0.327 ha for 2006 due to the different meat and meat products consumed.

Poultry and Eggs

Table 65: Estimated ecological footprint for poultry and eggs

Poultry and Eggs	Average per capita (1955)	Yield	Yield	Ecological footprint per person
	kg[2]	kg/Animal	kg/ha	ha
Eggs	15.11	16.94	226.12[1]	0.0668
Poultry	No info	17.41	232.41[3]	0.0000
Total	**15.11**	**N/A**	**N/A**	**0.0668**

1 Based on 240 eggs per hen (Egg Producers Federation of NZ (Inc), 2010)

2 CPI, 1955

3 FAOSTAT, 1961-1971 – Production – Livestock Primary – Yield

Eggs accounted for 15 kg of food consumed per person; significantly lower than the 47 kg in 2006, no chicken data was provided, however from the participants' comments little chicken was consumed in the 1950s because it was expensive. The resultant footprint is 0.0668 ha per person.

Dairy Products

Table 66: Estimated ecological footprint for dairy

Dairy Products	Average per capita (1955)	Yield	Ecological footprint per person
	kg[1]	kg/ha[2]	ha
Milk, delivered	140.61	1,759.00	0.0799
Butter	17.69	890.00	0.0199
Cheese	3.40	890.00	0.0038
Total	**161.71**	**N/A**	**0.1036**

1 CPI, 1955

2 FAOSTAT, 1961-1971 – Production – Livestock Primary - Yield

More dairy products were consumed in 1955 than 2006, although this is mainly due to higher consumption of milk meaning the ecological footprint is smaller, 0.1036 ha per person (0.1222 ha, 2006).

Total Grazing Land

Table 67: Estimated ecological footprint for grazing land

Food type	Ecological footprint per person	Ecological Footprint for Wellington City
	ha	ha
Meat and meat products	0.4871	67,366.63
Poultry	0.0668	9,240.57
Dairy products	0.1036	14,332.89
Total	**0.6576**	**90,940.08**

The total ecological footprint for grazing land is estimated to have been 0.6576 ha per person in 1956. This is similar to the 2006 footprint of 0.6282 ha. However, due to a smaller population in 1956 the overall footprint area is less. This footprint equates to about 31% of the land area available, while the 2006 footprint required 39% of Wellington's land area. Much like the 2006 result, grazing land is significantly more than crop land (12 times).

Forest Land

As with the 2006 calculation, forest land needed to produce timber for paper used for food packaging is assumed to have been accounted for in the energy intensity data for the processing and manufacturing of food. This is discussed in the following section.

Energy Land

Energy land for food is associated with the embodied energy of food. This is estimated through energy intensity data (GJ/$). The earliest data available was for the year 1971/72 (Cocklin et al., 1989), therefore expenditure for food in 1956 has been converted to the dollar values for this year. This was done through the Reserve Bank of New Zealand's Inflation calculator. The energy land footprint is 0.0347 ha per person for 1956. This value equated to 4,798 ha for Wellington or approximately 1.7% of the land available.

Table 68: Estimated ecological footprint for energy land for food

Embodied energy	Annual household expenditure	Annual expenditure per person[1]	1972 values[2]	Energy intensity[3]	Embodied Energy	Ecological Footprint per person
	£	£	$	GJ/$	GJ	ha
Fruit and vegetables, eggs	75.63	20.11	66.55	0.01946	1.2950	0.0086
Meat, poultry and fish	77.65	20.64	68.33	0.01946	1.3296	0.0089
Dairy	39.50	10.50	34.76	0.01946	0.6764	0.0045
Bread and cereals	31.57	8.39	27.77	0.01946	0.5405	0.0036
Other groceries	35.64	9.47	31.36	0.01946	0.6103	0.0041
Restaurants and takeaways	13.51	3.59	11.89	0.01946	0.2313	0.0015
Drinks, sweets	30.43	8.09	26.77	0.01946	0.5210	0.0035
Total	**303.93**	**80.79**	**267.43**	**N/A**	**5.2041**	**0.0347**

1 Consumers' Price Index 1955

2 Reserve Bank of New Zealand Inflation calculator

3 Cocklin et al., 1989

Wellington's Ecological Footprint for Food

Table 69: Estimated total ecological footprint for food

Food footprint	Energy	Consumed	Crop land	Grazing land	Total Ecological Footprint per person	Ecological Footprint for Wellington City
	ha	ha	ha	ha	ha	ha
Fruit, vegetables, grains	0.0086		0.0365		0.0451	6,242.15
Animal products	0.0261			0.6258	0.6519	90,154.76
Total	**0.0347**	**0.0000**	**0.0365**	**0.6258**	**0.6970**	**96,396.90**

The 1956 food footprint for Wellingtonians was 0.6970 ha per person or 96,397 ha for the population. This equates to 33% of the land area available. The largest component of this footprint, as with the 2006 footprint, is the grazing land needed for meat and meat products. Similar to the 2006 footprint crop land is significantly less than the grazing land area required.

4.6.4 Housing

The following information relates to the ecological footprint for housing in Wellington. The housing footprint is made up of two components: construction/maintenance and operation. This footprint estimates the land needed for housing, including houses and sections. Forest area is calculated based on construction materials needed for housing. Energy land is estimated from operational energy and embodied energy.

Wellington City's Ecological Footprint for Housing is 0.07 ha per person.

Summary

The housing footprint for Wellingtonians was 0.07 ha per person or 9,806 ha for the population, making up 3.4% of the available land. Energy land was the largest component of this footprint, accounting for 0.04 ha. The housing footprint is the smallest component of the overall ecological footprint, and was 4% of the total.

Statistics

Wellington population 1956 – 138,297
New Zealand population 1956 – 2,174,062
Land Area – 290,000 ha

Data Sources

- BRANZ
- Statistics New Zealand
- Department of Scientific and Industrial Research

Consumed Land

This is the land covered by houses, and it is considered to be consumed land because the land cannot be used for any other purpose.

Land covered by housing

The land covered by housing in Wellington city was calculated using the number of houses in 1956 multiplied by the average floor area of the houses in New Zealand at the time. According to the 1956 census there were 36,764 houses in Wellington (Statistics New Zealand, 1957d). This gives an average of 3.8 people per house, higher than the 2006 average of 2.6 people per house, and similar to the census value of 3.58 people per house for New Zealand.

An estimation of the average size of houses in New Zealand for the 1950s was obtained from BRANZ. The average house area was 120 m^2 and that of a multi-unit was 100 m^2, therefore an average of 115 m^2 was used (BRANZ, 2010b, pg 16).

By multiplying the number of houses by the average floor area, the total area covered by houses is 423 ha. This equates to 30.57 m^2 or 0.0031 ha per person, based on the Wellington City population.

Housing construction waste

Housing construction waste was estimated through data given in the City Engineers Department Annual Reports 1955 -1957 for the Wellington City Corporation (now Wellington City Council). There is very limited data on solid waste disposal for the 1950s as the first landfill audits and surveys were conducted in 1971 (Committee on Pollution of the Environment, 1973). Prior to the 1970s landfill sites were poorly managed and limited records were collected on the amount and type of waste entering the landfills. The following information was provided in the City Engineers Department Annual report for 1956. In 1956, a total of 160,777 cubic yards of solid waste entered Wellington landfills, of which 103,500 cubic yards was household refuse. These values were converted to tonnes for the calculations. A volume to weight conversion was used; following this the values were converted into metric tonnes:

Residential waste (loose)	225 pounds/cubic yard	8.88 cubic yards/ton
Commercial/industrial waste (loose)	450 pounds/cubic yard	4.44 cubic yards/ton

Source: U.S Environment Protection Agency, 1997

This results in 22,276 tonnes total (160,777 cubic yards) for solid waste. Wellington had two landfills in the 1950s, Houghton Bay Road Tip (now the site of Buckley Road Reserve and Sinclair Park) and Walworth Road Tip (now Ian Galloway Park) (Wellington City Corporation, 1955, pg 50). The Houghton Bay Road Tip covered an estimated area of 39.69 ha and the Walworth Road Tip 23 ha (Wellington City Council, N.D, WebMap).

The 103,500 cubic yards (10,573.60 tonnes, 47.5% of the total solid waste) of household refuse is assumed to be consumer goods waste and is accounted for in the consumer goods footprint calculation. The remaining 11,702.89 tonnes is assumed to be construction waste (52.5% of the total solid waste). Of this 91% is assumed to be residential construction waste (48% of total solid waste) and the remaining 9% non-residential construction waste (4.5% of total solid waste), which is accounted for in the services footprint. These percentages are estimated from the number of building permits issued in 1956. A total of 327 permits were issued, 299 for dwellings and flats and 28 for business premises (Wellington City Corporation, 1957, pg 12). Therefore, 10,700.8 tonnes is assumed to be residential construction waste, and 1002 tonnes non-residential construction waste.

To estimate the land area needed for residential construction, the same calculation is applied as for the 2006 calculation. 'For every tonne of waste at consumer level, there are 5 tonnes created in the manufacturing process and a further 20 tonnes of resource extraction waste' (Close & Foran, 1998, pg 32). Table 70 shows the results of this calculation and the ecological footprint of Wellington's total solid waste that entered the landfills in 1956. This is 0.0099 ha per person or 1,367 ha for the population about 0.5% of the land available. Therefore, the land needed for residential construction is 0.0047 ha per person.

Table 70: Estimated land area required for solid waste

Solid Waste	Wellington's waste	Waste per Person	Total Land Area	Land Area per Person
	Tonnes	Tonnes	ha	ha
Household Waste	22,276	0.1611	54.70	0.0004
Manufacturing Waste (x5)	111,382	0.8054	273.49	0.0020
Resource Extraction Waste (x20)	445,530	3.2215	1,093.97	0.0079
Total Waste	**556,912**	**4.0269**	**1,367.46**	**0.0099**

Ecological footprint for consumed land by housing in Wellington

The total consumed land was 0.0078 ha per person; about 60% of this land is required for waste as the result of construction. Consumed land for housing equates to 0.4% of the total land available.

Table 71: Estimated ecological footprint for consumed land

Land consumed for housing	Ecological footprint Wellington	Ecological footprint per person
	ha	ha
Housing	422.79	0.0031
Waste	656.88	0.0047
Total	1,079.67	**0.0078**

Garden Land

Garden land is the area of an average house section not covered by the house. This is not classed as consumed land as the land can be productive, for example if vegetables are grown in the garden.

The average section size in Wellington was 800 m^2 (Broadbase International, 2010). This is larger than the average for 2006 of 629 m^2, and probably happens because sections have been subdivided or subdivisions with smaller sections have been developed since the 1950s. This gives an average garden land area of 685 m^2 per section. The total area covered by garden land for housing is 2,518 ha and this equates to 182 m^2 or 0.0182 ha per person.

Table 72: Ecological footprint for garden land

Land for gardens	Number of dwellings	Average garden area	Ecological footprint Wellington city	Ecological footprint per person
	#	m^2	ha	ha
Garden land	36,764	685.0	2,518.33	0.0182

Forest Land

Forest land for housing is the area of forest required to grow the volume of timber needed for the housing stock. To estimate this land area the volume of timber per house is needed for both a timber house with timber floor and a timber house with concrete slab. The number of each type of house is needed. This information is then multiplied by the mean annual harvest increment (MAI) for New Zealand, which has been established as 25 m^3/ha/year (Evergreen Forest Limited, 1996) for Radiata pine.

The average floor area of the housing stock in the 1950s is assumed to be 115 m^2 (BRANZ, 2010b, pg 16). The volume of timber needed per average house was based on the amount used in the 2006 footprint calculation, taking into account the reduced floor area. Therefore, for a timber house with timber floors it was assumed the volume of timber needed was 12.7 m^3 and 10.4 m^3 for a timber house with concrete slab.

Only 40% of houses in the 1950s had a concrete slab, houses commonly had timber floors (60%) (French et al., 2007). Applying these percentages to the number of houses in Wellington, it is assumed that 14,706 houses had a concrete slab, and 22,058 houses had timber floors.

It is assumed an additional 39% of timber will be used for maintenance, repairs and alterations over the 50 year life of a house. Given this information the table below shows the results for this calculation.

Table 73: Estimated ecological footprint for forest land

Forest land	Estimated timber volume	Number of houses	Timber volume of houses (50 years)	Total timber volume (50 years)[1]	Land area needed (50 years)	Ecological footprint per person
	m^3/house	#	m^3	m^3	ha	ha
Timber frame with timber floor	12.7	22,058	279,038.76	387,863.88	15,514.56	0.0022
Timber frame with concrete slab	10.4	14,706	152,202.96	211,562.11	8,462.48	0.0012
Total	N/A	36,764	431,241.72	599,425.99	23,977.04	**0.0035**

1 Includes additional timber for maintenance and alterations.

The estimated forest land needed for the housing stock is 0.0035 ha per person or 479.5 ha for the population, 0.17% of the land available. The footprint per person is almost half that of the 2006 footprint and the footprint for the population is 10 times smaller than that for 2006.

Energy Land

The four main components of the energy land category for housing are:

- Household operational energy which includes the running of appliances, heating and lighting;
- Embodied energy from the raw materials used to construct houses;
- Energy required for the maintenance of houses over their lifespan of 50 years;
- The energy required for demolition and disposal of the building materials at the end of its life.

Household operational energy

The household operational energy was estimated using primary energy data from the Department of Scientific and Industrial Research (DSIR, 1974). This report discussed energy data from 1950 to 1974; data was available for primary energy sources for 1956 and energy consumption by sector. The latter data was only available from 1962 onwards, however a comparison between this data and that for the Energy Data file for 2006 showed that the percentage of total energy used by each sector (residential, commercial, industrial, agriculture and transport) has changed very little over the years, although there has been a significant increase in the amount of energy used per capita and by the country as a whole.

Therefore, the following percentages were applied to each industry sector;

- Residential 13%
- Commercial 10%
- Industrial 30%
- Agriculture 5%
- Transport 42%

The DSIR report showed that energy consumption per capita was 64.6 GJ/person (DSIR, 1974, pg 37); approximately 8.42 GJ/person was used for residential energy or household operational energy, or 18.30 PJ for New Zealand. Figure 29 shows the household energy by fuel type.

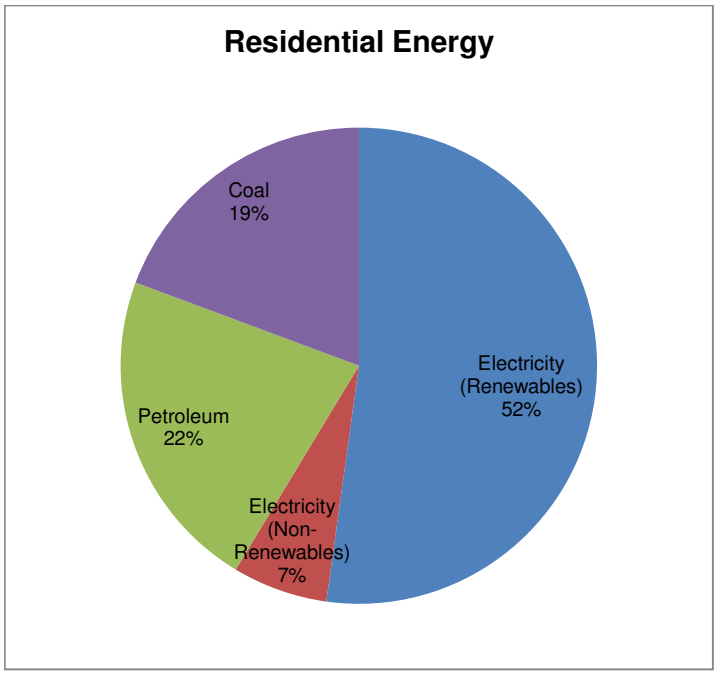

Figure 29: Household energy by fuel type

Source: DSIR, 1974

In 1956, 89% of New Zealand's electricity generation was from renewable resources, mainly hydro and geothermal; the remaining 11% was from fossil fuel sources (Bertram et al., 2009). The ecological footprint for household operation energy is 0.0287 ha per person. This is 3,964 ha for the Wellington population or 1.4% of the land available.

Table 74: Estimated ecological footprint for operational energy

Fuel type	Wellington energy consumption per household	Average energy consumption per person	Ecological footprint per person
	GJ	GJ	ha
Electricity	18.57	4.94	0.0054
Petroleum	6.98	1.86	0.0124
Coal	6.12	1.63	0.0108
Total	**31.67**	**8.42**	**0.0287**

Embodied energy in construction, maintenance and demolition of houses

Embodied energy for housing is associated with three stages of a house; construction, maintenance and demolition and disposal of materials at the end of the assumed lifetime. Embodied energy is the energy needed to carry out each step. These three stages will be discussed separately in relation to the embodied energy and ecological footprint.

Construction energy

As previously discussed this is energy associated with initial construction, and embodied energy is related to the materials, construction process and transportation to site. It was determined that a light timber frame house in New Zealand has an embodied energy of 1.799 GJ/m^2 (Mithraratne et al., 2007, pg 161). The life of a house is assumed to be 50 years in accordance with the New Zealand Building Code.

Maintenance energy

This is energy associated with maintenance carried out on an average house. This was previously established to be 1.187 GJ/m^2 (Mithraratne et al., 2007, pg 161) over 50 years.

Demolition and disposal energy

At the end of the 50 year lifetime, energy is associated with the demolition and disposal of the building. Energy associated with demolition was estimated to be 10kWh/m^2 (Adalberth, 1997, pg 327) or 0.04 GJ/m^2. Disposal energy is assumed to be 30 kWh/m^2 (Adalberth, 1997, pg 327) or 0.12 GJ/m^2.

Overall embodied energy

It was previous estimated that the percentage of the total embodied energy for each step was as follows:

- 57% for the construction of the building;
- 38% for maintenance and alterations;
- 5% for demolition and disposal at the minimum 50 year life.

The table below shows the results for the embodied energy calculation for an average house in Wellington in 1956.

The estimated ecological footprint is 0.0128 ha per person or 1,764 ha for the population and 0.6% of the land area available. Both these values are almost half that of the 2006 footprint calculation for embodied energy.

Table 75: Estimated embodied energy for an average house

Embodied energy	Embodied energy (50 years)	Embodied energy per person	Ecological footprint per person	Wellington Ecological Footprint
	GJ/m^2	GJ/year	ha	ha
Construction	1.799	1.100	0.0073	1,014.12
Maintenance	1.187	0.726	0.0048	669.13
Demolition	0.036	0.022	0.0001	20.29
Disposal	0.108	0.066	0.0004	60.88
Total	**3.13**	**1.914**	**0.0128**	**1,764.43**

Wellington's Ecological Footprint for Housing

Table 76: Total estimated ecological footprint for housing

Housing	Energy	Consumed	Garden	Forest	Total	Total Wellington
	ha	ha	ha	ha	ha	ha
Construction and maintenance	0.0128	0.0078	0.0182	0.0035	0.0422	5,841.97
Operation	0.0287				0.0333	3,963.73
Total	**0.0414**	**0.0078**	**0.0182**	**0.0035**	**0.0709**	**9,805.70**

Wellington's total ecological footprint for housing is shown above. The ecological footprint is estimated to have been 0.0709 ha per person or 9,806 ha for the population, making it about half the footprint for the Wellington population in 2006. This equates to 3.3% of the land available.

4.6.5 Transport

This section estimates the 1956 transport footprint for Wellington. The transport footprint is divided into three categories: private transport, public transport and transportation of goods. There are two land types for the transportation footprint: consumed land for roading and transport infrastructure, and energy land related to the energy required to manufacture and operate transport modes available.

Wellington City's Ecological Footprint for Transport is 0.23 ha per person.

Summary

The transport footprint for Wellingtonians is estimated to have been 0.23 ha per person or 31,710 ha for the population, making 11% of the available land. Energy land was the largest component of this footprint, accounting for 0.23 ha. The transport footprint accounts for 14% of the overall ecological footprint of the population.

Statistics

Wellington population 1956 – 138,297
New Zealand population 1956 – 2,174,062
Land Area – 290,000 ha

Data Sources

- Appendix to the Journals of the House of Representatives of New Zealand (AJHR)
- City of Wellington Yearbook 1953-55

Consumed Land

This is land covered by transport infrastructure; paved surfaces (roads and footpaths) and land covered by the Wellington airport and railway station.

Paved surfaces

The estimated area of land covered by sealed roads in the Wellington region (only data available) was 89.58 ha. There was 183.66 km (114 miles 10 chains) of sealed urban roads and 114.94 km (71 miles 34 chains) of sealed rural roads (New Zealand Parliament, 1957, Vol III, D5, pg 51). The average lane width is assumed to be 3 m. The regional data was adjusted by dividing the area by the regional population to estimate a per person area. No designated cycleways existed in Wellington in the 1950s.

No specific information was available for the length of paved footpaths in Wellington in 1956. A length of 73.46 km was derived from the 2006 calculation (by calculating the ratio of footpath length to road length), with the assumed width of footpaths being 3 m[7]. This results in an estimated area of 22 ha for paved footpaths.

[7] Based on 'modern' value from Land Transport New Zealand, 2006

Airport and Railway station

During the 1950s the Wellington airport was located in Paraparaumu, which is outside the Wellington city area of this study. Construction started in 1952 on the present airport in Rongotai, Wellington, with excavation of the land and removal of houses. The airport was complete and opened in 1959 (Wellington City Council, 2011). Therefore, the airport is only included in consumed land but the runway or buildings are not accounted for in the energy footprint calculation. It is assumed the airport area was 110 ha. The Wellington railway station covered an estimated 28 ha of land (McCracken, 2008), the same as in 2006.

Table 77: Consumed land for transport

Transport Infrastructure	Total area	Area per person
	ha	ha
Roads	75.82	0.0005
Footpaths	13.01	0.0001
Wellington Railway Station	28.00	0.0002
Wellington Airport	110.00	0.0008
Total	**226.84**	**0.0016**

It is estimated a total of 227 ha of land was consumed for transportation infrastructure; this results in a footprint of 0.0016 ha per person, only 0.08% of the land available.

Energy Land

There are three components to this calculation: fuel used for transport, embodied energy from the manufacturing, maintenance and disposal of vehicles and embodied energy for transport infrastructure (roads, footpaths and transport buildings).

Limited information was available in regard to travel and vehicle use in the 1950s. Energy data for transport was obtained from the DSIR report and the Appendix to the Journals of the House of Representatives for 1956.

Energy use for Transport

In 1968, 44% of the total energy consumed was for transport, while this figure was 42% in 1972 (Palmer, 1974, pg 49). These percentages were compared with the Energy Data file percentage for 2006, which gave a similar result. Therefore, it was assumed that transport energy was 42% of the overall energy for 1956. A total 64.8 GJ/person of energy was consumed in 1956. Transport energy is assumed to be 27.20 GJ/person or 56.14 PJ for New Zealand. It was assumed this included all forms of transport; road, rail, shipping and air travel. Average passenger miles for air travel in 1956 were 243.5 miles per person (New Zealand Parliament, 1957, Vol IV, H35 pg 13), or 391.88 kms/person/year. This value has been separated out from the total transport energy. The results from this calculation are shown below; the energy estimated for freight is also accounted for, with the calculation discussed in the following section.

The ecological footprint for passenger transport is estimated to have been 0.1813 ha per person in 1956 or 25,078 ha for the population.

Table 78: Distances travelled and energy used

Wellington travel	km/person/year	Energy use total	Energy used per person	Ecological footprint per person	Ecological Footprint for Wellington
	km	MJ/km	GJ/person	ha	ha
Road and rail travel	various	various	25.79	0.1719	23,777.17
Air travel	391.875	3.6	1.41	0.0094	1,300.68
All transport	**N/A**	**N/A**	**27.20**	**0.1813**	**25,077.86**
Less freight energy	N/A	N/A	0.63	0.0042	582.02
Total	**N/A**	**N/A**	**26.57**	**0.1771**	**24,495.84**

Freight

The results for energy use for freight are shown below. No information could be found for the tonne-kms for coastal shipping or road haulage. Freight information was found in the AHJR, where freight by rail was 1,148 million ton-miles (1,848,009,715 tonne-kms) (New Zealand Parliament, 1957, Vol II, T18, pg 46). Air freight for 1956 was 2,261,943 ton-miles (4,314,508 tonne-kms) (New Zealand Parliament, 1957, Vol IV, H35, pg 13).

The resultant ecological footprint for freight is estimated to have been 0.0042 ha, although this does not account for shipping or road freight. The overall transport energy does and this figure was deducted from the ecological footprint for all transport to estimate the passenger travel ecological footprint (Table 78).

Table 79: Estimated energy use for freight

Freight	New Zealand	Per capita	Energy use	Energy	Ecological Footprint
	tonne-km	tonne-km	MJ/tonne-km	GJ	ha
Rail	1,848,009,715	850.03	0.72	0.61	0.0041
Air	4,314,508	1.98	9.70	0.02	0.0016
Total	**1,852,324,223**	**852.01**	**N/A**	**0.63**	**0.0042**

Embodied Energy in Vehicles

Embodied energy for vehicles is the energy used in the manufacturing and maintenance process. This section estimates the embodied energy of vehicles in Wellington in 1956; some data was available for the Wellington region although more information was available for the number of licensed vehicles in New Zealand. Data was obtained from the AJHR Volume IV, H40. The embodied energy per vehicle was the same as that used for the 2006 footprint. It was assumed that the average life of a vehicle is 10 years.

Manufacturing embodied energy

The Canberra Ecological Footprint report uses an estimated value of 100 GJ of embodied energy for passenger vehicles and light commercial vehicles, 50 GJ for motorcycles, 300 GJ for heavy goods and buses and other types of vehicles. The table below shows the calculations for the manufacturing embodied energy of Wellington's vehicle fleet.

Table 80: Estimated manufacturing embodied energy for vehicles

Motor vehicle fleet	Number (New Zealand)	Embodied energy per vehicle	Total embodied energy (New Zealand)	Embodied energy for 10 years per person	Embodied energy per year per person	Ecological footprint per person
	#	GJ	GJ	GJ/10 years/person	GJ/year/person	ha
Light passenger vehicle	470,492	100	47,049,200	21.64	2.16	0.0144
Light commercial vehicle	63,200	100	6,320,000	2.91	0.29	0.0019
Motorcycle	28,902	50	1,445,100	0.66	0.07	0.0004
Heavy goods	51,963	300	15,588,900	7.17	0.72	0.0048
Bus	2,055	300	616,500	0.28	0.03	0.0002
Other (trailer and caravans)	60,710	25	1,517,750	0.70	0.07	0.0005
Total	**677,322**	**N/A**	**72,537,450**	**33.36**	**3.34**	**0.0222**

The estimated ecological footprint for manufacturing embodied energy is 0.0222 ha per person, half the 2006 footprint, and the result of there being a lower number of vehicles per person. From these calculations there was an average 0.22 passenger vehicles per person in 1956. In 2006 this figure was double, with 0.57 passenger vehicles per person.

Maintenance and Disposal

In addition to the embodied energy for the initial manufacturing of a vehicle, there is embodied energy associated with maintenance during the vehicle's life and disposal. It is assumed that the lifetime of a vehicle is 10 years.

These values are often expressed as percentages of the overall embodied energy of a vehicle. The Canberra Ecological Footprint report uses the following values, which are used for this report:

- 58% for manufacturing;
- 40% for maintenance and repair;
- 2% for disposal of the vehicle.

Table 81: Estimated embodied energy from vehicle fleet

Overall embodied energy of motor vehicle fleet	Total energy (10 years)	Total energy (1 year)	Per person energy	Ecological footprint per person
	GJ	GJ	GJ	ha
Manufacturing	72,537,450.00	7,253,745.00	3.34	0.0222
Maintenance and Repair	50,025,827.59	5,002,582.76	2.30	0.0153
Disposal	2,501,291.38	250,129.14	0.12	0.0008
Total	**125,064,568.97**	**12,506,456.90**	**5.75**	**0.0384**

From the manufacturing embodied energy calculation, the estimated overall embodied energy of the Wellington vehicle fleet can be calculated, as shown above. The estimated footprint was 0.0384 ha per person, about half the size of the 2006 footprint (0.0809 ha). This equates to 5,304 ha for the population or 2% of the land available.

Embodied Energy of Transport Infrastructure

This section estimates the embodied energy of the transport infrastructure. This includes transport buildings; railway station, and paved areas; roads, pavements and paved area surrounding the railway station. From the consumed land calculations, the areas covered by each of these items are shown in the table below.

Table 82: Estimated area covered by transport infrastructure

Transport Infrastructure		Total area
		ha
Paved areas	Roads	75.82
	Footpaths	13.01
	Wellington Railway Station platforms	0.48
Subtotal		**89.32**
Buildings (total floor areas)	Wellington Railway Station building	0.60
Subtotal		**0.60**

It is assumed that the embodied energy is 7,140 MJ/m^3 (Alcorn, n.d). The depth of roading materials and other paved areas (excluding the railway station platforms) is assumed to be 0.07m (Wellington City Council, 2006). The depth of the railway platforms is assumed to be 0.5m.

Embodied energy values are taken from the Canberra Ecological Footprint report. Only the railway station building is included in this calculation. It is assumed to be an office building, and therefore the estimated embodied energy is 11 GJ/m^2.

Table 83: Estimated embodied energy in construction of transport infrastructure

Embodied energy for transport infrastructure		
Buildings	Paved areas	Total
GJ	GJ	GJ
220,000	461,135	681,135

From this calculation it is assumed, like housing, that construction accounts for 57% of the overall embodied energy, maintenance accounts for 38%, 1.15% is demolition and 3.45% is for disposal at 50 years for buildings and 15 years for paved areas.

Table 83 shows the total embodied energy in construction is 681,135 GJ for transport buildings and paved areas. This equates to an ecological footprint of 0.0013 ha per person. Maintenance embodied energy is estimated to be 0.0009 ha and demolition and disposal were 0.0001 ha per person. The overall footprint is 0.0023 ha per person or 315 ha for the population (0.11% of the land available).

Table 84: Estimated total embodied energy in transport infrastructure

Energy Use	Total energy (50 years)	Total energy (1 year)	Energy per capita	Ecological Footprint per person	Wellington Ecological Footprint
	GJ	GJ	GJ	ha	ha
Construction	681,135	35,142	0.20	0.0013	180.54
Maintenance	454,090	23,428	0.13	0.0009	120.36
Demolition	13,742	709	0.00	0.0000	3.64
Disposal	41,227	2,127.03	0.01	0.0001	10.93
Total	**1,190,193**	**61,406.56**	**0.34**	**0.0023**	**315.47**

Total Ecological Footprint for Transport in Wellington

The overall ecological footprint for transport is estimated to have been 0.2293 ha per person or 31,715 ha for the population. This equates to 11% of the land available. This is divided into private, public and goods transport. The energy land component for road and rail travel was assumed to be all public transport, as little information was available in regard to the percentage of traffic on the road. From this information it is estimated that public transport was 76%, private transport 19.5% and freight 4.4%. This supports the idea that it was more common for people to use public transport as their main mode of transport.

Table 85: Estimated ecological footprint for transport

Transport footprint	Energy	Consumed Land total	Ecological Footprint per person	Wellington Ecological Footprint
	ha	ha	ha	ha
Private transport	0.0432	0.0014	0.0447	6,176.18
Public transport	0.1745	0.0000	0.1745	24,137.65
Goods transport	0.0099	0.0002	0.0101	1,396.32
Total	**0.2277**	**0.0016**	**0.2293**	**31,710.15**

4.6.6 Consumer Goods

This section discusses the estimated ecological footprint for consumer goods purchased by Wellingtonians in 1956. The consumer goods footprint consists of four land types: consumed land, crop land, forest land and energy land. Each of these land types will be discussed and calculated separately to determine the overall consumer goods footprint.

Wellington City's Ecological Footprint for Consumer Goods is 0.40 ha per person.

Summary

The consumer goods footprint was 0.40 ha per person or 54,945 ha for the population, making 17% of the available land. Grazing land was the largest component of this footprint, accounting for 0.35 ha. The consumer goods footprint accounts for 24% of the overall footprint.

Statistics

Wellington population 1956 – 138,297
New Zealand population 1956 – 2,174,062
Land Area – 290,000 ha

Data Sources

- City Engineering Department Annual Report 1956
- Consumers' Price Index 1955

Consumed Land

Consumed land for consumer goods is the land associated with the amount of solid waste that enters the landfill per year. From the City Engineering Department Annual Report for 1956, it was estimated that 11,702 tonnes of solid waste was construction waste, and the remaining 10,573.6 tonnes was assumed to be from consumer goods. This amount of waste would require an estimated 649 ha of landfill or 0.0047 ha per person. This equated to 0.02% of the total land area.

Table 86: Estimated ecological footprint for consumer goods waste

Solid waste		Waste	Waste	Ecological Footprint
		tonnes	tonnes per person	ha
Construction	Residential	10,700.81	0.08	0.0047
	Non-Residential	1,002.08	0.01	0.0004
	Total	11,702.89	0.08	0.0052
Consumer Goods		10,573.60	0.08	**0.0047**
Total		**22,276.49**	**0.16**	**0.0099**

Crop and Grazing Land

Crop land for consumer goods is land needed to produce tobacco and cotton. Grazing land is the land required for wool producing sheep. Data for New Zealand's consumption of these products was obtained from the FAO database (FAOSTAT, 2006, Production – Livestock Primary – Wool, greasy). The ecological footprint for crop and grazing land is 0.3538 ha per person, almost twice the 2006 footprint. This equates to 48,935 for the population, or almost 17% of the land available.

Table 87: Estimated crop and grazing land for consumer goods

Land use type	Consumer good	New Zealand Consumption (1956)	Average per capita	Yield	Ecological Footprint
		Tonnes	kg	kg/ha	ha
Crop land	Tobacco	2,592	1.19	2,758.60[1]	0.0004
	Cotton	8	0.00	642.00[2]	0.0000
Total		N/A	N/A	N/A	**0.0004**
Grazing land for wool	Greasy wool	232,450	106.92	90.65[3]	1.1795
	Clean wool (70%)	162,715	74.84	63.46	1.1795
	Wool for consumer goods (30%)	48,815	22.45	63.46	0.3538
Total		**N/A**	**N/A**	**N/A**	**0.3538**

1 Australian data from FAO

2 Pakistan data from ICAC, Cotton World Statistics, pg 49

3 Department of Scientific and Industrial Research, 1975, pg 381

Forest Land

The forest land required was estimated using the total amount of paper that entered the landfills in Wellington in 1956. Limited data is available for solid waste disposal during this time, and many landfills did not record the types and associated amounts of waste entering the landfill. An estimate based on the total waste that entered the Wellington landfills in 1956 was made. According to the SWAP database on average 20% of solid waste is paper. It is estimated that 4,455 tonnes of paper entered Wellington's landfills. Using the yield and MAI values for 2006, an ecological footprint of 0.0081 ha per person was calculated.

Table 88: Estimated ecological footprint of forest land for paper waste

Forest land	Quantity for Wellington	Quantity per person	Yield	MAI	Volume of paper	Ecological Footprint
	tonnes	kg	m^3/tonne paper	m^3/ha/year	m^3	ha
Paper	4,455.30	32.22	6.25	25	0.20	**0.0081**

Energy Land

Energy land needed for consumer goods is estimated through average expenditure for consumer goods and the energy intensity related to each category. Expenditure per person on consumer goods was obtained from the Consumers' Price Index (New Zealand Department of Statistics, 1956). The earliest energy intensity data (GJ/$) was for 1971/72 (Cocklin et al., 1989), so expenditure was converted to 1972 values.

Table 89: Estimated ecological footprint for energy land for consumer goods

Consumer Goods	Average annual expenditure per household[3]	Average annual expenditure per person	1972 values[1]	Energy intensity[2]	Embodied energy	Ecological footprint per person
	£	£	$	GJ/$	GJ	ha
Tobacco and Alcohol	80.31	21.35	81.77	0.0195	1.59	0.0106
Clothing and footwear	145.35	38.64	132.15	0.0098	1.29	0.0086
Household contents and services	69.75	18.54	71.01	0.0212	1.51	0.0101
Personal goods	14.64	3.89	14.91	0.0098	0.15	0.0010
Other supplies	31.54	8.38	32.11	0.0213	0.68	0.0046
Total	**341.59**	**90.81**	**347.79**	**N/A**	**5.22**	**0.0303**

1 Reserve Bank of New Zealand Inflation calculator

2 Cocklin et al. 1989

3 Consumers' Price Index 1955

The average weekly expenditure on consumer goods per capita in New Zealand was £341.59/week/household. This equates to $13,620.23 in 2006, assuming general consumer goods and services inflation (Reserve Bank of New Zealand, 2010). Household expenditure in 2006 was $25,610 (Statistics New Zealand, 2007, Household Economic Spending), an increase of $11,989 or $240 on average per year since 1950. Annual expenditure per person was £90.81 ($3,620.87 in 2006); this has an associated 5.22 GJ of embodied energy. The ecological footprint was 0.0303 ha per person, half that of the 2006 footprint. This is 4,186 ha for the population or 1.4% of the land available.

Total Ecological Footprint for Consumer Goods in Wellington

The ecological footprint for consumer goods in 1956 is estimated to be 0.6202 ha per person or 85,765 ha for the population, making 30% of the land area available. The largest portion of this footprint comes from grazing land for wool products.

Table 90: Estimated ecological footprint for consumer goods

Consumer Goods	Consumed Land	Crop Land	Grazing Land	Forest Land	Energy Land	Total land
	ha	ha	ha	ha	ha	ha
Tobacco and Alcohol					0.0106	0.0106
Clothing and footwear					0.0086	0.0086
Household contents and services					0.0101	0.0101
Personal goods					0.0010	0.0010
Other supplies					0.0046	0.0046
Construction waste	0.0047				-	-
Tobacco and Cotton		0.0004			-	-
Wool			0.3538		-	-
Paper				0.0081	-	-
Total	**0.0047**	**0.0004**	**0.3538**	**0.0081**	**0.0303**	**0.3973**

4.6.7 Services

This section discusses the estimated ecological footprint for services. The services footprint consists of three land types: consumed land, garden land and energy land. Each of these land types will be discussed and calculated separately to determine the overall services footprint.

Wellington City's Ecological Footprint for Services is 0.23 ha per person.

Summary

The service footprint for Wellingtonians is estimated to have been 0.23 ha per person or 32,075 ha for the population, making 12% of the available land. Energy land was the largest component of this footprint, accounting for 0.22 ha. The services footprint is 14% of the overall ecological footprint.

Statistics

Wellington population 1956 – 138,297
New Zealand population 1956 – 2,174,062
Land Area – 290,000 ha

Data Sources

- Wellington City Corporation
- Department of Scientific and Industrial Research

Consumed Land

Consumed land associated with services is the land covered by all non residential buildings (commercial and public buildings). This land was estimated from data for 1961 (City Engineering Department, 1963), as no records exist prior to this time. This report provided commercial and public building floor areas for the Wellington's Central Business District (Lambton, Te Aro, Thorndon Building Districts, and Kilbirnie and Lyall Bay). At this time 90% of the region's office space was in Wellington city and nearly all of this was in the CBD (Stephenson, 1964). It was therefore assumed this information would provide an estimation of the consumed land for buildings in 1956. Only building floor areas were available not building footprint areas, therefore it was assumed the average building height was 2 storeys. It was becoming more common during the 1940s and 50s for larger commercial buildings to be 4 to 6 storeys (Town Planning Department Wellington City Corporation, 1987). A total of 1,465,428 m^2 of commercial and public floor area was available in 1961. From this the ecological footprint is 73.3 ha for Wellington or 0.0005 ha per person.

Table 91: Estimated land area covered by commercial and public buildings

Ecological Footprint for Wellington	Ecological Footprint per person
ha	ha
73.27	0.0005

Another component of consumed land is the land needed for the waste from non-residential construction. This was determined previously as 1,002 tonnes for 1956; an estimated land area of 61.5 ha is needed for this amount of solid waste, equating to 0.0004 ha per person, and 0.02% of the land available.

Table 92: Estimated land needed for non-residential construction waste

Solid waste		Waste	Waste	Ecological Footprint
		tonnes	tonnes per person	ha
Construction	Residential	10,700.81	0.08	0.0047
	Non-Residential	1,002.08	0.01	**0.0004**
	Total	11,702.89	0.08	0.0052
Consumer Goods		10,573.60	0.08	0.0047
Total		**22,276.49**	0.16	**0.0099**

The total consumed land for services is estimated to have been 0.001 ha per person.

Garden Land

Garden land is land occupied by parks and green spaces. This is considered reversible built land because the land could be redeveloped and used for other purposes. The City of Wellington Yearbook recorded 2,988 acres of reserves and town belt land (1,209.2 hectares) in 1955.

Table 93: Estimated ecological footprint for garden land

Ecological Footprint for Wellington	Ecological Footprint per person
ha	ha
1,209.20	0.0087

Energy Land

Energy land for services is similar to the energy land component of the housing footprint. This includes the operational energy for the commercial and public buildings and embodied energy. The embodied energy component includes construction, maintenance and disposal and the embodied energy in the services.

Energy used for operation of service buildings

The energy used by service buildings (non-residential) was estimated from the DSIR report (Palmer, 1974). Limited primary energy consumption data is available for New Zealand during the 1950s. The graph below shows the estimated percentages of each fuel type for primary energy consumption.

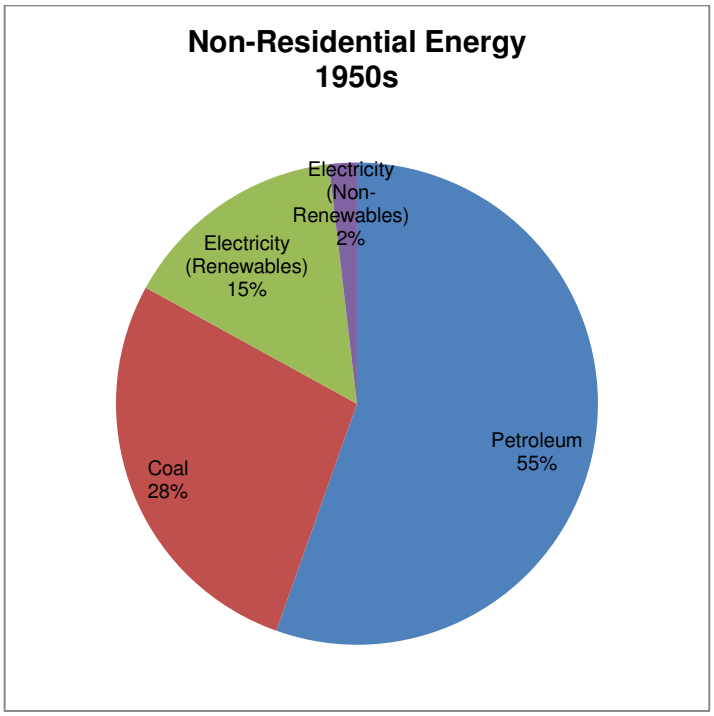

Figure 30: Non-residential energy use distribution

Source: Palmer, 1974

A total of 56 PJ of primary energy was used by service buildings in New Zealand in 1956. This equates to 26 GJ/person. Petroleum and coal were the main sources of primary energy; electricity includes hydro and geothermal production, and together these made up 89% of the primary energy sources for electricity, the remaining 11% were from fossil fuels (Bertram et al., 2009). Natural gas production started in the 1970s (Palmer, 1974).

Energy used by service buildings equated to 0.1482 ha per person or 20,493 ha for the population or about 7% of the land available.

Table 94: Estimated operational energy for service buildings

Fuel type	New Zealand Consumption	Average energy consumption per person	Ecological Footprint per person	Wellington Ecological Footprint
	GJ	GJ	ha	ha
Petroleum	31,220,400	14,36	0.0957	13,240.00
Coal	15,520,000	7.14	0.0476	6,581.75
Electricity	9,579,600	4.41	0.0049	672,23
Total	**56,320,000**	**25.91**	**0.1482**	**20,493.98**

Embodied Energy of Service Buildings

As previously discussed in the housing section embodied energy relates to three stages of a building; the construction, maintenance, demolition and disposal at the end of its assumed 50 year lifetime. The embodied energy is the energy associated with these stages. Each of these stages will be discussed separately along with the associated embodied energy and ecological footprint.

Construction energy

The initial embodied energy for a building comes from the construction, and relates to the embodied energy of the materials used, the construction process and transportation to site. The construction embodied energy intensity values for commercial and public buildings were those used in the Canberra Ecological Footprint report.

These are categorised as follows:

- Shopping malls, small shops, restaurants, clubs 6 GJ/m^2
- Schools, colleges, universities 10 GJ/m^2
- Offices, hostels, hospitals, laboratories 11 GJ/m^2
- Warehouses, industrial buildings 5 GJ/m^2

(Close & Foran, 1998, pg 125)

It was assumed the life of a commercial or public building is 50 years, the same as for housing. Construction energy is assumed to be 57% of the total embodied energy of the buildings.

Estimated percentages of building types are shown in the table below. The number of each commercial and public building type was obtained from the City of Wellington Yearbook. The percentage of each type of building was multiplied by the total floor area of commercial and public buildings.

Table 95: Estimated floor area by building type

Type of Building	Number of Buildings[1]	Percentage of Total	Estimated floor area
	#	%	m^2
Licensed hotels	46	2.07	30,337.40
Private hotels	135	6.08	89,033.67
Institutions	67	3.02	44,187.08
Public buildings	412	18.54	271,717.56
Commercial buildings	1,562	70.30	1,030,152.51
Total	**2,222**	**100.00**	**1,465,428.21**

1 Wellington City Corporation, 1955

Table 96 shows the estimated floor area of commercial and public buildings. The combined floor area for Wellington was 1,465,428 m^2. The estimated embodied energy for construction is 16,075,523 GJ over 50 years. This figure is used to estimate maintenance, demolition and disposal embodied energy components.

Table 96: Estimated floor area of commercial and public buildings

Building Type	Floor area[1]	Average Embodied Energy[2]	Total Embodied Energy
	m^2	GJ/m^2	GJ
Licensed hotels	30,337.40	11	333,711
Private hotels	89,033.67	11	979,370
Institutions	44,187.08	10	441,871
Public buildings	271,717.56	11	2,988,893
Commercial buildings	1,030,152.51	11	11,331,678
Total	**1,465,428.21**	**N/A**	**16,075,523**

1 City Engineering Department, 1963

2 Close & Foran, 1998

Maintenance energy

Maintenance energy is the energy associated with maintenance work that occurs during a building's minimum 50 year life. Maintenance energy is assumed to be 38% of the overall embodied energy. Maintenance energy occurs as the result of changes to walls, roof, electrical work, plumbing and the finishes in a building. These are elements of a building that are typically upgraded throughout the life of a building.

Demolition and disposal energy

This is the energy associated with the demolition and disposal of the building at the end of its assumed 50 year life. Through the housing calculations it was estimated that this equates to 5% of the overall embodied energy of a building, 1.15% for demolition and 3.45% for disposal.

Overall embodied energy

The table below shows the estimated embodied energy for the service buildings in Wellington and the associated ecological footprint. The assumed percentages for each stage are the same as the housing calculation:

- 57% for the construction of the building;
- 38% for maintenance and alterations;
- 5% for demolition and disposal.

The estimated ecological footprint for service buildings embodied energy is 0.0271 ha or 3,745 ha for the population, or 1.3% of the land available.

Table 97: Estimated embodied energy for service buildings

Embodied energy	Embodied energy (50 years)	Total energy (1 year)	Embodied energy per person	Wellington Ecological Footprint	Ecological footprint per person
	GJ	GJ	GJ	ha	ha
Construction	16,075,523	321,510	2.32	2,143.40	0.0155
Maintenance	10,717,016	214,340	1.55	1,428.94	0.0103
Demolition	324,331	6,487	0.05	43.24	0.0003
Disposal	972,992	19,460	0.14	129.73	0.0009
Total	**28,089,862**	**561,797**	**4.06**	**3,745.31**	**0.0271**

Energy Embodied in Services

Embodied energy for services is the energy associated with expenditure, known as energy intensity. Energy intensity data was only available for the year 1971/72 (Cocklin et al., 1989), and expenditure values were converted to 1972 equivalents. Private expenditure data was obtained from the Consumers' Price Index for 1955 and Government spending from the Appendix to the Journals of the House of Representatives Vol II. The results from these calculations are shown below.

Table 98: Estimated ecological footprint for expenditure on services

Service	Government spending per person	Private annual expenditure per person[3]	Average expenditure per person	1972 value[1]	Energy intensity	Embodied energy	Ecological Footprint per person
	£	£	£	$	GJ/$	GJ	ha
Defence	11.22	0.00	11.22	42.98	0.0045	0.19	0.0013
Administration	10.86	0.00	10.86	41.58	0.0093	0.39	0.0026
Social services	57.63	0.00	57.63	220.74	0.0213	4.69	0.0313
Health and community services	0.00	3.63	3.63	13.92	0.0231	0.32	0.0021
Cultural and recreational services	0.00	4.61	4.61	17.67	0.0231	0.41	0.0027
Personal and other community services	0.00	2.07	2.07	7.95	0.0231	0.18	0.0012
Stabilisation	5.43	0.00	5.43	20.79	0.0045	0.09	0.0006
Development of industry	6.67	0.00	6.67	25.54	0.0045	0.11	0.0008
Tourism	0.00	4.60	4.60	17.62	0.0073	0.13	0.0009
Financial and insurance	19.32	0.00	19.32	73.99	0.0044	0.32	0.0022
Other expenditure	11.36	0.00	11.36	43.51	0.0045	0.19	0.0013
Total	**122.49**	**14.92**	**137.41**	**526.29**	**N/A**	**7.04**	**0.0469**

1 Reserve Bank of New Zealand Inflation Calculator

2 AJHR, Volume II, pg 31

3 Consumers' Price Index 1955 Revision

National expenditure for public and private spending totalled £26 million for 1956, excluding wages. This is an average expenditure of £137.41/person/year. The resultant ecological footprint is 0.0469 ha per person or 6,492 ha for the population, making 2.3% of the land available.

Total Ecological Footprint for Services in Wellington

The overall ecological footprint for services is estimated to have been 0.2564 ha per person or 35,466 ha for the population, which is 12% of the land available. The results are shown in the table below.

Table 99: Estimated ecological footprint for services

Service	Consumed Land	Garden land	Energy land	Total Land
	ha	ha	ha	ha
Defence			0.0013	0.0013
Administration			0.0026	0.0026
Social services			0.0313	0.0313
Health and community services			0.0021	0.0021
Cultural and recreational services			0.0027	0.0027
Personal and other community services			0.0012	0.0012
Stabilisation			0.0006	0.0006
Development of industry			0.0008	0.0008
Tourism			0.0009	0.0009
Financial and insurance			0.0022	0.0022
Other expenditure			0.0013	0.0013
Service buildings - operation			0.1482	0.1482
Service buildings - construction, maintenance, disposal			0.0271	0.0271
Commercial and public buildings, non-residential waste	0.0010		-	-
Parks and green spaces		0.0087	-	-
Total	**0.0010**	**0.0087**	**0.2222**	**0.2319**

4.6.8 Wellington's Ecological Footprint for 1956

This section discusses the estimated ecological footprint of Wellingtonians in 1956. This information draws together the calculations for each of the five main ecological footprint categories: housing, transport, food, consumer goods and services. Each category is discussed in relation to its contribution to the overall footprint. The six land type categories are also discussed in the same way.

The ecological footprint of Wellingtonians in 1956 is estimated at **1.68 ha** per person (231,804 ha for the population) or **4.19 gha** per person (taking into account New Zealand's land productivity at 2.5 times the global average). This equates to 579,511 gha for the population. Wellington had a land area of 290,000 ha (the same as 2006) and a biocapacity of 2.10 ha per person for the 138,297 people living in Wellington at the time. Wellington was therefore in ecological reserve. The population was only using 80% of the land area available. However, when taking into account New Zealand's land productivity, the ecological footprint is 4.19 gha; this is about 200% or twice the area of land available. If everyone in the world lived this lifestyle and consumed the same amount as Wellingtonians in the 1950s, 2 planets would be needed to sustain this lifestyle every year.

A summary of the calculated results for each ecological footprint category are shown in the table below.

Table 100: Estimated total ecological footprint

Category	Ecological Footprint	Wellington Ecological Footprint
	ha	ha
Housing	0.07	9,806
Transport	0.23	31,710
Food	0.75	103,267
Consumer Goods	0.40	54,945
Services	0.23	32,076
Total	**1.68**	**231,804**
Total gha (accounting for land productivity)	**4.19**	**579,511**

Below is the analysis of the five main categories of the overall ecological footprint. The graph shows that the food footprint is the largest component of the overall footprint accounting for 0.75 ha or 44%. This is largely due to the 0.66 ha needed for grazing land for meat and meat products. This second largest contributor to the overall footprint was consumer goods, accounting for 0.40 ha per person or 24%. Grazing land was the largest component of the consumer goods footprint, contributing 0.35 ha per person. Services resulted in 14% of the overall ecological footprint or 0.23 ha per person. The largest component of this category was energy land associated with expenditure, operation and embodied energy for service buildings. Transport land accounted for 14% of the total footprint or 0.23 ha per person, this is mainly energy land. The housing category is the smallest component of the overall footprint. It accounts for 4% of the total and 0.07 ha per person, and again this is mainly energy land.

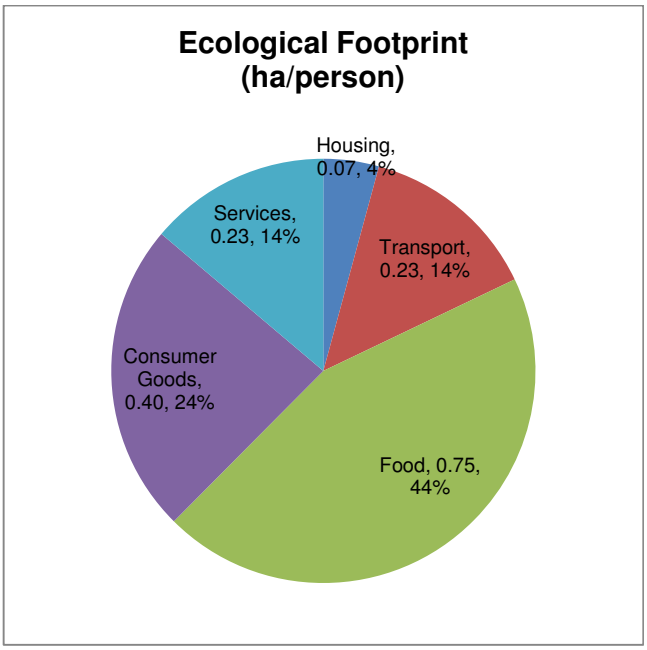

Figure 31: 1956 Ecological Footprint of Wellingtonians

Table 101 shows the land category components of the 1956 Wellington ecological footprint. The blank spaces are land categories unrelated to that category of the footprint. From this information it is clear grazing land is the largest land component of the overall ecological footprint. This result is discussed further below.

Table 101: Land category components of the overall ecological footprint

Land type	Food	Housing	Transport	Consumer goods	Services	Total
	ha	ha	ha	ha	ha	ha
Consumed	0.00	0.01	0.00	0.00	0.00	**0.02**
Garden		0.02			0.01	**0.03**
Crop	0.05			0.00		**0.05**
Grazing	0.66			0.35		**1.01**
Forest		0.00		0.01		**0.01**
Energy	0.03	0.04	0.23	0.03	0.22	**0.56**
Total Land	**0.75**	**0.07**	**0.23**	**0.40**	**0.23**	**1.68**

The graph below shows the percentages for each land use type. The largest component is grazing land, contributing 60% or 1.01 ha to the total ecological footprint. This land comes from the food and consumer goods footprint. This is followed by energy land, which was also the second largest component of the 2006 ecological footprint. Energy land is 33% of the overall ecological footprint or 0.56 ha per person. Most of this land came from the transport and services footprints. Crop, garden and consumed land all contribute small areas to the overall ecological footprint. Crop land is 3% of the total, 0.05 ha per person; this is primarily for food production. Garden land is 0.03 ha per person and 2% of the total, coming mainly from the housing footprint and is land for housing sections. Lastly, consumed land is 0.02 ha per person and 1% of the total ecological footprint. This land comes from the housing footprint and is land for houses.

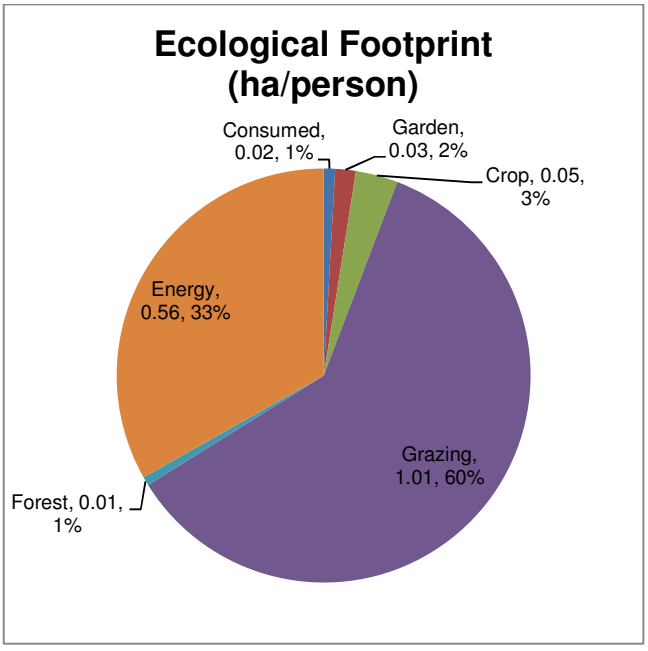

Figure 32: Land use components of the overall ecological footprint

4.7 Survey Findings

In addition to data and statistics collected to estimate the ecological footprints of Wellingtonians, residents who lived in Wellington during the 1950s were surveyed using a questionnaire and some participated in focus group discussions (Section 3.5.1, page 38). This section discusses the findings from both. The findings and opinions are then compared with the ecological footprints for 1956. This is to determine how the 1950s ecological footprint of Wellingtonians relates to lifestyle and quality of life, as perceived by the participants of the questionnaire and focus group discussions.

4.7.1 Questionnaire Results

A 60 question questionnaire was completed by 30 people who lived in Wellington during the 1950s. The questionnaire can be found in Appendix D. This section discusses the main results from the questionnaire, and further graphs can be found in Appendix G, including the number of people who answered each question. Although this information cannot directly be related to the general public during the 1950s, it does however give an indication of what Wellington was like during the 1950s, in terms of housing, the types of jobs people had, transportation owned and available, food grown, types of consumer goods owned, the standard of services, recreational activities people participated in and the participants' perception of quality of life at that time.

Three types of questions were asked; multiple answer, single answer and written questions, and some questions were a combination of these. Not all questions were applicable to everyone, Appendix F states the number of respondents, the type of question, and if a multiple answer question, the number of selections.

General Questions

Questions 1 and 2 asked participants where and when they were born and where they lived in Wellington during the 1950s. Of the 30 people, 16 were born in Wellington, 8 were born in other locations around New Zealand and 6 people were born overseas (The Netherlands, Australia, Wales and China). Figure 33 shows the ages of participants during the 1950s and now.

Characteristics of the participants

Information	Details
Age range 1950	0-36 years
Age range 1959	7-45 years
Age range now	58-96 years
Birth date range	1914-1952
Average age now	77 years

Figure 33: Ages of participants

Location of participants during the 1950s

Figure 34 illustrates the locations of the participants in the 1950s. Participants could list as many locations in Wellington as they lived in during this time. Some locations and people are not shown on this map owing to the scale, and these include: Ngaio (1 person), Khandallah (3 people), Johnsonville (1 person), Tawa (1 person) and the Hutt Valley (7 people). Everyone lived within the Wellington city area in the 1950s, although some people moved outside this area at some stage during the decade.

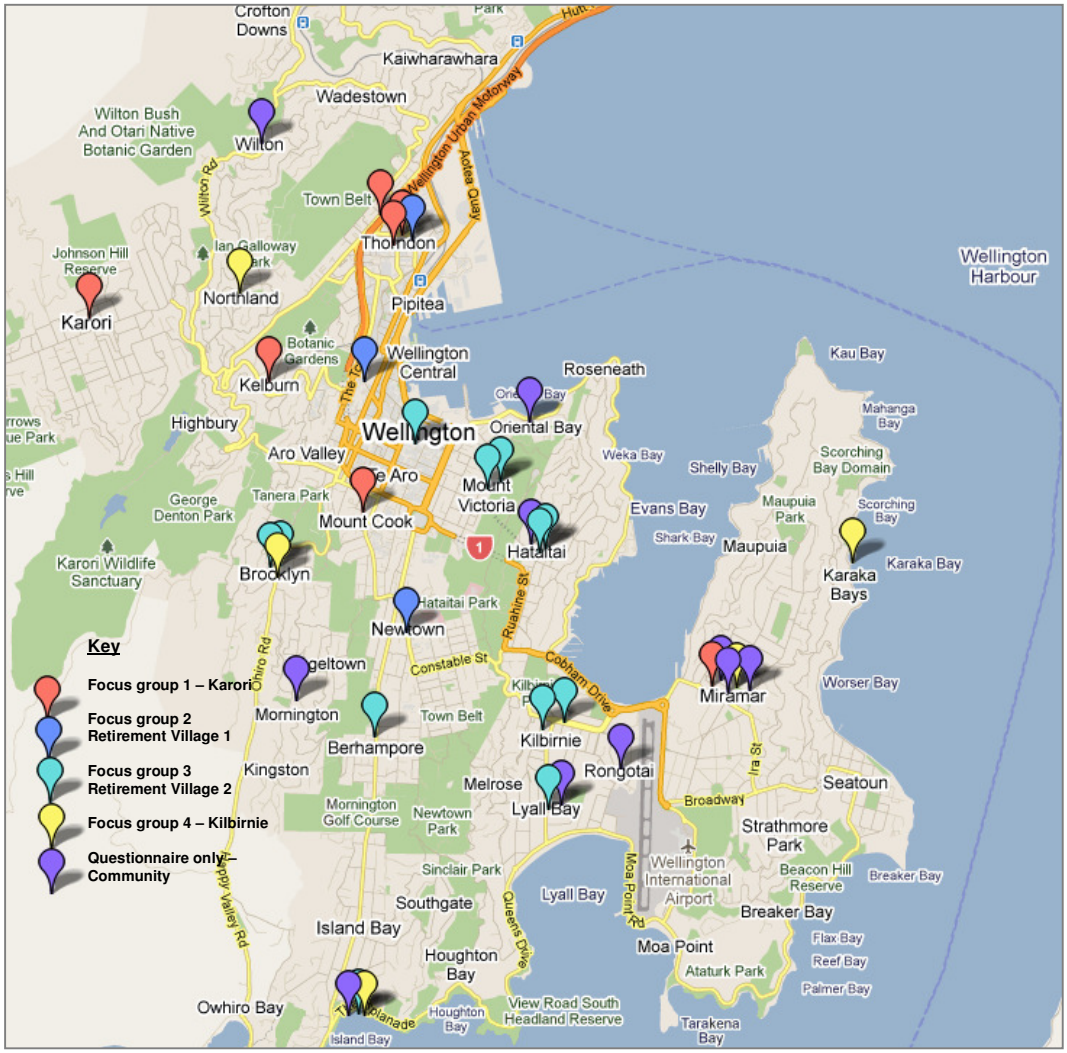

Figure 34: Location of survey participants in the 1950s

Source: Google Maps, 2010

Housing Questions

Questions 3 through to 10 asked participants various questions about housing in the 1950s. The following information presents the analysis and results. The graphs relating to this section of the questionnaire can be found in Appendix E.

The first housing question asked participants how many people lived in their house, separated into adults and children. The average number of adults was 2 and children 1.8. Question 4 followed on from this question asking if they had any lodgers living with them. 10 people responded, stating that they did have lodgers during the 1950s; some people had up to 4 lodgers, the average number being 1.6.

The majority of people surveyed lived in houses (67%, 24 people), while the rest lived in flats or other types of accommodation, for example hostels. Of the 21 people that answered question 6, 53% owned (or their parents owned) the dwelling they lived in during the 1950s, while 33% rented and 14% did not know.

Question 7 looked at the number and types of rooms in the dwelling. The average number of each type of room was as follows: Bedrooms (3), Living room (1), Dining Room (1), Kitchen (1) and Hall (1) (values rounded to the nearest 0.5). A number of people did not have a living room and/or a dining room; instead the kitchen would function as all of these spaces.

Question 8 related to the construction materials used for the dwellings they lived in (walls, floor and roof). All participants answered that the walls were timber clad with either brick or weatherboards. This was the case for flooring, with everyone stating they had timber or wooden floors. Roofs were commonly corrugated iron (23 people) with some having a tile roof (6 people).

Heating was most commonly found in living areas, generally the living room (27 people stated that the living room was heated) or kitchen (10 people), while bedrooms were rarely heated (5 people had heated bedrooms). Common means of heating the living room were open fires (59%, 16 people) or a gas fire (11 %, 3 people) or electric bar heater (15%, 4 people), although some respondents did not stipulate the type of heating. Most people heated this space in the evening between 5-10pm. The kitchen was commonly heated by the oven (coal range, gas stove) in the space and/or an electric bar heater, again generally in the evenings.

The last question for this section related to baches, by asking participants whether they or their parents owned a bach and its location. 10% (3 people) owned a bach, and these were in Te Marua (40kms), Foxton Beach (120kms) and Raumati South (50kms) (distances from Wellington according to Google maps). Baches were a popular accommodation choice for holidays and it appears more people may have rented rather than owned a bach.

Work Questions

Questions 11 to 13 questioned participants on jobs: those of the main breadwinner, their mother and themselves. According to the respondents the main breadwinners in their families were generally the males (either the husband or father). Some of the jobs listed included: university professor, accountant, engine driver for New Zealand Railways, painter, building contractor, tram driver and land surveyor. The average hours worked each day was 9 hours. 40% (10 people) of respondents stated their mother (or themselves if they were the mother) had a job apart from being a housewife. Some of these jobs were: teacher, house cleaning, child minding, office assistant, clerk and shop assistant. The average worked was about 4 hours a day. Overall 22 of the participants (74%) had jobs during the 1950s. These included: secretary, teacher, telephone receptionist, painter, babysitting, delivering papers and radiographer. Pay for

these jobs ranged from £3/week to £11/week (in 2006 this would be the equivalent of $156.87/week to $575.18/week, taking into account the inflation of wages between the 1950s and 2006) (Reserve Bank of New Zealand, 2010).

Transportation Questions

Questions 14 to 21 related to transportation modes owned and available during the 1950s. Of the 30 people surveyed over half (52%, 16 people) had a bicycle at home, while 48% (15 people) had a car at home, and no one surveyed owned a boat.

Public transport was commonly used in Wellington during the 1950s, because even though people owned cars they would take public transport daily as it was cheaper (as stated by the participants of the focus groups discussions.) Unfortunately an itemisation of transport fares was not available in the Consumers' Price Index 1955. Cars were generally used on longer trips. Question 15 addressed the use of public transport, asking participants if they used buses, trains, boats or trams and the purpose and frequency of their use. Buses were commonly used for daily travel to school or work: 59% of people stated that they used buses. 48% said they used trains and this was generally to get to work on a daily basis if longer distances were travelled. 1 person stated that they travelled on a boat, to travel to Eastbourne at the weekends. 70% of respondents used trams frequently for daily travel to work or school. Other modes of transport listed by the participants were walking and bicycling. The majority (96%, 27 people) stated that they thought public transport was affordable in the 1950s. Only 1 person stated it was expensive.

Question 17 addressed public, private and other forms of transport such as planes, to determine what forms of transport people commonly used. 52% of respondents stated that they used a private car, although generally only weekly or monthly, for shopping, to visit people at the weekends or for a holiday. 7 people said they had travelled on the ferry out of Wellington; most had only travelled once or twice on this service during the 1950s. 17% (5 people) had travelled by plane somewhere and this was more commonly within New Zealand, as overseas travel by plane was uncommon in the 1950s, because it was expensive. Train, tram and bus usage was similar to question 15, with these being daily modes of transport. 8 people bicycled on a regular basis either daily or weekly to get to places within Wellington. Of those who were at school during the 1950s, 45% (13 people) walked to school, 28% (8 people) took the tram, 10% (3 people) took a train, another 10% cycled and 7% (2 people) went by bus. No one got dropped off in a private car.

Question 19 looked at holidays commonly taken by people in the 1950s, asking respondents the types of holidays they went on, location, mode of transport and the type of accommodation they stayed in. 27 people stated that they had been on at least one holiday annually the 1950s. Of these, occasionally people had gone on 2 or 3 trips within a year. These holidays were typically summer holidays. The majority were within New Zealand, and the common mode of transport was by car, bus or train. Places of accommodation were often camping grounds, baches or relatives' houses, with few people staying in motels or hotels.

Questions 20 and 21 related to communication in the 1950s. Question 20 aimed to understand peoples' connections with their relatives, asking where their relatives lived and how often they saw them. Participants had the option to list up to four relatives; there were a total of 58 responses given. 50% of responses had relatives that lived in Wellington, with the majority being immediate family (siblings, parents and grandparents). Participants regularly saw these relatives, either weekly or monthly at most. 40% of the responses had relatives that lived within New Zealand; these were typically extended family members, aunties, uncles and cousins. Participants generally saw these relatives twice a year or yearly. 10% of the

responses had relatives overseas; the majority were parents or siblings of participants who had moved to New Zealand as part of the rehabilitation after the war. All of the participants never saw these relatives during the 1950s.

Question 21 addressed different modes of communication and who participants contacted and how often. 21 participants used letters. They commonly wrote letters monthly to relatives and friends in New Zealand and overseas. Fewer participants used the telephone and of the 14 who responded, most people called relatives or friends within New Zealand on an infrequent basis. 21 participants visited people; the majority visited relatives that lived in Wellington weekly and other relatives within New Zealand yearly.

Food Questions

Questions 22 to 31 asked about food, both grown and bought. Questions 22 and 23 dealt with food grown at home in the two categories of vegetables and fruit. 87% of the participants stated that they grew vegetables at home. Most people grew carrots (20%, 21 people) or lettuce/salad crops (19%, 20 people), while 17% of people grew tomatoes and 16% grew peas. Although potatoes were commonly eaten only 17% of participants grew them at home. A small percentage of people grew pumpkins (8%) or corn (3%).

60% of participants responded that they grew fruit at home. The most commonly grown items of fruit were lemons (27%, 12 people) and strawberries (25%, 11 people), followed by apples (23%, 10 people). Other items were plums (9%), pears (9%) and grapes (7%), but no one grew oranges, which is not surprising in the Wellington climate.

Owning poultry was more common in the 1950s than it is currently (over 500,000 birds were owned by Wellingtonians according to the 1956 Population Census), and 17% (5 people) of respondents stated that they had chickens at home, either for meat or eggs.

Question 25 looked at the amount of food (fruit and vegetables) people were able to produce at home. The majority of people (60%, 15 people) grew less than 25% of their food consumed, 20% (5 people) grew approximately 25% of their food, 12% (3 people) grew 50% of their food consumed, and 8% (2 people) grew about 75% of their food. No one grew all of their fruit and vegetables at home. A third of the respondents said they received food from relatives. Generally a case of fruit or vegetables was sent from relatives living on farms, often yearly or monthly depending on the produce.

Questions 27 and 28 asked where people bought their food and how often. Participants could select all applicable options for both questions. 54% (28 people) shopped at their local shops, 33% (17 people) would shop at the dairy, and 13% (7 people) shopped at markets. Supermarkets were included in this question, however very early supermarkets were more like large versions of local shops, and did not appear in Wellington until the late 50s. Most people (50%, 17 people) shopped once a week, and 44% (15 people) shopped daily. This was usually for milk and bread, although this was also delivered daily to some people. 6% of people did a big shop once every couple of weeks.

The next question was to determine what people commonly ate for breakfast, lunch, dinner or dessert. It was evident from the answers given, that people did not eat a lot of processed food and instead ate fresh food and made lunch to take to work or school. Breakfast was commonly porridge, cereal or toast, while lunch was generally a homemade sandwich with fresh fruit. Dinner was the typical meat and three vegetables, and dessert consisted of fresh or preserved fruit with custard or pudding. Dinners were commonly cooked by the mother in the family sometimes with help from the children. 17% said they ate out, although this was commonly fish and chips rather than eating at restaurants.

Consumer Goods Questions

Questions 32 to 35 related to consumer goods bought and available during the 1950s. Question 32 enquired about household appliances owned during the 1950s and the frequency of their use. 76% (22 people) owned a fridge and used it daily, 100% (29 people) owned an oven, and most people (21 people) used it daily while others used it weekly. 23 people owned a washing machine, and the majority of people used it weekly. 27 people owned a vacuum cleaner and most people used it weekly and 24 people owned a lawn mower and used it weekly or monthly. When answering this question some people gave the numbers of items owned but not the frequency of use.

Following on from this question 33 asked about other household items and whether they owned a TV, radio, gramophone or telephone. Further research after the questionnaire was sent, confirmed there was no TV in Wellington until 1962, so this question was somewhat irrelevant. Most people (29 people) owned at least one radio, with some people owning up to 3. Approximately half the surveyed people owned a gramophone and 25 people owned a telephone. Listening to the radio or gramophone appeared to be a common evening activity with 58% of respondents stating they listened to these as a family frequently in the evening, and 39% said they listened to them together as a family occasionally.

Question 35 related to the number of lights found in each room in the house. Bedrooms normally had one or two lights, the living room one to four lights, the dining room one or two and the kitchen one to three lights.

Services Questions

Questions 36 to 41 referred to services available in the community and the accessibility of these services to the general public. Doctors were generally visited as needed. Most participants visited the dentist regularly every 6 months to a year. Clinics were rarely visited and hospitals were visited when needed for accidents or the birth of babies. 95% had to pay for these services when used and 17% stated these services were expensive.

The following questions related to schooling; primary, secondary and tertiary education. 18 people stated that they went to school during the 1950s, and of these 61% chose where they went to school and 72% went to the school closest to them, meaning some chose to go to their closest school. 27% had people in their family that attended university and 14% had family members undertake an apprenticeship during the 1950s.

General Activities Questions

This section asked questions relating to what the participants and their parents (if applicable) did in their spare time. Question 42 related to evening activities, again watching TV was referred to so this part of the question was irrelevant. Four options were given for this question plus a space for other activities, and participants could select all applicable answers. 26 people read in the evenings, 16 played games and 8 people gardened. Other activities included listening to the radio, studying, sewing and knitting and sport.

Weekend activities listed included playing sport, household chores, visiting family and friends and church, plus a space for other activities. Most people went to church (24 people), followed by visiting family and friends (24 people) and household chores (23 people) with 13 people playing sports. Other weekend activities included social activities like going to dances, the theatre or exploring Wellington with friends.

Questions 44 and 45 related to the people who were children during the 1950s, questioning them on whether they did out of school activities and what sorts of toys they owned. 19 people selected that they did out of school activities, the most common being girl guides (12 people) and music or sports (9 people each) with 4 people participating in boy scouts. 19 people also answered question 45, and most owned dolls and/or a dolls house (13 people) or construction toys (8 people), Dinky toys and toy trains were owned by 3 and 4 people respectively. These results are influenced by women out numbering male participants in this questionnaire.

The last question for this section referred to activities undertaken by their parents or themselves, if they were the parent. Most parents participated in sewing or knitting (19 people) and gardening (17 people) with 8 people participating in DIY and 9 in sports.

Quality of Life Questions

The majority of questions in this last section were those with written answers. The purpose of these questions was to get participants' perceptions of the quality of life they led in the 1950s and to compare this with some aspects of their current quality of life. The results from these questions have been summarised to highlight the main ideas that were brought up through these questions. Questions 47 through 50 asked what the participants thought was better about the 1950s and better about now, and also what was worse about the 1950s and worse about now. Aspects that the participants considered to be better about the 1950s, was that life seemed simpler and safer, and there was less materialism and pressure on parents to provide their children with transport, electronic gadgets and supervise their internet use. There was good community spirit, people knew their neighbours and there was social interaction between neighbours. People made do with what they had, luxuries were rare but people were happy. The focus of life in the 1950s appeared to be family, friendship, and community with an emphasis on socialising and not relying on electronic items to entertain them as happens nowadays.

Factors relating to the 1950s that the participants thought were worse than today were that they did not have as much access to global information as today, without TV and the internet. Communication was slow or expensive, especially if long distance (toll calls) and far less was known scientifically. Women had fewer choices and few opportunities and they were expected a lot of the time to be homemakers and sacrifice careers for family. They did not have equality socially, academically or with employment wages. Housing was difficult to come by and there were more restrictions on young people. People were expected to conform to social norms, and being 'different' was less acceptable. Travel was expensive so holidays were closer to home, there was a lot of concern about money and people had to work hard to buy houses or cars. Even with these issues people were still content with life and accepted certain elements of it, like hard work, but fought for changes like equality for women.

In terms of what participants considered better about today, the main ideas that were stated related to access to information, high standard of living, especially in terms of consumer goods, and availability of modern technology. It is interesting to note that while fast communication still relates to staying in touch with family and friends a lot of what the participants stated that is better about now, is materialistic rather than related to community and social interaction. Some examples of this are that modern technology and modern appliances mean less time is spent doing housework. Other aspects mentioned were social attitudes that have been liberalised, more equality and opportunities for women, more knowledge through better and faster access to information, greater choice of food, access to a variety of entertainment, and better public and private transport. Modern people are more aware of environmental and race issues, medical advances and availability of vaccines. Travel is easier and there is greater freedom than in the 1950s. A lot of what is considered to be better about now is related to consumption and demand on

resources, as there is more choice available now and people buy out of want rather than need. Higher wages and a great number of two income families results in a larger disposable income to spend on 'things'.

Many issues were raised when participants were asked to state what they thought was worse about today. Several of these issues related to safety. A lot felt that it was less safe today due to crime, drugs, an increase in youth drinking, and more violence and murders. Attitudes were another common point raised, evidenced through lack of manners, respect and consideration for others and they saw evidence that young people were overindulged and under mentored. Life has become more materialistic and modern New Zealand has grown into a throwaway society. There are increasingly more ways in which to waste time (TV, computers, electronic games), and there is information overload, according to the participants. Interpersonal relationships have changed due to technology and changes in social interaction. People are experiencing more performance pressure from work and this is resulting in stress and a lack of time and energy for family. There are also greater differences between the highest earners and the majority of the public. Lastly, life seems hectic all the time, and people do not seem content.

Questions 51 and 52 related to whether the participants felt a sense of pride in Wellington in the 1950s and currently, with space for them to explain their reasons. 13 out of 25 people (59%) said they felt a sense of pride in the way Wellington looked during the 1950s. Some reasons for not answering this question were that some people never considered it or thought about it. Some of the reasons for the participants being proud of Wellington in the 1950s, were they enjoyed the landscape of Wellington, and as newcomers it was an adventure and they felt happy, welcome and appreciated here. Some people did not recall feeling proud or not proud as it was either the only city they knew or they never considered it at the time. Reasons for not feeling proud were it looked grubby and run down and it was pretty boring and staid. 96% of people (25 out of 26) felt a sense of pride in the way Wellington looks currently. Participants feel a sense of pride in Wellington now because it is more developed, there is improved access to the waterfront, and it is vibrant with lots of activities during the week and weekends. Wellington caters for a lot of ages and cultures now, and its compactness makes it a very walkable city. No reasons were given for not feeling a sense of pride in Wellington now.

Questions 53 to 57 related to accessibility and safety during the 1950s. The first question asked participants how easy or difficult it was for them to get to a local park or green space. 27 people responded and all said it was very easy or easy to get to some sort of green space, with several saying they could walk to their local park. In terms of safety, of the people that responded, all felt safe in their homes during the day or night, often because there was no apparent danger and crime levels were low. Walking in their neighbourhood, most people felt they were very safe or quite safe, for similar reasons as before and because there were people around and the presence of the local policemen reassured them that they were safe. Most people felt safe walking in Wellington city at night, some were a little more cautious, however they still felt safe with police and other people around. When asked if they locked the house and/or car during the 1950s, people generally locked both although only when they were going out for a while or in the evening, otherwise there did not seem to be a need to lock the house or car during the day.

When asked how satisfied their family was with their work life balance during the 1950s, the majority of people stated they were satisfied (80%), 16% were very satisfied, 4% were not satisfied and no one stated that they were very unsatisfied. Of the people that gave reasons, some were satisfied because they never thought about it and just got on with life. Several stated that their mother was always home, however their father tended to work long hours. Long hours working was the reason stated for not be satisfied with their work life balance.

This section included a question about social networks or groups their family were a part of during the 1950s; this was to gauge what people participated in for social and community interaction. 43% of families went to church, while 27% joined a school group, 24% were part of a sports club and 3% participated in hobby groups.

The last question asked participants to rate their or their family's overall quality of life during the 1950s. 68% of people rated their quality of life as good, 18% extremely good. 11% neutral, 3% poor and no one selected extremely poor. People felt their family's quality of life was extremely good during the 1950s because their family was not rich but was happy, they got on well with their parents who were intelligent and happy, and they had a large circle of family friends and good family relationships. Explanations for their family's quality of life being good included they felt loved and cherished, had a very pleasant family home and life, and in general they seemed to have everything they needed. Not all responses were positive in regard to why life was good. Some explained that life was hard going, there was not a lot of spare money; however they made do with what they had. Reasons for the participants thinking their family's quality of life was neutral included that they were not rich but had a well rounded family unit, and as newcomers their life was about settling and adapting to a new way of life. 1 person stated their family's quality of life in the 1950s was poor due to lack of money; however they were happy, they had everything they needed and did not want for a lot of things because the emphasis was on relationships rather than material wealth.

4.7.2 Summary of questionnaire results

In summary, the residents of Wellington in the 1950s appear to have been content with their life and what they had during the 1950s. This perception was influenced by the fact the war and depression had ended and the quality of life begun to improve as cities were developed, wages increased and people's lifestyles changed as they gained more freedom. One opinion that was bought up by several participants was that they did not have a lot or a lot of money spare but they had the necessities and were happy. Whereas, it appears people today would not be content with just owning the necessities. Instead they strive for more and society is increasingly more focused on materialistic objects.

People's living conditions could be considered less than ideal; most people lived in uninsulated timber frame houses that were cold in winter and damp. Occupants had heating, although tending to heat one room of the house for economical reasons, as heat would have been lost through uninsulated walls and single glazed windows. However, over half the participants stated that the primary source of heating for the house(s) they lived was an open fire, which is not very efficient. These often achieve only 5-15% efficiency of energy converted to heat, the result of heat lost through convection to the chimney (Ministry for the Environment, 2005).

In most cases the males in the family, generally the husband or father, were the breadwinners. They often worked long hours during the week and then did extra 'work' around the house in the weekends. Almost half of the participants stated that their mothers worked as well during the 1950s. From the jobs listed, women often worked in what were considered 'female' roles for example clerical work.

Residents of Wellington in the 1950s relied on public transport for example trams and trains as their daily mode of transportation. Private vehicles were expensive and even if people owned them they typically only used them for longer trips. People did not use their cars daily to travel to work or do the shopping. Walking was also very common. Holidays were very family orientated events, with most people travelling within New Zealand to stay with relatives during the summer. Communication and staying in touch with people

was also an important part of life. Because toll calls and international travel were expensive and the technology that exists today had not been created, people wrote letters regularly to people in New Zealand and overseas. Phones were becoming more common although most calls were local. Often people would visit people they knew locally on a regular basis to catch up.

Food in the 1950s was fresh, unprocessed and simple. Many people had gardens and grew fruit or vegetables, and some people were able to grow both. Although this only supplied a small amount of what was eaten, it was 'what you did', it was part of the culture of society. If people were able to grow produce then they did. Shopping was commonly done daily or frequently due to the lack of electrical appliances to keep it cool, and as a result produce purchased was fresh. Food cooked or prepared at home was simple but nutritious. Meat and three vegetables were a typical dinner and lunches were sandwiches and fruit. Takeaways were rarely bought and when they were they were a treat.

'Modern' appliances were available and becoming more common during the 1950s, however they were still expensive. Daily household chores were, for some, laborious and time consuming as a result. Health in New Zealand begun to improve during the 1950s, as modern health services were available and knowledge improved. The participants regularly went to the dentist, visited the doctors as needed and went to hospital for the births of children; there was no indication of poor health or substandard health services in the 1950s. Most people were involved in community activities or groups; thus interacting with others in the local community as this was thought to be important. People knew their neighbours and others in their suburbs. Attending social events also helped people who had moved to Wellington from overseas get to know other people in the community.

In terms of the perceived quality of life, most people felt their quality of life during the 1950s was good or extremely good. People had the necessities for life however basic they may have been and they were content with what they had. People felt safe in the city; there was a sense of community, and less pressure on parents to provide children with the latest technology and trends. For many it was a new start in a new country that provided many opportunities. The majority of people felt that their family's work/life balance was satisfactory or better. People tended to work long hours both at work and home in order to provide for their family, but this was accepted by many as what needed to be done. However, fewer people felt a sense of pride in Wellington during the 1950s than they do currently. Several participants felt the city was run down and grubby, and limited development had occurred prior to the 1950s. The majority felt a sense of pride in the way the city looks now because it has been improved and revitalised through development.

4.7.3 Focus Group Discussion Results

Four focus group discussions were conducted; the participants of these groups were self-selected from the people who filled in the questionnaire. In total, 22 people out of the 30 people who filled in the questionnaire participated in these group discussions. This section goes through the main findings from the discussions based on the questions asked (See Appendix D for the questions).

Findings are divided into opinions and information mentioned by all groups, 3 groups, 2 groups and 1 group. This was done to determine common ideas and opinions between the groups in relation to life in Wellington in the 1950s and to expand on information and thoughts given in the questionnaire. Questions related to the difference in the quality of life between now and the 1950s, based on the five categories of an ecological footprint. The year for 'now' was 2010, when the focus group discussions were conducted. However, for some questions for example housing, participants could comment on the last house they lived in, as many of them lived in units or studio apartments in retirement villages.

Housing

Question: What are the differences between housing now (2010) and then (1950s)?

Number of Groups	Main Ideas Discussed

Four (All)	• Rooms heated in houses:
	  • Bedrooms never heated;
	  • Kitchen shut off from rest of house and heated, most economical way of heating living spaces;
	  • Family would congregate in kitchen;
	  • Many people felt this led to health problems (asthma and dust mites) due to moisture from cooking and drying clothes;
	  • Majority of participants were young so put up with cold indoor temperatures and put on a jersey.
	• Types of heating:
	  • Open fires (not very efficient), chip heaters, coal ranges in kitchen common;
	  • Moveable electric bar heaters;
	  • Did not worry about power bills, unlike today, not very expensive.
	• Heating centralised nowadays:
	  • Different way of operating houses today, heating commonly in centralised living areas and often the whole house is heated;
	  • More efficient today, although some for example electric under floor heating is expensive.

Three	• No insulation in 1950s:
	  • Even new houses built had no insulation;
	  • No talk of the need for insulation and lack of awareness of such materials;
	  • Walls commonly timber with scrim, sometimes wallpaper;
	  • Commonly lived at ambient temperature;
	  • Cold and draughty interior environment.
	• All new houses today built with insulation:
	  • Part of Building Code requirements;
	  • Old houses still exist with no insulation, essentially living in the same environment people did in the 1950s.

Three (continued)	• Shortage of housing:
	  • Difficult to purchase houses;
	  • No building during the war, demand was high for housing in the 1950s;
	  • People often could not afford to buy so had to rent, this sometimes meant living in an undesirable location or house;
	  • If you owned the house you lived in commonly all your money went toward the mortgage and you could not afford a car.

Two	• Housing developments out of town:
	  • New state house and residential subdivisions were being developed out of town for example: Tawa, Nae Nae, Taita and Wainuiomata;
	  • People moving into the city and few leaving after the war.
	
	• Types of housing:
	  • Hostels, boarding houses and flats common;
	  • Young girls left home and moved into hostels in the city;
	  • Large wooden houses converted into shared accommodation;
	  • Hostels and boarding houses more affordable;
	  • One participant had an allowance of £3 ($317.08, 2006 value) and paid £2.17 in rent ($229.36 in 2006), not much left over to save.
	
	• Families in housing:
	  • Emphasis on housing families in flats and houses;
	  • Single people were not allocated flats or houses;
	  • Very few two income families so little disposable income;
	  • Rehab loans offered by the government, 3% state advances loans, to people earning below a certain income level, established to encourage people to buy and build houses.

One	• Design of houses in 1950s:
	  • Commonly hallway down the middle, ‘woman’s’ kitchen at the back and living area at the front
	  • Design meant everything was separated and not very convenient;
	  • Laundries outside and generally detached from house;
	  • Mixture of house sizes in streets, both large and small houses found in the same streets and suburbs.
	
	• Design of houses now:
	  • Much more uniform size of houses in new subdivisions;
	  • New houses not proportional to size of family;
	  • One participant gave example of a five bedroom house their neighbours built with only three occupants living in it;
	  • House to section ratio has changed, sections typically smaller with large houses almost covering the site.

Summary

Overall, the participants agreed that the standard of living today is much higher than that of the 1950s. Many of the common difference between housing in the 1950s and today were related to the internal environment of houses; heating system and location and temperature were main aspects bought up between all groups. Houses in the 1950s were often cold, damp, with no insulation and were poorly designed compared with houses today.

Transportation

Question: What are the differences between transport now and then?

Public transport

Number of Groups	Main Ideas Discussed

Four (All)	• Trams:
	  • Wellington had good services;
	  • Convenient, cheap and main form of transport.

Three	• Modes of transport:
	  • People often used two or more modes of transport to get to work or school;
	  • Walk and or take the train, tram or cable car;
	  • Shanks' pony (walking) was common, many people saying that they walked everywhere to save money or if public transport was not available;
	  • One participant recalled walking to kindergarten because it was safe to do so, less traffic than today;
	  • Another recalled it being much safer to walk through town at night than presently;
	  • Public transport was often governed by people's wages; some would not take the tram for a week to save money, even though trams were cheap.

Two	• Trains:
	  • Trains were used for long distance travel within the region;
	  • A 'teacher's' train ran early in the morning to the Hutt Valley transporting teachers from the city to schools in the area.

One	• Travelling with young children:
	  • Even though public transport was convenient it was often difficult and a bit of a hassle to travel with children because public transport was often full;
	• Similar to today's services:
	  • Similar train and bus services and timetables operate today as in the 1950s;
	  • Trams no longer operate;
	  • Public transport was better utilised in the 1950s, public transport often empty during the day nowadays with people preferring private transport.

Private transport

Number of Groups	Main Ideas Discussed

Four (All)	• Ownership of private cars:
	  • People were lucky if they owned one in the 1950s;
	  • Owned one car rather than the three or more families own today;
	  • Cars were expensive and difficult to purchase, needed foreign currency to buy a new car;
	  • A lot of older cars in the 1950s;
	  • Several participants did not own cars until the late 1950s, they became more common in the 1960s;
	  • Typically were not allowed to drive parents' car;
	• Bicycles:
	  • Many participants owned bikes and used them to travel around their local area for exercise;
	  • Was safer to bike on the road because there was less traffic.

Three	• No extra common information
Two	• No extra common information
One	• Often people that did not own a house lived in state houses; these people were often the people who owned cars, because they did not pay mortgages and had reduced rents; • Uncommon for houses to have garages and it was difficult to get a park on the street, due to the configuration of suburbs and width of roads in the hilly suburbs.

Transport now – public and private transport

Type of transport	Main Ideas Discussed (by all groups)
Public	• Services better now compared with 1950s: • Easier and more convenient because there are more routes, greater frequency of services and these are free during the day with Super Gold cards (Senior citizen community cards); • Sometimes not very reliable due to outages and repairs; • Change in patronage since the 1950s, with few people using public transport during the day.
Private	• Many participants preferred to use public transport and no longer owned cars; • The participants that did still own cars preferred them over public transport; • Far more cars on the roads and people have unnecessary preoccupations with private cars.

Summary

From the participants' comments regarding transport, it is clear that public transportation was more widely used in the 1950s. This was influenced by the cost and lack of ownership of private vehicles in New Zealand. The participants' primary modes of transport in the 1950s were public transport and walking. While many still use public transport now, they highlighted that there are many more private vehicles on the road now, with public transport not as well utilised even though the services are better compared with the 1950s. However it is clear that the lack of private cars did not stop people moving around Wellington in the 1950s, and the lack of cars made some modes, like walking, safer.

Holidays

Question: What are the differences between holidays now and then?

Number of Groups	Main Ideas Discussed

Four (All)	• Travel:
	  • Overseas travel rare and expensive;
	  • Travel by car, train or ferry common.
	• Accommodation:
	  • Typically stayed at relative's houses or farms;
	  • Camping was common too;
	  • Not many motels and hotels were expensive.
	• Location:
	  • Regular summer holidays or weekends away to locations near Wellington;
	  • Longer holidays often further away in the North or South Island.
	• Cost:
	  • Holidays were commonly inexpensive trips away
	• Holidays today:
	  • Greater frequency and ease of being able to travel
	  • Most participants had travelled overseas in the past 10 years

Three	• Holidays not luxurious:
	  • Holidays were inexpensive and not luxurious like some trips today;
	  • Had to save hard for holidays;
	  • Most money went towards rent so it took a long time to save up for holidays;
	  • Holidays were not a priority for some participants who had mortgages and children;
	  • Was common for people to own baches, but they certainly were not as big as houses like some are today.
	• Overseas travel today:
	  • Much better service and easier to travel overseas;
	  • Common for people to take short holidays to Australia;
	  • Several participants believed that younger generations take overseas travel for granted.

Two	• Overseas travel in the 1950s:
	  • Participants within two groups had travelled overseas;
	  • Other participants agreed they were very lucky to have done so;
	  • Both had saved up to travel, both holidays were not luxurious.
	• Holidays today:
	  • Several participants took regular short holidays because they had the time to do so;
	  • Some had fewer holidays due to their age and they had no work to take a break from.

One	• Domestic air travel:
	  • A couple of participants had travelled within New Zealand during the 1950s;
	  • Domestic travel was reasonably uncommon;
	  • Very few planes in New Zealand.
	  .
	• Flying boats:
	  • Flying boats departed from Evans Bay in Wellington and flew to Australia; some participants had travelled on this service.

Summary

The main points that the groups agreed upon was that holidays were commonly local or within New Zealand. People regularly took summer holidays that often consisted of camping trips away, travelling in the family car. Holidays were simple and inexpensive, and domestic air travel was rare. Very few people flew overseas and if they did so they had to save for this and were lucky to be able to so.

Food

Question: What are the differences between food grown/bought now and then?

Number of Groups	Main Ideas Discussed

Four (All)	• Bought:
	  • All food was fresh or preserved;
	  • Limited canned products and no frozen food;
	  • Would buy extra fruit and vegetables to supplement what was being grown.
	• Grown:
	  • Common to have vegetable gardens;
	  • Many participants explained that they had large vegetable gardens, although they needed to supplement what was grown with bought vegetables;
	  • If people did not grow vegetables it was generally due to the inability to do so because of the section configuration or soil.

Three	• No extra common information

Two	• Bought:
	  • Nothing was open on the weekends would do shopping on Friday for the weekend;
	  • Bread was bought daily so it was fresh;
	  • Much more choice today with variety of food available in supermarkets and restaurants;
	  • Can buy food that was not available in the 1950s.
	• Grown:
	  • Fruit and vegetables were often grown out of necessity to save money;
	  • People often got sent food parcels with fruit and vegetables from relatives on farms.

One	• Bought:
	  • Several green grocers in suburbs and some in the city centre;
	  • Could not buy alcohol in supermarket, dairies or restaurants;
	  • Bread was price controlled and very little variety only white or brown, brown bread not the same as that available today.
	• Grown:
	  • Several people also grew fruit such as, apples and plums, which were often bottled;
	  • Families were larger than today, cost to feed family was relatively expensive at the time;
	  • Very New Zealand 'thing' to have a garden

Question: What are the differences between meals eaten at home/out now and then?

Number of Groups	Main Ideas Discussed

Four (All)	• Eaten at home:
	  • Brought packed lunch to work, school or university, never bought lunch;
	  • Dinners similar to nowadays; meat and three vegetables was a typical dinner;
	  • Sunday roast was common; leftover meat was used throughout the week to make curry, shepherd's pie or used as cold meat in sandwiches;
	  • Chops were commonly eaten, expensive today;
	  • Chicken was expensive and rarely eaten.
	  • Breakfast was commonly porridge, cereal or toast, with bacon and eggs a treat on Sunday;
	  • Food was nothing fancy, was simple and was what is called slow cooking nowadays.
	  • Food wasted due to no freezers and limited electric fridges with many people just having food safes.
	• Eaten out:
	  • Restaurants were in hotels and food served was no different to what people cooked at home;
	  • People did buy takeaways although they were considered a treat; bought fish and chips or Chinese takeaways;
	  • People would commonly go to tearooms or milkbars for milkshakes and ice creams to meet with friends after school.

Three	• Eaten at home:
	  • Desserts were often eaten every night, mostly consisting of custard, milk pudding or steam pudding in winter served with fresh or preserved fruit.
	• Eaten out:
	  • No extra common information.

Two	• No extra common information.

One	• Eaten at home:
	  • No extra common information.
	• Eaten out:
	  • At university could eat at the cafe, was not great food but was cheap, for example pies or soup;
	  • Enormous range of ethnic restaurants available today.

Summary

From the participants' comments it is evident that food was fresh and consisted of home cooked meals or packed lunches. There was food wastage because of the lack of refrigerators, however people shopped regularly and this would have reduced some food waste. Meals eaten at home were simple and what are considered 'slow cooked' meals today. Restaurants and takeaway places existed, although restaurants were in hotels and served similar food to what people cooked at home. Takeaways were commonly fish and chips or Chinese takeaways and were considered a treat. Participants agreed the variety and types of food available in restaurants and supermarkets now are much better than the 1950s.

Household Items

Question: What are the differences between common household items now and then?

Number of Groups	Main Ideas Discussed

Four (All)	• Fridges:
	  • There were fridges although ownership was not widespread in the 1950s;
	  • Most people had food safes, a metal box that sat outside on the cold side of the house;
	  • Fridges became more prevalent at the end of the 1950s, and most participants did not purchase one until the 1960s;
	  • Much easier to just freeze or put food in the fridge today, and not much food is preserved anymore.
	• Washing machines:
	  • Electric washing machines were available but not very common as they were expensive;
	  • People commonly had gas coppers or coppers with fires underneath, where the water was heated and clothes 'boiled' in the water;
	  • Gas coppers were available later in the late 1950s/early 1960s;
	  • Clothes would then be wrung out with a mangle and hung outside to dry.

Three	• No extra common information.

Two	• Washing machines:
	  • Participants in two groups mentioned having electric washing machines in the mid 1950s, and stated these made life easier with babies and children.
	• Vacuum cleaners:
	  • Several participants had vacuum cleaners in the 1950s, making cleaning easier; previously they would shake curtains and beat rugs on fences.

One	• Hot water:
	  • Electric hot water was a big gain and made daily tasks much easier;
	  • Some participants had Califonts which was a gas heater for hot water;
	  • Some coal ranges had wet backs to provide hot water;
	  • Would bathe once a week, generally Saturday night or if you were going somewhere special, because you had to heat the bath water.

Summary

From the participants' comments it appears that while many modern appliances were available in the 1950s they were expensive and some were rare until the late 1950s. Household appliances went through a transition during the 1950s with people moving away from manual or non electrical appliances to electric appliances that made daily tasks much easier. Cleaning the house was laborious prior to these changes with people shaking and beating dust out of household furnishings and washing in coppers, wringing out the washing through mangles before hanging it out to dry. It is interesting to note that no groups discussed cooking and the appliances associated with it, apart from one participant who brought up the fact that there were no microwaves just stoves and ovens during the 1950s.

Entertainment

Question: What are the differences in entertainment now and then?

Number of Groups	Main Ideas Discussed

Four (All)	• Cinema:
	  • Cinema was a regular social activity;
	  • People often went weekly at the weekend;
	  • Important social part of life in the 1950s;
	  • Many participants thought that what was shown at the cinemas and on television today was "rubbish";
	  • "Nice" movies and stories shown at the cinema in the 1950s;
	• Dances:
	  • There were often social dances on Saturday night in community halls around town;
	  • Dances were quite formalised and you would put on your best clothes to attend one;
	  • Also debutant balls;
	  • Dances were a large part of people's social lives.

Three	• No extra common information.

Two	• Theatre:
	  • While expensive the theatre was another form of entertainment people went to;
	  • Was commonly amateur theatre performances
	  • Perceived that only the wealthy went to the theatre, with the occasional participants having saved up to go to some special performances.
	• Radio:
	  • Families would often listen to the radio in the evenings, and stories would be told;
	  • Radio stopped at 9pm, "informing people it was time to go to bed".

One	• Dinner parties were often attended; • People often attended church on a regular basis; • Played cards as a family in the evening; • Listened to a family member playing the piano; • Members of social clubs and attended dances through these; • Some friends in a hostel would walk around Wellington exploring different parts of the city.

Summary

From the participants' recollections of entertainment during the 1950s it is evident that a lot of what they did revolved around social events and interaction with friends and family: dances, cinema, theatre, listening to the radio as a family. People regularly attended these events to catch up with friends and meet new people. Participants believed that young people were missing out on this kind of entertainment because there are no dances today, and movies shown at the cinema and TV shows are rubbish, and many young people sit in front of computers and do not get the kind of social interaction that was present in the 1950s.

General Questions

Question: Do you think it was cheaper to live in the 1950s in Wellington compared with now?

All groups and participants agreed that **yes** it was cheaper, relative to today, to live in the 1950s compared with today, some are their reasons are:

- Less variety of things, but did not cost as much;
- Fewer people went on holiday so spent less money;
- We spend our money in a different way now, did not spend a lot in the 1950s;
- Saved money back then;
- There is so much more to spend money on today;
- Basic needs were covered and did not buy any things that would have been considered unnecessary that today are considered as basic needs;
- More pressure today to spend from media and society;
- Public transport fares and entertainment were cheaper
- Very little commercial advertising in the 1950s
- In the 1950s marketing was done by your neighbours, you found out about new household items through them

Question: What do you consider to be better about the 1950s compared with now?

Several participants reiterated some of the main points bought up in the questionnaire for example drinking, drugs and safety. In comparison to listing what people considered to be worse about the 1950s, they were much quicker at listing what was better about the 1950s or worse about today.

- No drink;
- No drugs;
- It was safer;
- People were more community minded;
- People knew their neighbours;
- Less swearing and violence;
- Greater freedom;
- Simplicity of life.

Question: What do you consider to be worse about the 1950s compared with now?

- Took mothers for granted;
- Fathers often out working and did not see a lot of them;
- Less choice of goods;
- Money, the lack of it;
- Fewer appliances;
- Lack of awareness and modes of communication;
- Limited accommodation for holidays;
- Everything being shut at the weekend and lack of vibrancy in the city.

5. Discussion and Conclusions

This chapter draws together all the results from this research. These are in two parts, the first discussing the main findings of the research in respect to three aspects of the study. The first aspect relates to the ecological footprint calculations, comparing the ecological footprints for the two years studied, 1956 and 2006, looking at the changes and increases over 50 years, and the differences in energy to land ratios for electricity. Secondly, the ecological footprint results for both years are compared to the associated lifestyle and quality of life, looking for any similarities between these two factors. The last aspect discusses how changes to the current lifestyles and consumption patterns of Wellingtonians, to reduce the current ecological footprint, would affect quality of life.

The second part of this chapter draws conclusions from the research, addressing the aims and hypothesis of the study.

5.1 Ecological Footprint Comparisons

Two comparisons are made between the ecological footprints; the first sets out the differences between the five main ecological footprint consumption categories. The second discusses the differences between the land use categories. Both discussions give reasons for these changes over the years. Table 102 illustrates the five main categories of an ecological footprint, showing the ecological footprints for both years and the differences.

Between 1956 and 2006, increases occurred in all the components of the ecological footprint of Wellingtonians. The largest percentage increase (103%) occurred for the transport. This is due to the energy land required doubling between 1956 and 2006, during which time the ecological footprint associated with energy use (fuel) doubled, the embodied energy of vehicles (manufacturing, maintenance disposal) doubled, and the embodied energy of buildings (construction, maintenance, demolition and disposal) was six times greater. These increases are due to increases in vehicle ownership and distances travelled, and also the development of transport infrastructure.

The housing ecological footprint increase (65%) is due to several factors including an increase in the size of house footprints and lower occupancy compared with 1956. Houses were an average of 115 m^2 in the 1950s (BRANZ, 2010b, pg 16) whereas the housing stock now has an average floor area of 145 m^2 (QV). This is an increase of almost 30%. Occupancy has decreased 32% from 3.8 people/house to 2.6 people/house. This results in a larger consumed land footprint per person. Larger houses have led to an increased volume of timber needed in houses demanding more forest land, 82% more forest land is required now to build new houses. Operational energy for houses is double that of 1956. This is likely to be due to the use of modern appliances, the fact larger houses require more electric lighting, and it is common to heat the whole house now.

Consumer goods increased about 80%; the majority of this increase can be attributed to consumed land. This related to the amount of land associated with consumer waste. This result indicates that people are not only spending and purchasing more, also justified by an increase in energy land associated with consumer goods expenditure, but that they are throwing away more as a result. As the focus group participants discussed there is a tendency to throw away items now as opposed to getting them fixed. Wellington residents live in a consumer society and as technology and trends change there is pressure to keep up and constantly upgrade possessions.

The ecological footprint for services also increased significantly over the last 50 years (50% increase), again due to the amount of energy land required. Two of the three components of energy land doubled. These are the ecological footprints associated with embodied energy for service buildings and embodied energy for services expenditure. The results come from having more service buildings and more government and private spending on services. The ecological footprint of operational energy increased slightly.

The food footprint increased the least, by only 3%; this increase is primarily due to energy land doubling over 50 years. This relates to the embodied energy of food, calculated through expenditure. Energy intensity values or the amount of energy needed per dollar of food (GJ/$) has increased significantly since the 1970s (the earliest data available). This is due to an increase in imported products and the energy needed for transportation, as well as more processed foods being available and consumed and the energy needed to manufacture and process these.

Table 102: Comparison of ecological footprint consumption categories

Category	Ecological Footprint per person				
	1956		2006		Difference
	m^2	Number of sections[1]	m^2	Number of sections[1]	%
Housing	709	1.1	1,172	1.9	**65**
Transport	2,293	3.6	4,665	7.4	**103**
Food	7,467	11.9	7,672	12.2	**3**
Consumer Goods	3,973	6.3	7,123	11.3	**79**
Services	2,319	3.7	3,485	5.5	**50**
Total	**16,761**	**27**	**24,116**	**38**	**44**
Total (accounting for land productivity)	**41,903**	**67**	**60,289**	**96**	**44**

1 Assuming average section size of 630 m^2

Changes also occurred in the energy to land ratios for electricity, although the energy to land ratio for fossil fuel was kept at 150 GJ/ha for both calculations. However, the energy to land ratio decreased for domestic and commercial electricity, applied to the domestic and service buildings operational electricity calculations. This was the result of a decrease in the use of renewable resources for electricity generation since 1956. Renewable energy sources include: hydro, geothermal and other sources such as wind. The domestic and commercial electrical energy to land ratio for 1956 was 906.5 GJ/ha, as electricity generation was 89% from renewables and 11% from fossil fuels (Bertram et al, 2009). Hydro electricity accounted for 88% of New Zealand's electricity. Coal and oil accounted for 52% of fossil fuel sources. During the 1970s, gas production commenced. This has affected the percentage of renewable resources used to generate electricity and since then it has been steadily reducing.

In 2006, the domestic and commercial electrical energy to land ratio was 711 GJ/ha. The renewable component of electricity generation has decreased by almost 30% to 66% and the remaining 34% was from fossil fuel sources. The hydro component had also decreased to 55% of the overall electricity generation. Geothermal, wind and other sources have increased as a proportion of total renewable generation. The use of coal and oil has decreased with gas now accounting for 64% of fossil fuel sources.

The second comparison relates to the land use categories, and this section discusses the changes between 1956 and 2006 for the six land use categories shown below in Table 103. Results are given in

metres squared rather than hectares. Increases occurred in all of the land categories. The most significant increases over the 50 years occurred for consumed and forest land.

The significant change in the ecological footprint for consumed land can be attributed to three components requiring this type of land. The first is housing, as the ecological footprint almost doubled in 50 years. This is due to more houses in Wellington, the larger footprints of houses and more construction waste. The second is consumer goods; this is due to a significant increase in consumer waste requiring more landfill area. The third is services, and like housing this is due to more commercial and public buildings in Wellington and larger footprints for these buildings.

Forest land also increased significantly, and the majority of this came from the consumer goods component of the ecological footprint. Forest land is the area of forest needed to produce the paper resources used by the population. This includes paper for books, magazines, newspaper, and office use. The area required was six times larger in 2006 than in 1956. This increase is despite the move to electronic means of communication, like computers and mobile phones.

Another increase, although not as large as consumed and forest land, was energy land. Energy land doubled between 1956 and 2006, and significant increases occurred in the majority of the energy land consumption categories. The energy land for the food component increased by the largest percentage (117%), and this is due to lower energy intensity values for 1972 (the earliest data) resulting in lower embodied energy for food expenditure. Annual food expenditure in 1956 was converted to 2006 values and compared with 2006 expenditure. In 1956 people spent the equivalent of $2,688 per person (2006 value) and in 2006 people spent $2,350 per person. Energy land for consumer goods increased 116%, and this was also due to energy intensity values resulting in lower embodied energy values for consumer goods expenditure in 1956. Consumer goods expenditure also increased, being the equivalent of $3,620 per person in 1956 (2006 value) while in 2006 each person spent $7,776. Energy land for transport doubled in 50 years; as previously discussed this is the result of more vehicle ownership, increased fuel use and development in transport infrastructure.

Crop land increased due to higher consumption of foods associated with crop land, increasing the area of crop land needed for food by 17% between 1956 and 2006. Grazing land increased 11% over 50 years. The increase in grazing land required is attributed to the reduced yield for sheep's wool, even though there has been a decreased amount of wool used for consumer goods such as clothing and carpets. The amount of wool being used for consumer goods in New Zealand has halved over 50 years from 22 kg per person to 12 kg per person in 2006.

Table 103: Comparison of land use categories

Land Type	Year	Food m^2	Housing m^2	Transport m^2	Consumer goods m^2	Services m^2	Total m^2
Consumed	1956	0	78	16	47	10	151
	2006	0	242	44	954	117	1,357
	Difference	0%	209%	169%	1934%	1101%	798%
Garden	1956		182			87	270
	2006		186			167	353
	Difference		2%			91%	31%
Crop	1956	544			4		549
	2006	638			1		639
	Difference	17%			-85%		16%
Grazing	1956	6,576			3,538		10,114
	2006	6,282			4,922		11,204
	Difference	-4%			39%		11%
Forest	1956		35		81		115
	2006		63		593		656
	Difference		82%		636%		470%
Energy	1956	347	414	2,277	303	2,222	5,563
	2006	752	681	4,621	652	3,174	9,880
	Difference	117%	65%	103%	116%	43%	78%
Total Land	1956	7,467	709	2,293	3,973	2,319	16,761
	2006	7,672	1,172	4,665	7,123	3,458	24,116
	Difference	3%	65%	103%	79%	49%	44%

Note values have been rounded

5.2 Comparison of Ecological Footprints to Quality of Life

This section discusses the ecological footprint for both years in relation to the associated quality of life. The points discussed are based on the information published in the Quality of Life survey (Nielsen, 2009), and the information provided by the participants of the questionnaire and focus group discussions. Information from these sources is compared with the relevant ecological footprints to determine if there is a relationship between the size of an ecological footprint and quality of life and what the relationship is. The five main categories of an ecological footprint are discussed separately, from greatest to smallest footprint area; aspects relating to quality of life and lifestyle are discussed for each.

The ecological footprint for Wellingtonians in 2006 was 2.321 ha per person, 40% over the land area available in the city. According to the Quality of Life Survey 94.6% of Wellington residents felt their quality of life was good or extremely good, and 72.7% were happy with their work/life balance (Nielsen, 2009). In 1956, the ecological footprint for Wellingtonians was 1.68 ha per person, below the biocapacity of Wellington. The information provided by the participants of the questionnaire and focus group discussions indicates the following; 86% of participants felt their quality of life was extremely good or good, while 96%

were satisfied or very satisfied with their family's work/life balance in the 1950s. This suggests a 30% reduction in footprint would not change the perception of quality of life in Wellington.

Food

The largest component of both the 2006 (0.77 ha, 35%) and 1956 (0.75 ha, 44%) ecological footprints was food. No questions relating to food were asked in the Nielsen study, although participants of the focus group discussed the difference between food now and in the 1950s. Energy land attributed the most to this increase, dramatically increasing since 1956. Energy land for food comes from embodied energy from expenditure and energy intensity. Today there is a greater variety of food, some varieties of fruit and vegetables only available during season in the 1950s are now available in supermarkets all year round, imported from overseas to meet demand. Produce was often home grown in the 1950s and supplemented with fresh brought produce, and now it is available frozen, canned and out of season. Increasing amounts of processed food are being eaten today for convenience and economics. In the 1950s eating out was a treat, now Wellington has a higher number of restaurants per capita than New York and is known for its dining out culture (Positively Wellington Tourism, 2011). These factors lead to higher expenditure for food and higher energy intensity values as a result of the transportation and processing of food.

Consumer Goods

Consumer goods formed the second largest component of the 2006 (0.71 ha, 30%) and second largest for the 1956 (0.40 ha, 24%) ecological footprints. Although not raised as an issue in the Nielsen study, the focus group participants discussed consumer goods now and in the 1950s. The overall ecological footprint for consumer goods has increased since the 1950s. Consumed and energy land increased significantly. Today's 'throw away' society has probably the largest effect, due to the amount of waste entering the landfills in Wellington. Waste consumes physical land directly and indirectly, the indirect component relating to manufacturing and resource extraction. Consumer goods are available cheaply and in some cases are more convenient to replace than repair. The participants of the focus groups talked of repairing items instead of replacing them because it was expensive to buy household items and clothes, the latter often being homemade. Relating to this is an increase in the demand for paper products, magazines, newspapers and books. Between the 1950s and 2006 a significant increase in demand for these products occurred resulting in a greater demand for forest land. There are talks of the paperless office because society has access to technology such as computers, however the opposite is occurring. The third significant increase is in energy land, this is related to expenditure on consumer goods linked to the above factors. A 'throw away' society leads to greater spending on consumer goods. Importing of products manufactured overseas also results in higher energy intensity values due to transport.

Transport

Transport was the third largest component of the ecological footprint in 2006 (0.47 ha, 21%) and has significantly increased since 1956 (0.23 ha, 14%). Public transport was discussed in the Nielsen study, and both public and private transport modes were addressed in the questionnaire and focus group discussions. The overall transport footprint has doubled since 1956; consumed land was almost three times larger in 2006 due to the development of transport infrastructure in Wellington. Energy land doubled with the greatest increase occurring for private transport (0.04 ha in 1956 to 0.34 ha in 2006). The participants of the focus groups discussions described public transport as being convenient, cheap and the main form of transport in the 1950s. They also mentioned that public transport today was much better than in the 1950s, however it is much less utilised. Several mentioned that people's preferences have changed. In the 1950s people took public transport to save money, many did not have cars and if they did they were

commonly used for longer trips. Today, people tend to use private transport more than public transport. This results in a higher ecological footprint because energy use is shared amongst fewer people. Many cars only have one or two people in them, a very inefficient use of a car, and a bus may have 20 people. Overall the bus will use more fuel but this is divided between more people.

According to the Nielsen study 34% of Wellingtonians use public transport. Only 20% of these use it on a regular basis (5 or more times a week). Most people (24.9%) use some form of public transport less than once a month (Nielsen, 2009, pg 195). People between the ages of 15 - 24 years are the most frequent users of public transport (41.9% use it 5 or more times a week). With an increase in age comes a decrease in usage of public transport, which reflects what several of the focus group participants felt, as they stated they preferred to use their car rather than public transport. This was also the most common reason (46.6% of participants) for people to not use public transport according to the Nielsen study (Nielsen, 2009, pg 199). This is despite the fact people felt that public transport in Wellington is affordable (38.3%), safe (45%), easy to get to (42%) and reliable (40%) (Nielsen, 2009, pg 205 – 221).

Peoples' attitudes and preferences towards private transport use as opposed to public transport have had a significant impact on the ecological footprint of transport since 1956.

Services

The ecological footprint for services has increased since 1956, when it was 0.23 ha (14% of the overall footprint), to 0.35 ha (13%). Some aspects of public services were discussed in the Nielsen report, in particular, health and wellbeing with respect to accessibility of health services. Services were not specifically discussed in the focus group discussions, however some points were bought up and the questionnaire addressed this subject. From the participants' comments in the questionnaire it was apparent that health care services were accessible in the 1950s and available to most people. People typically went to the dentist on a regular basis, the doctor as needed and hospitals less frequently and generally for the birth of children. The majority of people had to pay for these services and several people perceived it to be expensive at the time. Several participants stated that health problems were commonly linked to their living conditions, cold damp houses often led to asthma and dust mites.

In terms of the services and the CBD environment in Wellington during the 1950s, the participants agreed that most of the services required were available and businesses and the CBD were starting to develop after the war. However, many commented that the CBD looked 'run down' and 'grubby' due to little development during the war. The change in footprint for the services component is largely due to the development of the CBD and an increase in buildings and building areas. Fewer participants felt a sense of pride in Wellington in the 1950s (59%) compared with today (96%).

According to the Nielsen study 88.7% of Wellingtonians perceived their overall health to be good or better (Nielsen, 2009, pg 23). Most people (93.2%) stated that they had been able to visit a GP (General Practitioner) in the last month as required (Nielsen, 2009, pg 27). The most common reason for not being able to see a GP was that the GP was too busy. Fewer people stated that the GP was too expensive or that they could not easily access one by public transport. The majority (98.4%) of Wellingtonians felt that there were services available to them for support with illness or injury (Nielsen, 2009, pg 50).

Housing

Housing was the smallest component of the overall footprint for both 1956 and 2006, but did increase significantly from 0.07 ha in 1956 to 0.12 ha 2006. Housing was not addressed in the Nielsen study because the focus was more on public aspects of Wellington. However the participants of the focus groups

discussions compared housing today with that in the 1950s. From the participants' responses in the questionnaire most people lived in 3 bedroom houses, commonly with one living area, bathroom and kitchen. In comparing houses in the 1950s to today the majority felt that houses were much better today. This was due to insulation, better heating systems and design. The participants described houses as cold and damp. Commonly only the kitchen or living room was heated and that was the room the family congregated in. Houses may be more comfortable and much better quality but at the same time they have increased in size and decreased in occupancy compared to the 1950s. People commonly heat the whole house today, and this in turn has affected the operational cost of housing with more energy required to achieve this standard of living.

According to the participants housing appears to have changed the most since the 1950s, with real improvements in the comfort and quality of housing when compared with the other components of an ecological footprint. Although this change has not had the most significant affect on the 2006 ecological footprint, it is obviously the standard of building that is appreciated not the modern (large) size of houses.

5.3 Reducing Current Ecological Footprint and its Effects

This section discusses the possible effects on lifestyle and quality of life that reducing the current ecological footprint of Wellingtonians may have. Each component of the ecological footprint is discussed separately, indicating what changes could occur and the effects from doing this.

Food

The largest component of the current food footprint is grazing land. This is the result of eating meat and meat products which are land intensive foods. Wellingtonians need to consider reducing their consumption of meat by eating a diet higher in vegetables. This does not necessarily mean changing to a vegetarian diet but this does mean a change in people's habits and diets, resulting in a change in lifestyle however not necessarily a change to quality of life. Reducing the consumption of meat has a significant impact on the food footprint and subsequently the overall footprint. If Wellingtonians ate a vegetarian diet, this would reduce the food footprint by 60%. This assumes meat and meat products and poultry are not consumed, but allows for eating the same amount of eggs and dairy products as in 2006. This diet would result in the grazing land component of the food footprint reducing from 0.6282 ha per person to 0.1694 ha per person. This lowers the food footprint to 0.3084 ha from 0.7672 ha and the overall ecological footprint of Wellingtonians to 1.95 ha, still above the biocapacity of 1.62 ha. Alternatively, if Wellingtonians reduced their meat consumption by half, since having dairy products inevitably means some meat production, this would reduce the food footprint by 30% from 0.7672 ha to 0.5378 ha per person, also reducing the overall ecological footprint to 2.18 ha. The amount of food eaten and bought has increased 40% since the 1950s; this indicates there may be an increase in food waste as well. The amount of food bought and eaten needs to be controlled to reduce waste and over eating. The food footprint should have reduced since 1956 due to higher food yields through more productive agricultural systems. Modern agricultural technology needs to be combined with low footprint diets and minimal food wastage.

Housing

The largest component of the current housing footprint is energy land. This is the result of higher operational and embodied energy. Wellingtonians need to consider building smaller houses that reflect the size of occupancy rather than large houses for small occupancy rates as is the case currently. This will reduce embodied energy in houses and the operational energy needed. This will also reduce the consumed land for new houses. This will change lifestyle as people will be living with reduced floor areas

and it may mean having one living room not two. Quality of life is unlikely to be reduced through this change. Decreasing operational energy can be achieved through efficient appliances and heating systems and using these in an efficient way. This does not mean not heating the house but heating it in a much more efficient way for example not heating bedrooms just communal living areas. New houses should be designed to consider energy efficiency. This means having smaller houses, good insulation, double glazing, orientation of the house to the sun, and energy efficient lighting and heating systems. Onsite generation of energy could be considered in some cases. This would mean a change in lifestyle and possibly higher build costs for houses but these can result in lower operational energy costs.

Transport

Again the largest component of the current transport footprint is energy land. The majority of this is from energy use to operate transport both private and public, however private passenger vehicles account for the largest percentage of fuel used. Changes that could be made include only owning one car per family and utilising public transport more. The public transport systems in Wellington are perceived to be good, reliable and affordable by most people. However the majority of people still prefer to use private vehicles as their primary mode of transport. Travelling on public transport instead of by private car not only reduces the ecological footprint of travel but will also reduce traffic on the roads. This will mean a change in habits and lifestyle; however the good public transport systems in Wellington means such an action will not affect quality of life.

Consumer Goods

The largest component of the modern consumer goods footprint is grazing land. This is largely through the use of wool for consumer products such as carpets, rugs, clothing and other finished products. Wool like meat is a land intensive product. An alternative to wool is synthetic products. Carpets for example can be made from sustainable and or recycled synthetic fibres, either just synthetic fibres or blended with wool. Another change could be to buy cotton clothing instead of wool items. Cotton has a much higher yield value of 642 kg/ha (ICAC, Cotton World Statistics, pg 49) as opposed to wool which has a yield value of 23.80 kg/ha (2006 clean wool yield). Of more significance is the increased money spent on consumer goods in modern society. Spending less and replacing consumer goods less often, as in the 1950s, will lower the footprint.

Services

Energy land was the largest component of the current services footprint. This relates to operational and embodied energy in service buildings, the majority of which is the operational energy. This is an area of the ecological footprint which cannot be reduced by individuals; this involves changes in the community and policy changes. In order to reduce the overall operational energy of service buildings several changes in behaviour and operations can be made. For example carrying out energy audits on commercial and public buildings would help to determine where energy saving opportunities can be made. This would probably be at the expense of the building owner or occupants but can result in operational cost savings. Secondly, new buildings can consider energy efficient design and systems. More efficient use of buildings could be made through timetabling. These changes are similar to those that could be implemented for housing, only on a larger scale. These will mean changes in behaviour for the occupants but not a reduced quality of life.

5.4 Conclusion

In conclusion, the ecological footprint of Wellingtonians in 1956 was 1.68 ha, less than the biocapacity of 2.10 ha. The overall ecological footprint for the population was 231,804 ha, therefore Wellington was in ecological reserve with 58,196 ha surplus to requirements, with a total land area of 290,000 ha available. This proves the hypothesis that '*the ecological footprint of Wellingtonians in the 1950s did not overshoot the carrying capacity or biocapacity of the Wellington City area at that time.'*

In comparison the ecological footprint of Wellingtonians in 2006 was 2.41 ha, above the biocapacity of 1.62 ha. The overall ecological footprint for the population was 432,796 ha, 142,796 ha over the total land area of 290,000 ha available, meaning Wellington is now in ecological deficit. Wellington is now relying on 'borrowed' land from other areas around including the Wellington region.

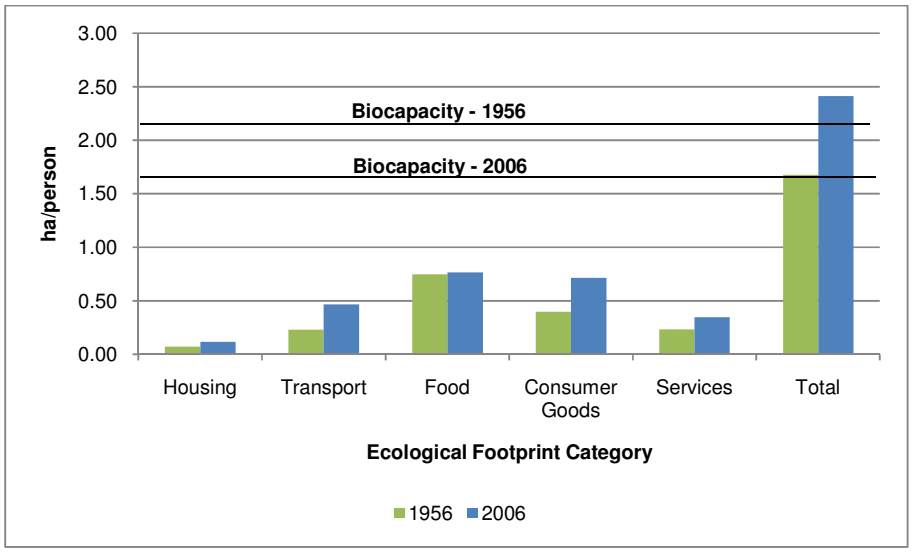

Figure 35: Changes in ecological footprint and biocapacity

Figure 35 illustrates where changes have occurred between the ecological footprints of Wellingtonians in 1956 and 2006. The ecological footprint is below the biocapacity for 1956, indicating Wellingtonians were living sustainability during this time. The 2006 ecological footprint is above the associated biocapacity, indicating Wellingtonians are no longer living sustainability within the city. The biocapacity has also reduced due to population growth since the 1950s. With the current ecological footprint Wellington city can only sustain 120,332 people, less than the population during the 1950s (138,297) and substantially less than the 179,466 that lived in Wellington in 2006. This graph also illustrates where significant increases have occurred in the past 50 years, relating to development, over consumption of resources, and humanity's ever increasing reliance on and use of energy.

Of the three largest footprint components, transport, food and consumer goods, two increased significantly in relation to land area; transport and consumer goods. Transport increased by the largest percentage (103%) or 0.24 ha per person. This is mainly as a result of development through transport infrastructure such as roads and an increase in energy use due to an increased number of vehicles leading to higher fuel use. The consumer goods footprint has increased by 0.31 ha since 1956, although this is a smaller increase in terms of percentage (75%) in comparison to the transport footprint. This is the result of consumer spending and habits. The amount of consumer waste has increased significantly since the 1950s, as now people tend to replace items rather than repair them. Embodied energy associated with consumer goods has also increased; this is the result of higher consumer spending and demand for

imported goods. The food footprint makes up the largest percentage of the overall footprint (32%) for both years. However, only a slight increase has occurred (0.02 ha, 3%). This is because yield values have increased with more productive agricultural practices even though Wellingtonians now consume 40% more food than they did in 1956. The services footprint is the second smallest component of the overall footprint, and it has increased 0.12 ha since 1956; this increase is the result of development occurring in Wellington's CBD. Consumed land, the land used for commercial and public buildings, increased to 10 times the area for 1956. The housing footprint increased by a small land area (0.05 ha), although it was 65% greater than the footprint for 1956. This is primarily due to the development of residential housing in Wellington, as consumed land tripled over 50 years.

The ecological footprint results, in combination with the information provided by the participants of the questionnaire and focus groups, show that a smaller ecological footprint can be achieved while still maintaining a satisfactory lifestyle and quality of life. While there were some aspects of living in Wellington during the 1950s that were perhaps unsatisfactory, for example the standard and quality of housing, overall the majority (86%) of people were content with what they had and considered their or their family's quality of life, during the 1950s, to be good or better than good. People valued family, relationships and community over wealth and possessions. Money was limited for many people. This meant that people had to make do with what they had and bought what they needed rather than what they wanted. One aspect of life in Wellington during the 1950s that was discussed by all the groups was that everyone led very similar lifestyles in the 1950s, and were content with what they had. In contrast, today there is an increasing gap in lifestyle and income between the rich and poor in many countries, including New Zealand. There is also a tendency to compete with what other people have and place value on materialistic possessions.

The ecological footprint results for Wellingtonians in 2006 suggests that a high consumption lifestyle leads to a higher footprint although with no significant difference in quality of life. The Nielsen study results showed that 94.6% (Nielsen, 2009, pg 4) of Wellingtonians rate their current quality of life as good or higher. Several lifestyle changes need to occur if Wellington city is going to live sustainably again. These changes will mean changes to personal habits, for example using public transport as opposed to a private vehicle to travel to work, however this is not necessarily a lower quality of life. There will need to be government and policy changes. There are some aspects of the ecological footprint that are shared by the community, for example the development of infrastructure, and this needs to be carefully considered and planned. A change to people's thinking and ideals will also mean a move away from putting value on material possessions, wealth and objects. If these are aspects of life people base their quality of life on, then there may be a perceived reduction in their quality of life if footprint reduction is the goal. However, if people have similar values to those of the 1950s, valuing family, relationships, and community, these factors are going to remain unaltered when reducing the ecological footprint of Wellingtonians.

This method of measuring sustainably reinforces the point that everyone in the community contributes to and can make a change to sustainability and resource consumption in their area. Wellingtonians can change and move forward to the lifestyle and consumption of those residents who lived in the city during the 1950s and life could still be good.

6. Reflection and Future Work

This final chapter contains two discussions, the first being a reflection on the research that was carried out, discussing changes and recommendations to the methodology, for both the ecological footprint calculations and the focus group discussions. The second section discusses future work, with suggestions for changes to data collection and statistics that would enhance the accuracy and ease of calculating ecological footprints for New Zealand, its regions and cities. This section also discusses future research that could be undertaken to further understand New Zealand's position in providing a sustainable environment for its residents.

6.1 Methodologies

The methodology used for the ecological footprint calculations was based on established methodologies. The use of the Canberra ecological footprint report (Close & Foran, 1998) was successful in its use, as many of the calculations could be directly applied to Wellington because in both cases the calculations were for cities. Consumption and resource data for Canberra was relatively comparable to Wellington's data; therefore it provided a useful published example to check the results for Wellington. Data proved to be a limitation of these calculations; the aim was to use a 'bottom-up' approach for all calculations although this was not possible for all calculations because per capita data was not available.

Several difficulties were experienced in the data collecting phase of the methodology. The collection of data for 2006 was relatively straightforward in comparison to sourcing reliable data for 1956. The sources for the 2006 data regularly update this data and some data which was found through two or more sources would provide the same values. Records kept currently are much better than those in the 1950s. Several difficulties occurred in the collection of data for the 1950s. Firstly, most of the data is in published form and not available online, and this increased the possibility of human error when recording the values. Data was also collected by a wide variety of organisations in the 1950s, many of which no longer exist or have changed names. Because of this, research had to be conducted to determine what organisations collected the data needed. The way in which records were published also complicated data collection for the 1950s, as often values or figures would be written into the body of text in a report and this meant it was time consuming finding some information. In some cases data was collected by two different organisations and the results would be different. This meant decisions had to be made regarding which source of information was more trustworthy.

Data was often collected sporadically in the 1950s; it appears data collection improved in the 1970s with more detailed statistics being collected from this point onwards. This meant data for 1955 or 1957 had to be used to estimate data for 1956. In some cases no data was available for the 1950s, for example food data for New Zealand only dates back to 1961 and as a result estimations were made based on food consumption increases during the 1960s and incomplete Consumers' Price Index records. Also for service buildings partial data existed (such as floor areas of commercial and public buildings) and estimations of total land area were made from what was available. The total land area could have been found by going through individual property records for buildings in 1956, but this would have been a time consuming process.

Several assumptions and adjustments (conversions) also had to be made to the data available for the 1950s; this was because data was in imperial units. Monetary values had to be converted to dollars and 1972 values because this was the earliest published energy intensity data available. Solid waste for the

1950s was recorded in cubic yards (volume) and tonnes (weight) were required. As there is no direct conversion between the units, estimations had to be applied based on pounds/cubic yard and cubic yards/ton. These difficulties with published records and information for the 1950s resulted in more assumptions and estimations being made than for the 2006 data.

In regard to the focus group discussions the most successful method of recruiting participants was through visits to retirement villages and discussing the research and their involvement, as this enabled people to ask any questions at this time. It was also the most efficient method with several being recruited in one visit. The other main method used was placing flyers in city council libraries and pools, and this did result in people calling and participating in the research, however this was a slower process. The use of both a questionnaire and focus group discussions was successful, as they enabled complementary qualitative and quantitative data to be collected in an effective way. Upon reflection some changes to the questionnaire could be made, and these include tailoring some of the questions more, for example labelling questions that were only relevant to people who were women, men or children in the 1950s. This is because some questions were only relevant to those who were at school during the 1950s, although some people filled them in who had left school by that time. Subsequently their answers were removed and not included in the overall results.

6.2 Future Work

In order to understand New Zealand's position in regard to sustainability, resources and consumption further research needs to be undertaken. The Ministry for the Environment has in the past calculated ecological footprints for New Zealand and its regions; this is because these are the areas for which sufficient data exists. However, this research could be more widespread to include cities. This would provide an understanding of the consumption of an urban area in relation to its region. In order for this to be feasible New Zealand organisations need to collect data in more detail for cities and change the way in which it is collected to provide sufficient data for 'bottom-up' calculations which are better suited to cities and regions. Currently, much of the data required for ecological footprint is collected on a national or regional basis; this does not provide enough detail for cities and results in a 'top-down' approach being used for calculating the ecological footprint. More detailed information is needed for cities to provide enough data for 'bottom-up' analyses.

Sources of data have improved in recent times, as most data is available in electronic form and several organisations are linked to the Statistics New Zealand website. The majority of data required for ecological footprints for New Zealand is collected and analysed by New Zealand organisations, although some is not, as with the food data. It is important that data is collected and regularly updated so that the most recent information is available, although, sometimes the most recent data can still be a few years old as it take time to collect, process and analyse. This was one of the limitations of this research; the 2006 population census was the most recent and dictated the year for which the current ecological footprint could be calculated.

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8. Appendices

Appendix A

Cover Letter

12 May 2010

To whom it may concern,

As part of a Masters of Building Science degree undertaken through Victoria University of Wellington, I am researching the environmental impact of Wellingtonians in the 1950s and their associated lifestyles. Environmental impact is measured using the Ecological Footprint methodology which looks at the amount of productive land need to supply all goods and services for a particular way of life on a sustainable basis.

The study will report on the calculated ecological footprint of Wellingtonians in the 1950s. In addition to this, information in the form of statistics and published information, relating to New Zealand and Wellington during this time, will be reviewed. This will provide factual information about living in Wellington in the 1950s. As part of the research I am also interested in understanding what life was like in Wellington during this time and how it compares to the present. In order to gather this information I am looking for a group of people who lived in Wellington between 1950 and 1959. This group of people will form several focus groups; these are groups of around 6 people who will meet to discuss aspects relating to this investigation.

The focus groups will be met by myself at a prearranged time in a location suitable to yourselves. The focus group participants do not still have to live in Wellington, as I will travel to you. Guide questions have been set up by myself to cover topics of interest to this research. A copy of these questions will be sent to you prior to the focus group meetings. This enables you to look over the questions, write down any notes or answers, and for me to answer any questions you may have prior to the meetings. If you would like a copy of the questions before giving your consent please contact me. As mentioned, the questions are a guide and the focus group meetings will be set up as a discussion rather than an interview. The discussions during the focus group meetings will be recorded by myself through notes and on a Dictaphone. This is so what is said can be accurately written in the final report.

The information gathered through the focus group meetings is strictly kept between myself and my supervisor, it will remain confidential and will be securely stored for a further five years upon completion of my thesis. If required, focus groups may be met with more than once, and this will be arranged to suit the participants.

Should you wish to view a copy of my thesis, it will be available in the VUW School of Architecture library from mid 2011 onwards. Otherwise, if you wish, I will email or post an electronic copy of the thesis to you (depending on what is more suitable) if you tick the relevant box on the consent form attached.

If you have further questions please contact me either by email: fieldcarm@myvuw.ac.nz or by phone 04 463 6253.
My supervisor, Professor Brenda Vale, can also be contacted by email: brenda.vale@vuw.az.nz or by phone 04 479 0253.

Please inform me at the earliest convenience by returning the consent form to fieldcarm@myvuw.ac.nz or alternatively to Carmeny Field, C/O School of Architecture and Design, 139 Vivian Street, PO Box 600, Wellington, New Zealand, of your consent decision.

Thank you very much for your time and cooperation.

Carmeny Field
Masters of Building Science Candidate
School of Architecture
Victoria University of Wellington

Appendix B

Consent Form

12 May 2010

To whom it may concern,

Title of research: Ecological Footprint of Wellingtonians in the 1950s.

Please tick only the relevant boxes below to which you wish to consent. If you wish to consent to this research please tick box (1). If you do not wish to participate in this research, and therefore do not consent, please do not tick any of the boxes. If you wish to receive a copy of the complete thesis please tick box (2).

(1) ☐ I,_____, consent to participating in this research as part of a focus group as part of the Masters of Building Science study.

(2) ☐ I wish to receive a copy of the complete thesis.

Please provide your preferred contact details below, also sign and date to validate this consent form. Forms can be returned via email to fieldcarm@myvuw.ac.nz or alternatively posted to Carmeny Field, C/O School of Architecture and Design, 139 Vivian Street, PO Box 600, Wellington, New Zealand.

Preferred method of contact:

Phone:_____ Best contact time:_____

Email:_____

Signed:_____ Date:_____

Thank you for your cooperation.

Carmeny Field
Masters of Building Science Candidate
School of Architecture
Victoria University of Wellington

Appendix C

Were you living in Wellington in the 1950s?

Do you know someone who was?

I'm looking for people to be part of a survey and focus group (Ethics Approval no. 17719), to gather information on life in the 1950s, as part of a Masters degree entitled the 'Ecological Footprint of Wellingtonians in the 1950s'.

If you are interested or would like some more information please contact Carmeny Field (Victoria University of Wellington) via email **fieldcarm@myvuw.ac.nz** or phone **(04) 463 6253**.

Survey Questions

Before you get started

Thank you very much for taking the time to participate in this study, your input is very valuable. The following questions are to be filled in by each individual participating in this research. The questions will be discussed further when the focus group meets later. It would be appreciated if you can fill in as much information as possible, as some of this information does not need to be discussed at the meeting. If there are questions you are not sure about, please feel free to contact me prior to the focus group meeting. If you require any extra space to write an answer, please do so on the last page and note the question number.

At the focus group meeting we will further discuss, as a group, some of the questions in this questionnaire, for example quality of life.

Focus Group questions

1. Where and when (year) were you born?

Where:_____

_____

When:_____

_____

2. Please name all the places you lived in Wellington between 1950 and 1959

_____

_____

Housing

3. Number of people in your immediate family under the same roof when you lived in Wellington

Adults:_____

Children:_____

4. Did you have lodgers or relatives living with you as well?

☐ Yes ☐ No

If yes, how many?_____

5. What type of dwelling(s) did you live in?

☐ Flat

☐ Apartment

☐ House

☐ Other:_____

6. Did your parents rent or own the dwelling(s) you lived in between 1950-59?

☐ Rent

☐ Own

☐ Don't know

7. Can you recall the number of rooms in the dwelling you lived in for the longest time?

Bedroom(s)_____

Living room(s)_____

Dining room_____

Kitchen_____

Hall/circulation space_____

Other (please describe)_____

_____

8. What were the construction materials used for the dwelling described above?

Walls:_____

_____

_____

Floor:_____

_____

_____

Roof:_____

_____

_____

9. How often would you heat the house and what was the schedule?

Room heated	**How was it heated (eg. Fire place)**	**When was heated (eg. 5-9pm)**
Master Bedroom		
Bedroom 1		
Bedroom 2		
Bedroom 3		
Bedroom 4		
Living room		
Dining room		
Circulation spaces		
Kitchen		
Other:		

10. Did your family own a bach as well? If so where?

☐ Yes ☐ No

Location:_____

Work

11. Who was the main breadwinner and what were their job(s)?

Main bread winner:_____

Job(s):_____

Approximate hours at work each day:_____

12. Did your Mother (main female carer) have a job apart from being a housewife?

☐ Yes ☐ No

If Yes, what was her job?_____

Approximate hours at work each day:_____

13. Did you have a job during the 1950s, if yes, what kind of work? Pay rate?

☐ Yes ☐ No

Job:_____

Pay rate:_____

Transportation

14. What forms of private transport did you have at home?

☐ Car

☐ Bicycle

☐ Boat

☐ Other:_____

15. What forms of public transport did you/your family use and how often?

Transport mode	Purpose of Journey (eg. Travel to school)	How often per week (eg. Daily for 2 hours)
Bus		
Train		
Boat		
Other:		
Other:		

16. Was it (public transportation) perceived to be expensive or affordable?

☐ Expensive

☐ Affordable

17. How many times a year and for what would you use the following modes of transport?

Transport mode	How many times a year (eg. Weekly, Daily)	Purpose (eg. do the shopping)
Car		
Boat		
Plane		
Train		
Bus/Coach		
Bicycle		
Other		

18. How did you generally get to school?

☐ Private car

☐ Cycle

☐ Walk

☐ Bus

☐ Train

☐ Other:_____

19. In a typical year how often and where did you go for holidays and mode of transport?

Type of Holiday (eg. Summer holiday)	Where	How did you travel (eg. private car)	Accommodation type (eg. hotel)

20. How often did you see your relatives?

Type of relative	Where they lived	How often did you see them

21. How did you communicate with significant relatives/friends and the frequency?

Communication mode	Who	Frequency
Letter		
Phone		
Visit		
Other:		

Food

Grown

22. Did you grow vegetables at home? What type?

☐ Yes ☐ No

Types (please tick all relevant):

☐ Potatoes ☐ Lettuce/Salad crops

☐ Tomatoes ☐ Pumpkins

☐ Corn ☐ Peas

☐ Carrots ☐ Other:_____

23. Did you grow fruit at home? What type?

☐ Yes ☐ No

Type (please tick all relevant):

☐ Apples ☐ Plums

☐ Pears ☐ Lemons

☐ Strawberries ☐ Oranges

☐ Grapes ☐ Other:_____

24. Did you produce anything else at home?

☐ Yes ☐ No

Type:

☐ Chickens for meat

☐ Eggs

☐ Other:_____

25. Approximately what percentage of your food was grown at home?

☐ Less than ¼ ☐ ¼ ☐ ½ ☐ ¾ ☐ All

26. Did you have home grown food from relatives and neighbours and approximately how often?

☐ Yes ☐ No

If **Yes**:

What type of food	**How often (eg. once a week)**

Bought

27. Where did you shop?

☐ Dairy

☐ Local shops

☐ Market

☐ Supermarket

☐ Other:_____

28. How often did your family go shopping?

☐ Daily for meat and milk

☐ Once a week for a big shop

☐ Every couple of weeks for a big shop

☐ Other:_____

29. What would a typical breakfast, lunch, dinner be?

Meal type	**Typical food eaten**
Breakfast	
Lunch	
Dinner	
Dessert	

30. Who cooked and prepared each meal?

☐ Your Mother only

☐ Your Father only

☐ Mainly your mother

☐ Mainly your father

☐ Other:_____

31. Did you eat out, what would you typically have, and how often?

☐ Yes ☐ No

If **Yes**:

Meal type **(eg. Fish and Chips)**	**Frequency** **(eg. once a week)**

Consumer Goods

Household items

32. Did your family own any of the following, how often were they used?

	Daily	Weekly	Monthly
☐ Fridge	☐	☐	☐
☐ Oven	☐	☐	☐
☐ Washing machine	☐	☐	☐
☐ Vacuum	☐	☐	☐
☐ Lawn mower	☐	☐	☐

33. Did your family own any of the following and how many?

☐ T.V Number:_____

☐ Radio Number:_____

☐ Gramophone Number:_____

☐ Telephone Number:_____

34. Did you listen/watch these as a family and how often?

☐ Yes ☐ No ☐ Occasionally

Type	**How often**
T.V	
Radio	
Gramophone	
Other:	

35. How many lights did you have in each room?

Room type	Number of lights
Master Bedroom	
Bedroom 1	
Bedroom 2	
Bedroom 3	
Bedroom 4	
Living area	
Dining area	
Kitchen	
Other	

Services

36. How often would you go to the following?

Services	How often
Doctor	
Dentist	
Clinic	
Hospital	

37. Did you have to pay? If yes, was it expensive or affordable?

☐ Yes ☐ No

☐ Expensive ☐ Affordable

38. Did you choose where you went to school?

☐ Yes ☐ No

39. Did you go to the school closest to home?

☐ Yes ☐ No

40. Did anyone in your family go to university in the 1950s?

☐ Yes ☐ No

To do:_____

41. Did anyone undertake apprenticeships in the 1950s?

☐ Yes ☐ No

To do:_____

General activities

42. What did you do in the evenings?

☐ Watch T.V

☐ Play games

☐ Read

☐ Gardening

☐ Other:_____

43. What did you do in the weekends?

☐ Play sport

☐ Household chores

☐ Visit family or friends

☐ Church

☐ Other:_____

44. Did you do out of school activities as children?

☐ Yes ☐ No

What activities?

☐ Girl Guides

☐ Boy Scouts

☐ Music

☐ Sport

☐ Other:_____

45. What toys did you own?

☐ Toy trains (Hornby/Real Rail)

☐ Dolls/Dollhouse

☐ Construction toys (Mecanno, Minibrix, Bayko, etc)

☐ Dinky toys

☐ Other:_____

46. What did your parents do as hobbies, with friends, groups or similar?

☐ Sewing/knitting

☐ Gardening

☐ DIY

☐ Sports

☐ Other:_____

Quality of life

47. What do you consider to be better about the 1950s?

_____

_____

_____

_____

_____

_____

48. What do you consider to be better about now?

_____

_____

_____

_____

_____

_____

49. What do you consider to be worse about the 1950s?

_____

_____

_____

_____

_____

_____

50. What do you consider to be worse about now?

51. Did you feel a sense of pride in the way Wellington looked and felt in the 1950s?

☐ Yes ☐ No

52. Do you feel a sense of pride in the way Wellington looks and feels now (if you live in Wellington)?

☐ Yes ☐ No

53. How easy or difficult was it for you/your family to get to a local park or other green space?

54. How safe did you/you family feel in your home during the day/night? Why?

55. How safe did you feeling walking in your neighbourhood? Why?

56. How safe did you feel in the city during the day/night? Why?

57. Did your family lock their house/car? When?

58. How satisfied do you think your family was with the balance between work and other aspects of their life for example family time and leisure?

☐ Very satisfied ☐ Satisfied ☐ Not satisfied ☐ Very unsatisfied

59. What social networks or groups were your a family part of?

☐ Church

☐ Sports clubs

☐ Hobby groups

☐ School

☐ Other:

60. How would you rate you/your family's overall quality of life in the 1950s?

☐ Extremely Good ☐ Good ☐ Neutral ☐ Poor ☐ Extremely Poor

Explain:_____

_____

_____

_____

_____

_____

_____

Thank you for your time.

Please bring the complete form with you to your focus group meeting.

Kind Regards,

Carmeny Field

Contact:

Email: fieldcarm@myvuw.ac.nz

Phone: 04 463 6253

Cellphone: 027 419 5742

Additional answers or notes:

Appendix E

Discussion Topics for Focus Group Meetings

Topic questions

Housing:

- What are the differences between housing now and then?
    - Quality, size, heating (colder/warmer), length of time/move often/why did you move.

Transportation:

- What are the differences between transport now and then?
    - Rely more on public or private transport, cost, better public transport now/then, what kind of private transport and for what purpose was it used.

Holidays:

- What are the differences between holidays now and then?
    - Where you would go, frequency, cost, choice.

Food:

- What are the differences between grown food now and then?
    - Cost, grown, eating out, cooking at home, amount of food, type of food, common to have a vege garden, what did you grow at home?
- What are the differences between purchased food now and then?
    - Where you shop, grocery list or not, how much you buy, types of food you buy.
- What are the differences between meals now and then?
    - Common breakfast, lunch, dinner and desserts.
- What are the differences between meals eaten out now and then?
    - Frequency, cost, type of food

Household items:

- What are the differences between common household items now and then?
    - What items, affordability, what was available?

Entertainment:

- What are the differences between entertainment now and then?
    - What did you do to entertain yourselves

General:

- Do you think it was cheaper to live in the 1950s in Wellington compared with now?
- What do you consider to be better about the 1950s compared with now?
- What do you consider to be worse about the 1950s compared with now?

Questionnaire Graphs

General Questions

Question 1

Number of responses – 30 people
Type of question – written answer
Number of selections – N/A

Question 2

Number of responses – 30 people
Type of question – written answer
Number of selections – N/A

Housing

Question 3

Number of responses – 29 people
Type of question – written answer
Number of selections – N/A

Question 4

Number of responses – 29 people
Type of question – single answer + written answer
Number of selections – 29

Question 5

Number of responses – 30 people

Type of question – multiple answer

Number of selections - 36

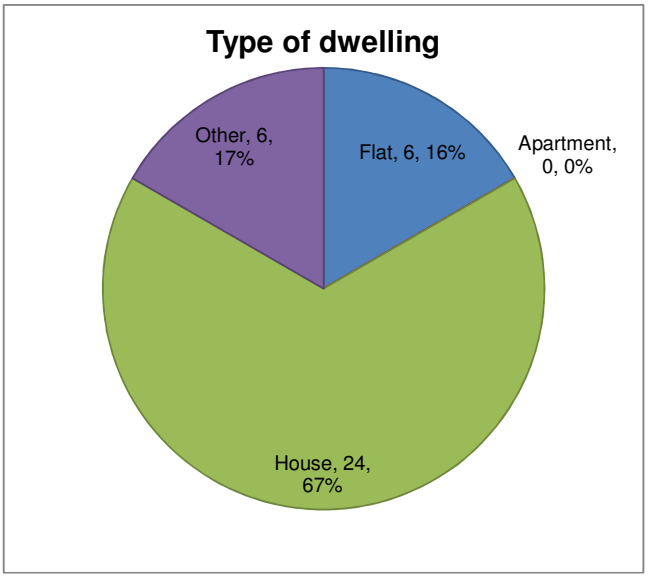

Figure 36: Types of dwelling lived in by participants in 1950s

Question 6

Number of responses – 21 people

Type of question – single answer

Number of selections – 21

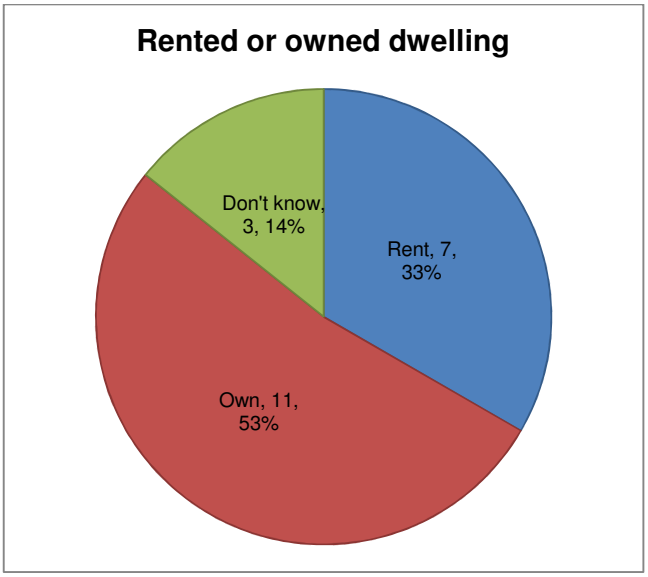

Figure 37: Rented or owned dwellings

Question 7

Number of responses – 29 people
Type of question – written answer
Number of selections – N/A

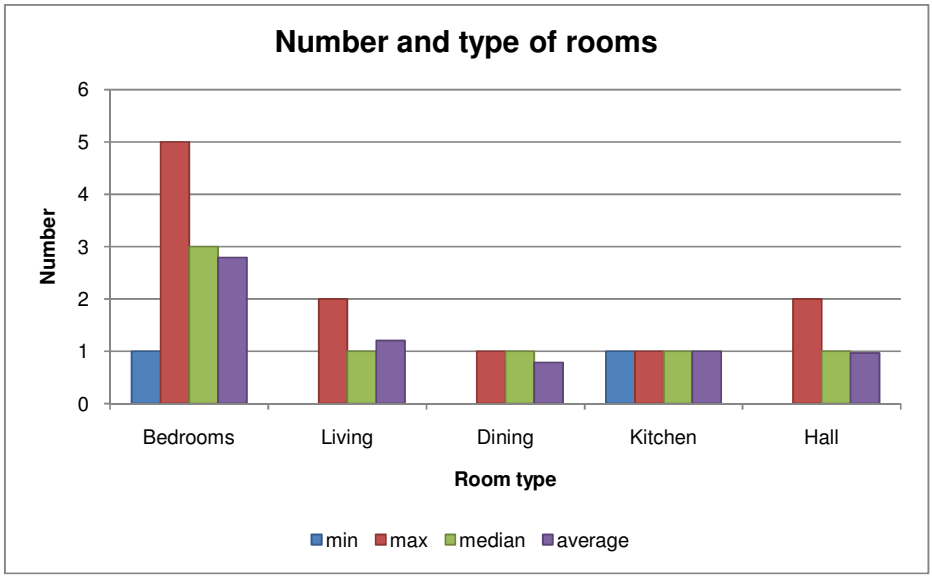

Figure 38: Number and type of rooms in dwellings

Question 8

Number of responses – 30 people
Type of question – written answer
Number of selections – N/A

Question 9

Number of responses – 30 people
Type of question – written answer
Number of selections – N/A

Question 10

Number of responses – 30
Type of question – single answer + written answer
Number of selections – 30

Work

Question 11

Number of responses – 30 people
Type of question – written answer
Number of selections – N/A

Question 12

Number of responses – 25
Type of question – single answer + written answer
Number of selections – 25

Question 13

Number of responses – 30
Type of question – single answer + written answer
Number of selections – 30

Transportation

Question 14

Number of responses – 30
Type of question – multiple answer
Number of selections – 31

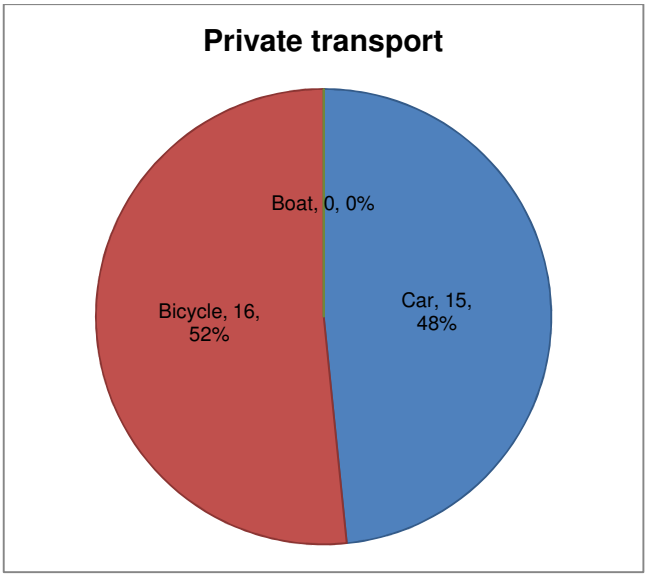

Figure 39: Private vehicles owned in 1950s

Question 15

Number of responses – 30
Type of question – written answer
Number of selections – N/A

Question 16

Number of responses – 28

Type of question – single answer

Number of selections – 28

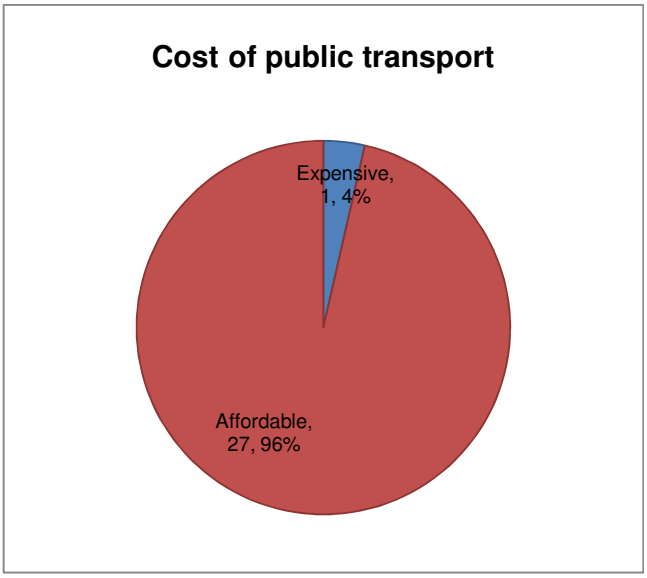

Figure 40: Perceived cost of public transport in 1950s

Question 17

Number of responses – 29

Type of question – written answer

Number of selections – N/A

Question 18

Number of responses – 17

Type of question – multiple answer

Number of selections – 29

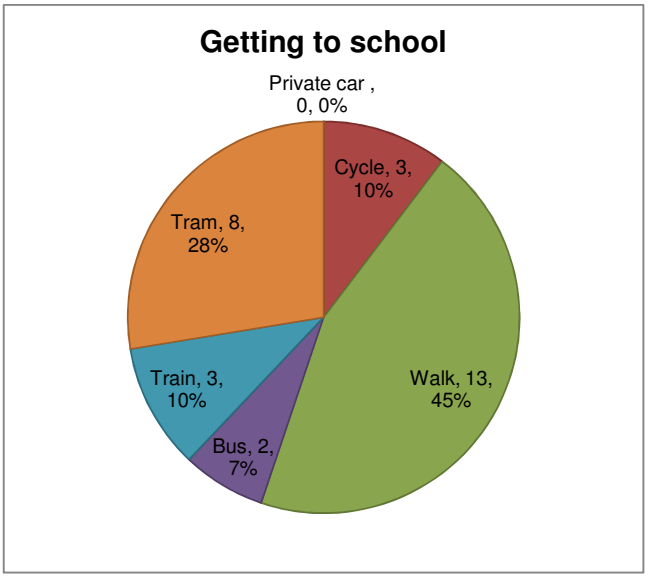

Figure 41: Transportation mode for getting to school

Question 19

Number of responses – 29

Type of question – written answer

Number of selections – N/A

Question 20

Number of responses – 30

Type of question – written answer

Number of selections – N/A

Question 21

Number of responses – 30

Type of question – written answer

Number of selections – N/A

Question 22

Number of responses – 30

Type of question – multiple answer

Number of selections – 106

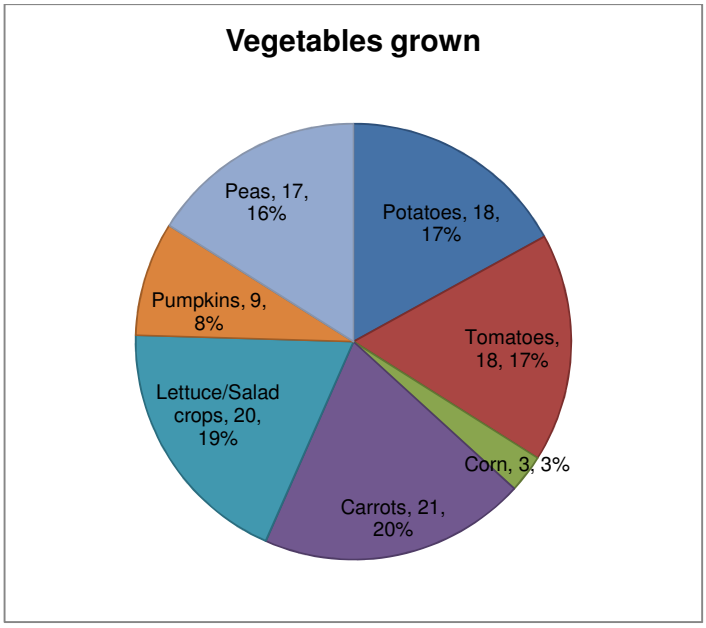

Figure 42: Vegetables grown at home in the 1950s

Question 23

Number of responses – 30

Type of question – multiple answer

Number of selections – 44

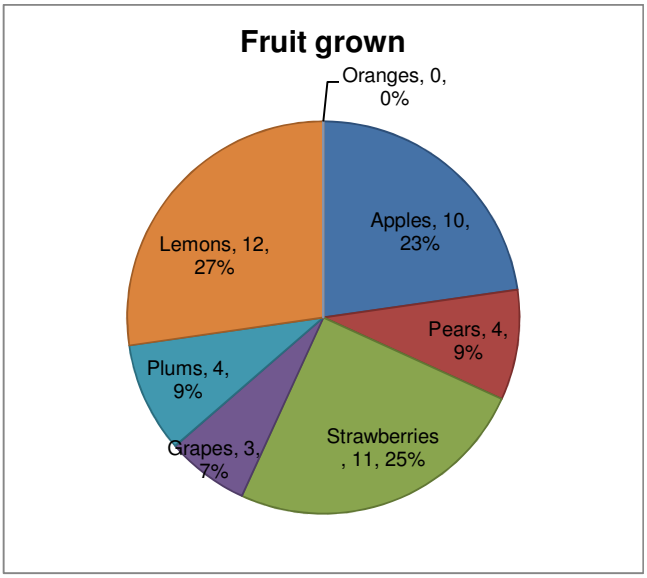

Figure 43: Fruit grown at home in the 1950s

Question 24

Number of responses – 30

Type of question – multiple answer

Number of selections – 4

Question 25

Number of responses – 29

Type of question – single answer

Number of selections – 25

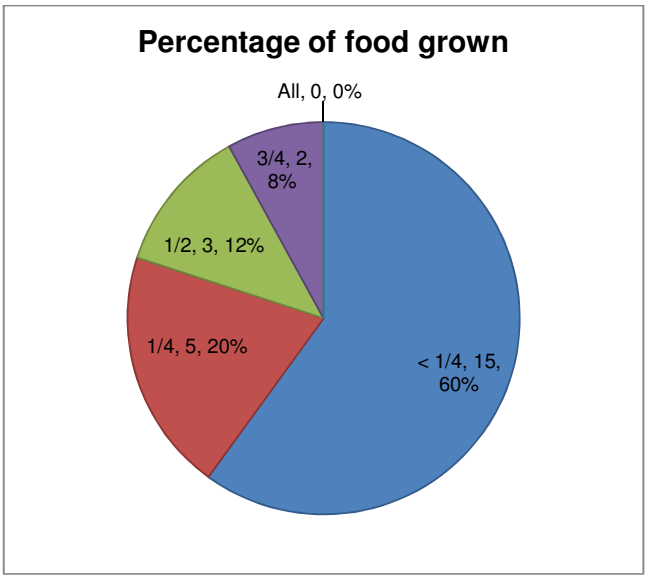

Figure 44: Percentage of food grown at home in 1950s

Question 26

Number of responses – 30

Type of question – single answer + written answer

Number of selections – 30

Question 27

Number of responses – 30

Type of question – multiple answer

Number of selections – 52

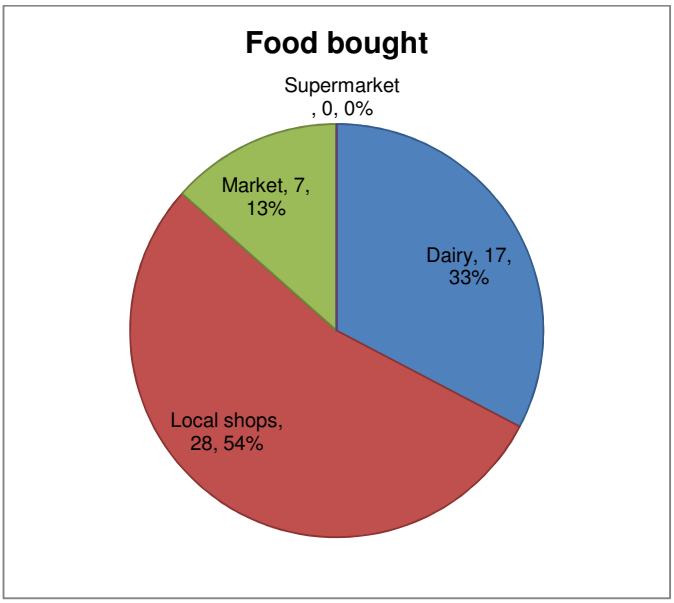

Figure 45: Where food was bought in the 1950s

Question 28

Number of responses – 24

Type of question – multiple answer

Number of selections – 34

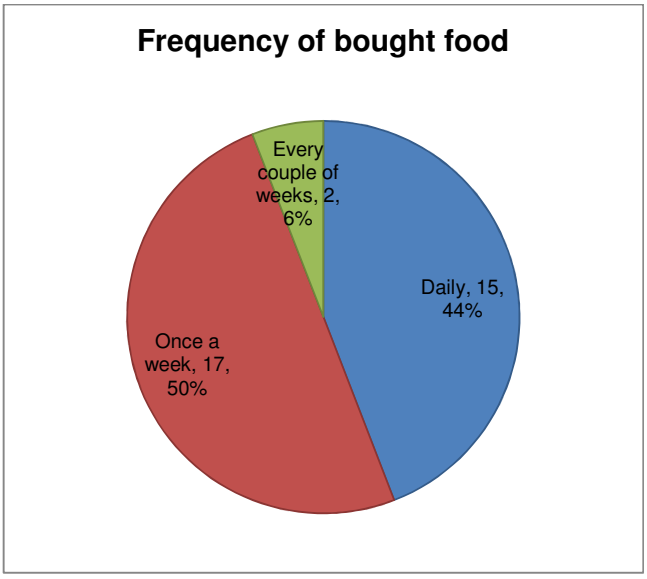

Figure 46: Frequency of food bought in the 1950s

Question 29

Number of responses – 30
Type of question – written answer
Number of selections – N/A

Question 30

Number of responses – 30
Type of question – single answer
Number of selections – 16

Question 31

Number of responses – 30
Type of question – single answer + written answer
Number of selections – 30

Question 32

Number of responses – 29
Type of question – multiple answer
Number of selections – 228

Question 33

Number of responses – 30
Type of question – multiple answer
Number of selections – 72

Question 34

Number of responses – 28
Type of question – single answer
Number of selections – 27

Question 35

Number of responses – 27
Type of question – written answer
Number of selections – N/A

Question 36

Number of responses – 30
Type of question – written answer
Number of selections – N/A

Question 37

Number of responses – 24
Type of question – multiple answer
Number of selections – 25

Question 38

Number of responses – 18
Type of question – single answer
Number of selections – 18

Question 39

Number of responses – 18
Type of question – single answer
Number of selections – 18

Question 40

Number of responses – 26
Type of question – single answer + written answer
Number of selections – 26

Question 41

Number of responses – 28
Type of question – single answer + written answer
Number of selections – 28

Question 42

Number of responses – 30

Type of question – multiple answer

Number of selections – 50

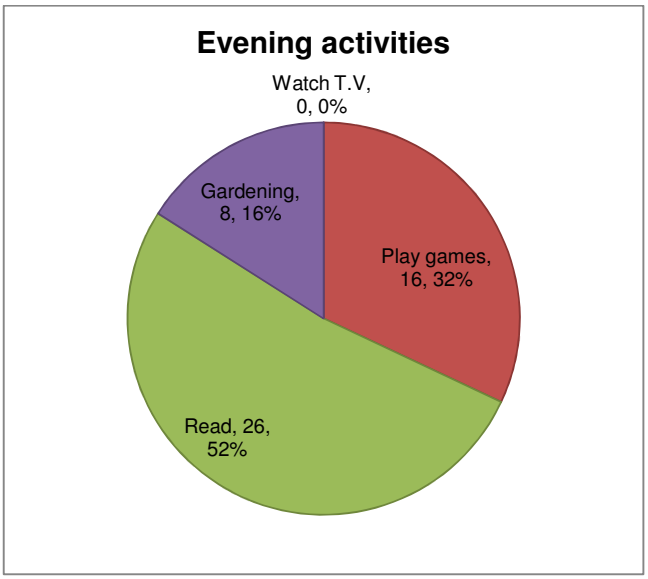

Figure 47: Evening family activities in the 1950s

Question 43

Number of responses – 30

Type of question – multiple answer

Number of selections – 84

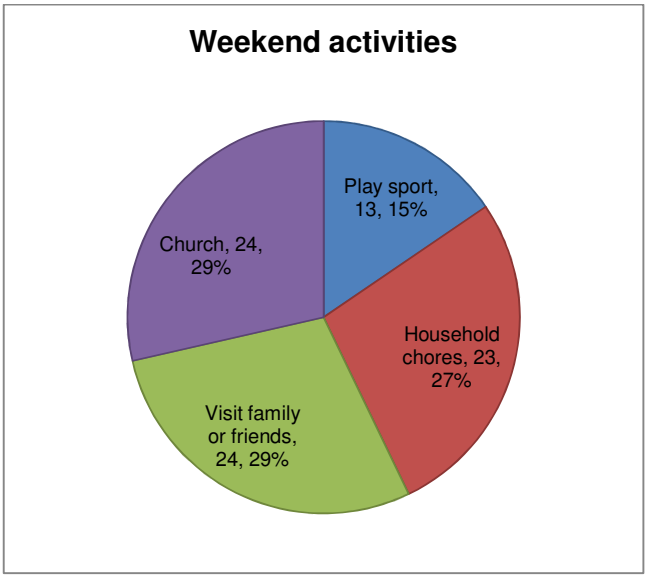

Figure 48: Weekend family activities in the 1950s

Question 44

Number of responses – 20

Type of question – multiple answer

Number of selections – 34

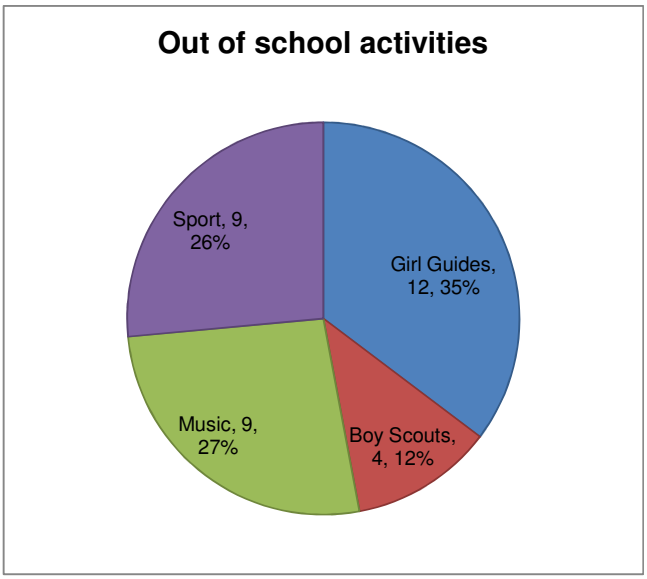

Figure 49: Out of school activities undertaken in the 1950s

Question 45

Number of responses – 20

Type of question – multiple answer

Number of selections – 25

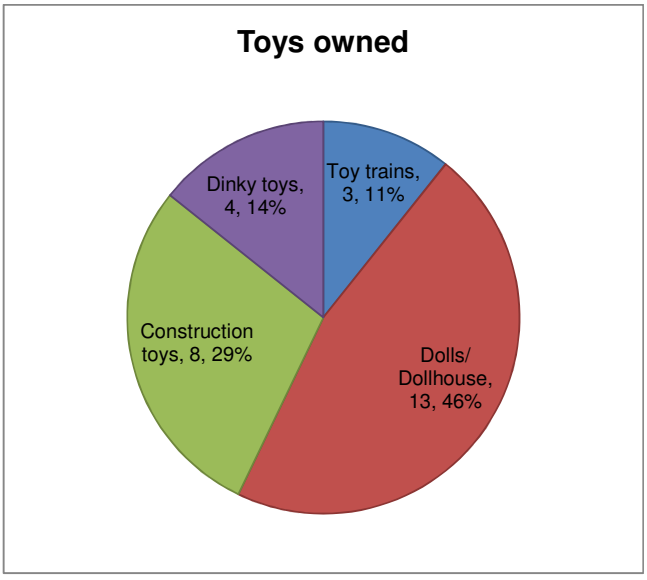

Figure 50: Toys owned by children in the 1950s

Question 46

Number of responses – 25

Type of question – multiple answer

Number of selections – 34

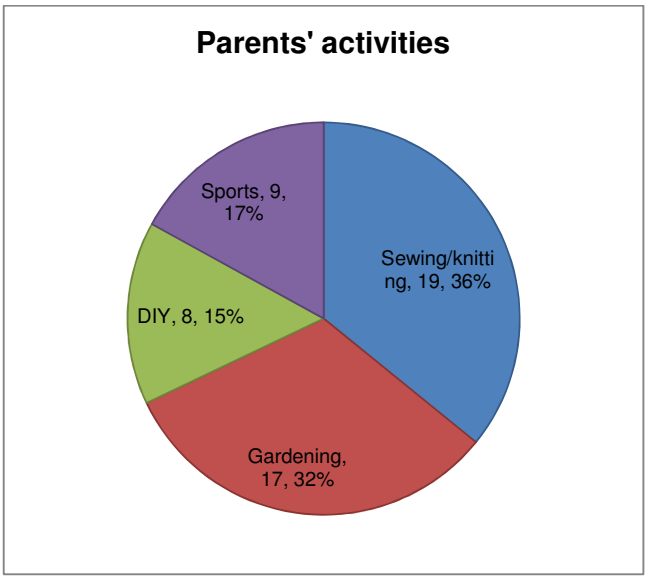

Figure 51: Activities undertaken by parents in the 1950s

Question 47

Number of responses – 27

Type of question – written answer

Number of selections – N/A

Question 48

Number of responses – 25

Type of question – written answer

Number of selections – N/A

Question 49

Number of responses – 22

Type of question – written answer

Number of selections – N/A

Question 50

Number of responses – 25

Type of question – written answer

Number of selections – N/A

Question 51

Number of responses – 25

Type of question – single answer + written answer

Number of selections – 25

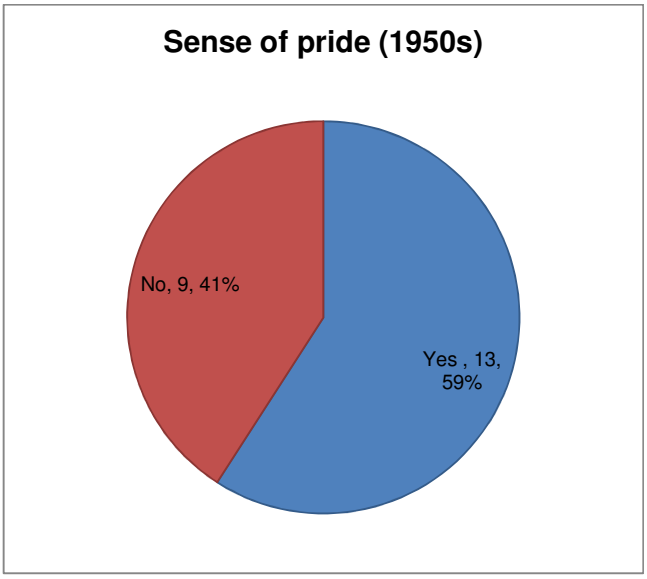

Figure 52: Sense of pride in Wellington in the 1950s

Question 52

Number of responses – 27

Type of question – single answer + written answer

Number of selections – 27

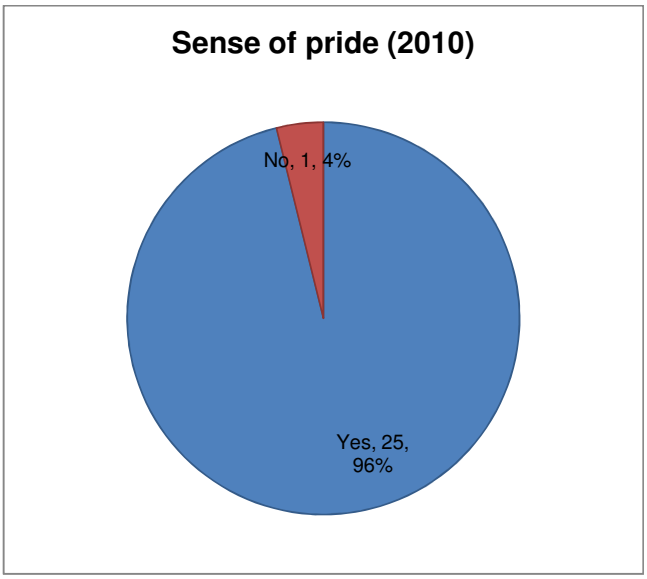

Figure 53: Sense of pride in Wellington in 2010

Question 53

Number of responses – 27
Type of question – written answer
Number of selections – N/A

Question 54

Number of responses – 25
Type of question – written answer
Number of selections – N/A

Question 55

Number of responses – 25
Type of question – written answer
Number of selections – N/A

Question 56

Number of responses – 25
Type of question – written answer
Number of selections – N/A

Question 57

Number of responses – 26
Type of question – written answer
Number of selections – N/A

Question 58

Number of responses – 25

Type of question – single answer

Number of selections – 25

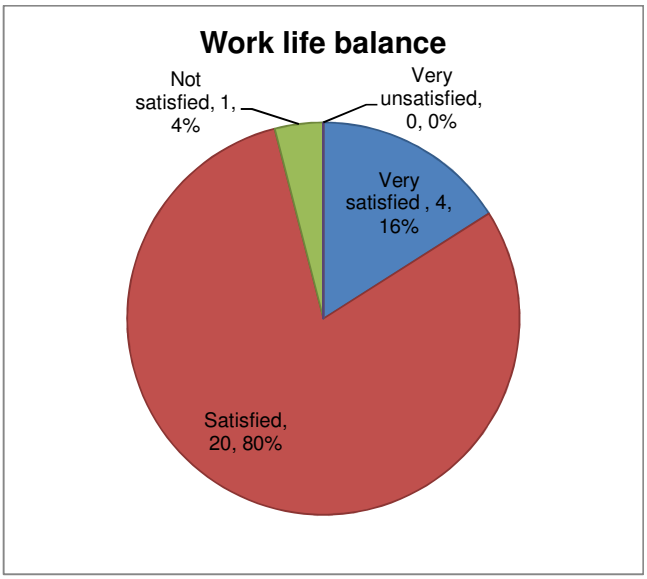

Figure 54: Work life balance of parents in the 1950s

Question 59

Number of responses – 29

Type of question – multiple answer

Number of selections – 49

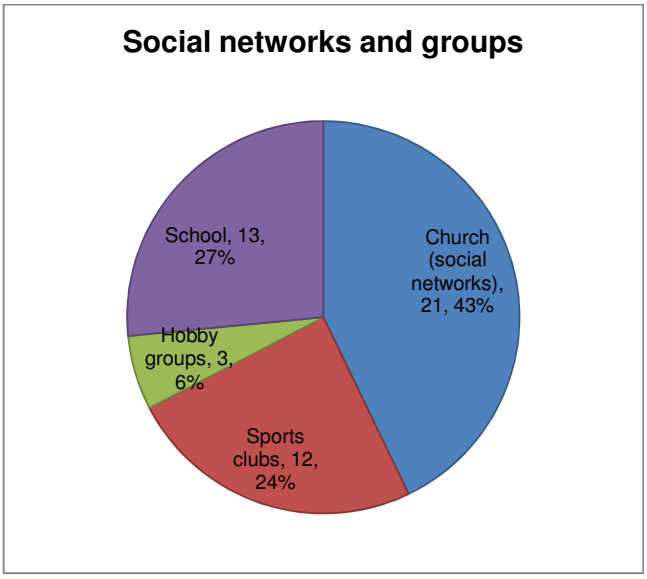

Figure 55: Social networks and groups parents belonged to in the 1950s

Question 60

Number of responses – 28

Type of question – single answer

Number of selections – 28

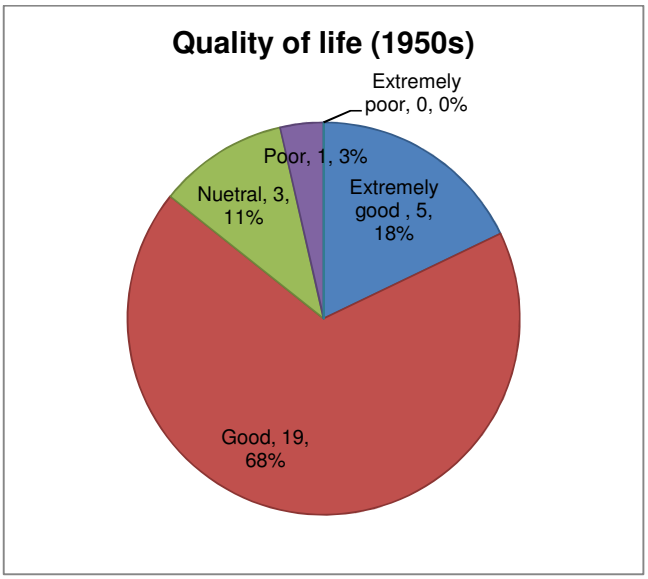

Figure 56: Family's quality of life in the 1950s

Sample Focus Group Discussion Transcript and Analysis

This section shows an excerpt from a focus group discussion transcript to demonstrate how they were typed up and then summarised to provide comparison between aspects in the 1950s and now. Note names have been removed and replaced with numbers for anonymity. Discussions from each person were highlighted to compare how much each person contributed to the conversations.

Transcript excerpt:

Start:

Researcher: What about the heating, would you say houses were a lot colder, did people heat to necessity?

2) Yes heat to necessity [all agree]

Researcher: So you wouldn't heat 24 hours a day like people would now?

2) You put jerseys on.

3) But there was no real awareness of need for insulation. We said: we are temperate climate and we put a fire on or a heater. I remember the one bar heaters that we had in our house.

Researcher: And they did nothing I imagine?

3) And they didn't, they weren't very efficient but there was very little talk of insulation, until relatively recently.

4) We never heated bedrooms.

5) Something to do with our predominately British heritage. No we didn't [agrees with not heating bedrooms]. I only started heating mine [bedroom] when it became a study, other than that we did our homework in the kitchen which was big. And that was the heated room, and everybody piled in there.

Researcher: And was it heated because of the oven being used and the stove top or did you have a heater?

5) Well that helped [oven and stove for heating], but there was a big convection heater under a clothes horse, it was often occupied by clothes drying. So there was steam everywhere.

2) It meant in a sense that it was an economical way of heating. Because you were all there in the one room, so you were all using the same heat source.

5) Yes that's right, my sister and i had asthma, so you know there were dust mites galore.

Researcher: Do you think it affected your health?

5) Well the cat bore the brunt of the accusations but I think it was that and the steamed vegetables.

2) But on the other hand there's seems to be that the incidence of asthma now is much, much greater than it was then.

5) You see houses aren't that much better amongst people who don't have a big income. They just no better at all.

Researcher: So they are stuck in those houses?

5) Yea so they are still operating in the same way.

4) We didn't have Batts [insulation] or anything like that.

1) No we had scrim and paper on the walls

5) That's right.

1) And in a southerly [it would lift off (4)] it use to billow in and out.

3) It was partly education and partly awareness and partly income. I don't remember people talking about the need for insulation, when I was in the 50s.

5) I don't know how much the power bills use to be, as I wasn't the power bill payer in the 50s, how much it loomed, you know everybody's worried about power bills now and talking about it. But I don't remember conversations about power bills.

3) Well I was in a flat on The Terrace, it was a two storeyed house and we were up stairs and we use to just pay the power bills. I never remember any worry, the sort of worry I get now when I get my power bill. We just paid and the gas it was manageable.

End

Summarised text (highlight section relates to summarised information from previous transcript):

Housing Question

Group 1

Main ideas

Past (1950s)

- houses still around today;
- Nae Nae and Taita being developed;
- houses being built, further out of town;
- lots of people coming rather than going, immigrants;
- so few people moving out of Wellington after war;
- quite hard to buy or move (mentioned several times);
- land sales regulations, prevented or influenced buying and selling of houses;
- young girls left home and moved into hostels-public service, post office hostels ;
- hostels commonly wooden large houses that were subdivided (change of use);
- boarding houses feature of the 50s;
- suburbs much more mixed than nowadays, had both large and small houses on the same street;
- much more uniform today in terms of size of houses in newer suburbs;
- disposable income not as high as it is today, more two income families ;
- Tawa being developed;
- 3% state advances loan, if income below a certain level;
- needed half the value of the house to get a mortgage;
- no building done during the war;
- design of houses, hallway straight down the middle, with the women's kitchen at the back, and a sort of living room at the front, not very convenient and separate everything;
- scrim on walls, no insulation (mentioned several times), very little talk of insulation;
- single women not allowed to be allocated a flat, had to move in with someone else, emphasis on housing families;
- never heated bedrooms, heated kitchen and lived in that room;
- economical way of heating;
- not very healthy, asthma, dust mites, steam and moisture and dried clothes in same room too;
- houses now aren't that much better amongst people who don't have a big income;
- didn't worry about power bills like we do now, power supply was state controlled and would frequently cut out;
- heating: open fire (not very efficient), chip heater, coal range in kitchen and warm that space, moveable electric heaters, 1 bar or two bar heaters.

Now (2010)

- much sunnier;
- lined not scrim;
- live in an old house still no insulation (several commented),have central heating system but too expensive to run;
- much higher standard of living;
- insulation and a heat pump makes a huge difference;
- still older houses 1960-70s currently lived in;
- larger houses now that are bigger than required eg.3 person family in a 5 bedroom house, need for ensuites and nice kitchens and bathrooms to sell a house;
- house to section ratio changed, small sites with large houses almost filling the site.

Appendix H

Example Spreadsheet

Services		**2006**						
Category				**Source**				
General Statistics	Population of New Zealand		4,027,947					
	Population of Wellington		179,466					
			ha					
Consumed Land	Commercial and public buildings		319.82	Info from Colliers International	0.0018	ha		
	Garden land		3000	Wellington City Council	0.0167	ha		
				http://www.wellington.govt.nz/services/resbelt/index.html	**Consumed land**	**0.0185**	**ha**	
Energy Land			**GJ**					
Operational energy	Per person		**48.54**	Ministry of Economic Development				
	Coal	10.33%	20,200,000	http://www.med.govt.nz/upload/57976/000-200707.pdf	5.01	GJ	0.0334	ha
	Oil	11.05%	21,600,000		5.36	GJ	0.0358	ha
	Gas	17.08%	33,400,000		8.29	GJ	0.0553	ha
	Geothermal	4.96%	9,700,000		2.41	GJ	0.0000	ha
	Other	13.91%	27,200,000		6.75	GJ	0.0000	ha
	Electricity	42.66%	83,400,000		20.71	GJ	0.0291	ha
	Total		**195,500,000**		**48.54**	**GJ**		
						Total	**0.1536**	
Embodied energy			**Floor area (m2)**		Total embodied energy (GJ)	GJ/50 year	GJ/person/year	ha
Construction	Accommodation		183,998	Colliers International	11	2,023,978	0.2256	0.0015
57%	Commercial		3,747,128	Via email contact	5	18,735,640	2.0879	0.0139
	Educational		107,288		10	1,072,880	0.1196	0.0008
	Medical		660		11	7,260	0.0008	0.0000
	Industrial		605,236		5	3,026,180	0.3372	0.0022
	Office		2,342,188		11	25,764,068	2.8712	0.0191
	Public		444,470		11	4,889,170	0.5449	0.0036
	Religious		91,008		10	910,080	0.1014	0.0007
	Retail		474,212		6	2,845,272	0.3171	0.0021
	Total		**7,996,188**		N/A	**59,274,528**		
							Total	**0.0440**
	Percentage of total embodied energy		**GJ (50 years)**		**GJ/person/year**	**Ecological footprint**		
Construction	57%		59,274,528		6.61	0.0440	ha	
Maintenance	38%		39,516,352.00		4.40	0.0294		
Demolition	1.15%		1,195,889.60		0.13	0.0009		
Disposal	3.45%		3,587,668.80		0.40	0.0027		
					Total	**0.0770**		
	Service		National annual expenditure ($)	Average annual expenditure per person ($)	Energy intensity value (GJ/$)	GJ/person	ha	
Expenditure	Central government administration and defence		5,188,000,000	1288.00	0.0012	1.55	0.0103	
	Local government administration		1,888,000,000	468.73	0.0014	0.66	0.0044	
	Education		6,426,000,000	1595.35	0.0009	1.44	0.0096	
	Health and community services		8,971,000,000	2227.19	0.0008	1.78	0.0119	
	Cultural and recreational services		3,593,000,000	892.02	0.0008	0.71	0.0048	
	Personal and other community services		2,425,000,000	602.04	0.0008	0.48	0.0032	
	Communication services		4,652,000,000	1154.93	0.0003	0.35	0.0023	
	Property services		9,970,000,000	2475.21	0.0009	2.23	0.0149	
	Tourism		10,264,000,000	2548.20	0.0012	3.06	0.0204	
	Business Service		13,623,000,000	3382.12	0.0002	0.68	0.0045	
	Finance and insurance		10,092,000,000	2505.49	0.0002	0.50	0.0033	
						Total	**0.0895**	
						Energy land	**0.3200**	**ha**

Wellington Region

Figure 57: Wellington Region

Source: http://mapping.gw.govt.nz/

Map of Wellington City – 1950s

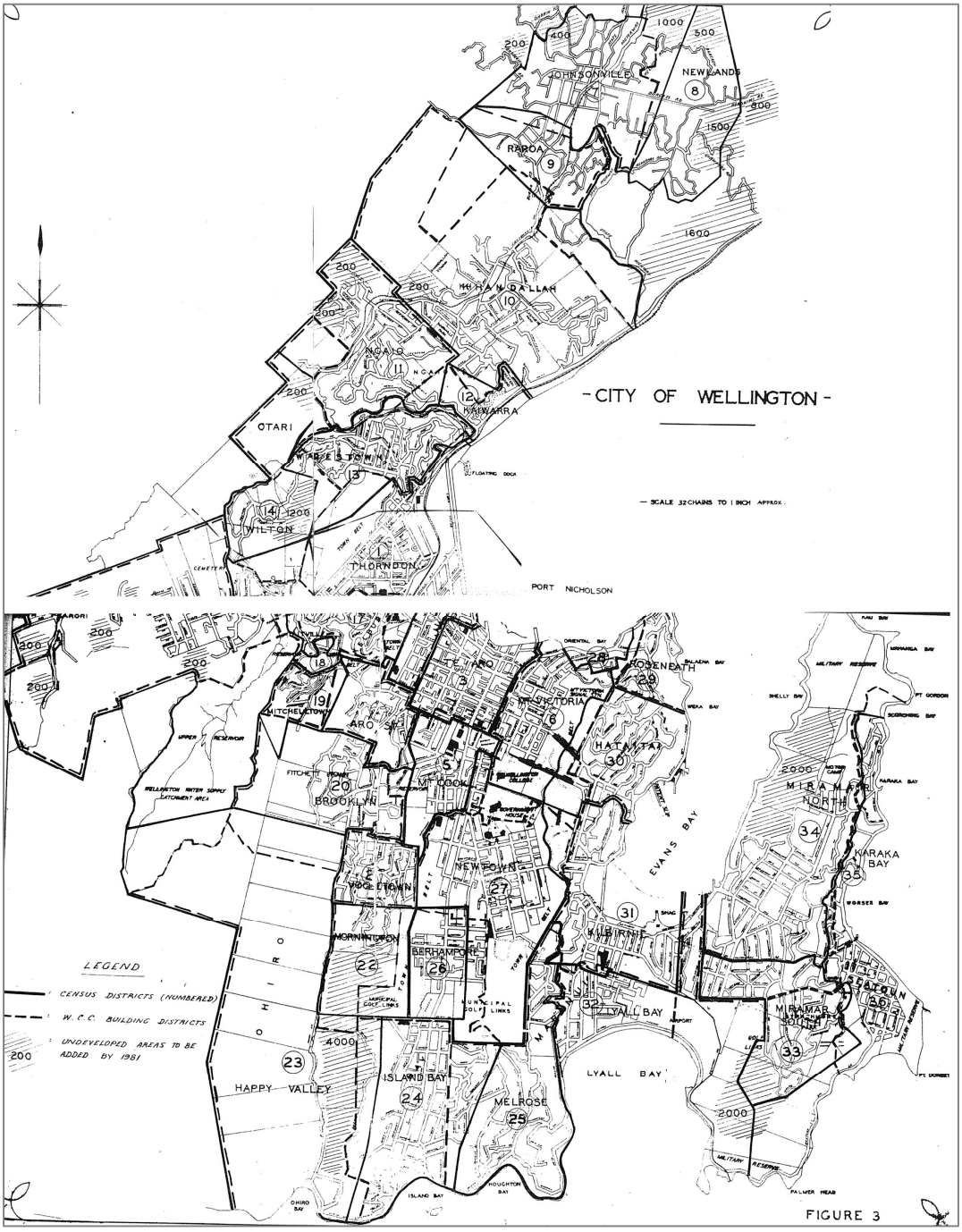

Figure 58: Wellington City Map (1950s-1960s)

Source: City Engineering Department, 1963

Assisted Immigrant by Country

Year	Great Britain	Netherlands	Austria	Germany	Denmark	Switzerland	Greece	Other
1947	158							
1948	1140							
1949	1527							
1950	2532							
1951	2873	55						
1952	3849	1100						
1953	4872	2709						
1954	5611	688						
1955	3880	452						
1956	4732	391						
1957	4172	252	139	30	-	-	-	-
1958	4070	245	44	69	106	45	-	-
1959	4343	141	36	35	92	31	-	-
1960	2360	90	25	39	13	22	-	-
1961	2217	12	2	-	-	-	-	-
1962	3474	84	14	-	-	10	-	2
1963	4283	42	33	27	-	-	137	10
1964	4171	-	6	16	5	14	130	5
1965	4300	-	9	12	5	11	29	34
1966	3963	-	19	7	8	27	18	5
1967	4020	-	9	9	10	36	11	2
1968	2732	-	2	4	5	17	4	-
1969	485	-	-	2	-	2	1	-
1970	377	-	-	-	2	-	1	2
1971	532	-	-	-	4	3	-	-
Total	**76,673**	**6261**	**338**	**250**	**250**	**218**	**331**	**55**
Year	**Great Britain**	**Netherlands**	**Austria**	**Germany**	**Denmark**	**Switzerland**	**Greece**	**Other**

Table 104: Immigration to New Zealand 1950-1970

Source: New Zealand Official Yearbook, 2000

Poultry Census Data

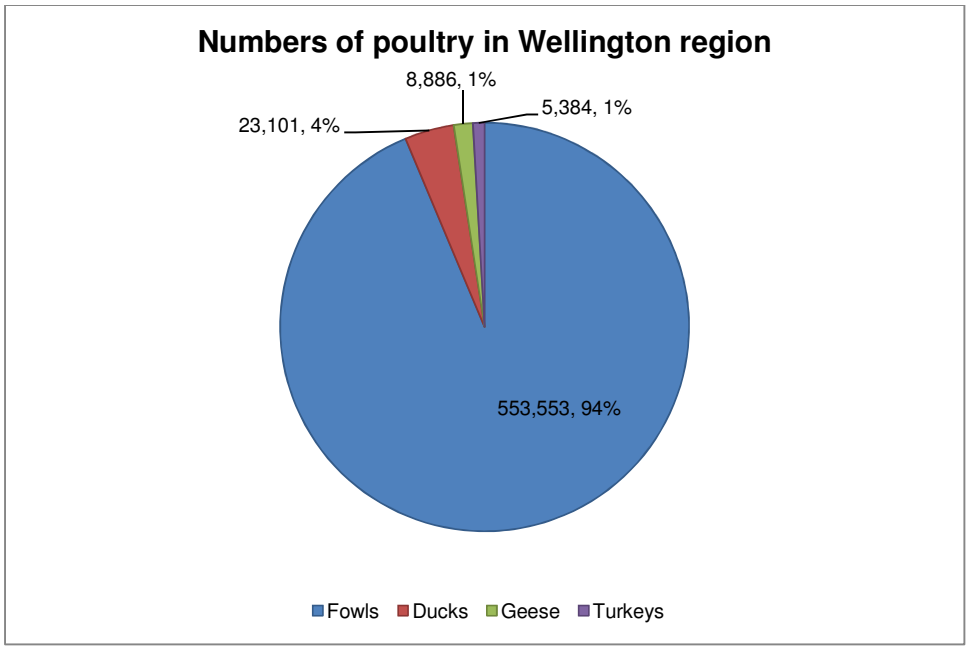

Figure 59: Numbers of poultry in the Wellington region, 1956

Source: Statistics New Zealand, Census of Poultry Appendix A, 1956

Number of Fowls	Proportion
1-12	19140
13-24	8068
25-49	1063
50-74	175
75-99	49
100-149	82
150-199	37
200-299	50
300-399	34
400-499	24
500-749	36
750-999	29
1000-1999	46
2000 and over	20
Average	19.2

Figure 60: Number of fowls in Wellington region, 1956

Source: Statistics New Zealand, Census of Poultry Appendix A, 1956

Appendix M

FAO data food calculations

This section shows the calculated results from the estimated food data for 1956, extrapolated from the 1960s food data available. These results were higher than those calculated from the Consumers' Price Index and did not directly reflect what people were purchasing and eating in the 1950s, whereas the CPI does. Some consumption results were similar for example the CPI data estimated 79kg of fruit was consumed per person; the consumption figures estimated from the FAO data available gave 80 kg. The two sets of results were compared and contrasted to ensure they gave reasonable results.

Crop Land

Fruit

Fruit	New Zealand consumption (1956)	Average per capita	Yield	Ecological footprint per person
	tonnes	kg	kg/ha	ha
Apples	28,015.54	12.89	20,243	0.0006
Bananas	32,208.07	14.81	6,620	0.0022
Citrus - other	26.40	0.01	157	0.0001
Coconuts	4,978.00	2.29	6,620	0.0003
Dates	5,789.46	2.66	6,620	0.0004
Fruits - other	29,672.96	13.65	6,620	0.0021
Grapefruit	2,115.49	0.97	21,115	0.0000
Grapes	28,437.50	13.08	10,764	0.0012
Lemons and limes	1,201.50	0.55	10,095	0.0001
Oranges and Mandarins	9,956.00	4.58	2,063	0.0022
Pineapples	376.00	0.17	6,620	0.0000
Tomatoes	31,052.37	14.28	32,718	0.0004
Total	**173,829.27**	**79.96**	**N/A**	**0.0098**

Vegetables

Vegetables	New Zealand consumption (1956)	Average per capita	Yield	Ecological footprint per person
	tonnes	kg	kg/ha	ha
Beans	157.50	0.07	7,437.80	0.0000
Cassava	0.00	0.00	10,366.40	0.0000
Olives	0.00	0.00	0.00	0.0000
Peas	8,715.88	4.01	3,887.60	0.0010
Pimento	9.50	0.00	10,366.40	0.0000
Potatoes	141,243.60	64.97	16,622.30	0.0039
Sweet potatoes	793.00	0.36	18,502.45	0.0000
Vegetables, other	160,498.42	73.82	10,366.40	0.0071
Total	**311,417.89**	**143.24**	**N/A**	**0.0121**

Grains

Grains	New Zealand consumption (1956)	Average per capita	Yield	Ecological footprint per person
	tonnes	kg	kg/ha	ha
Barley	5.00	0.00	2,784.45	0.0000
Cereals, other	6,281.25	2.89	2,750.00	0.0011
Maize	26.30	0.01	1,575.60	0.0000
Oats	19,555.46	8.99	2,286.45	0.0039
Rice (milled)	2,226.26	1.02	2,944.15	0.0003
Rice (paddy)	3,337.71	1.54	2,944.15	0.0005
Rye	0.00	0.00	2,356.40	0.0000
Wheat	204,530.04	94.08	3,357.90	0.0280
Total	**235,962.02**	**108.54**	**N/A**	**0.0339**

Beverages

Beverages	New Zealand consumption (1956)	Average per capita	Yield	Ecological footprint per person
	tonnes	kg	kg/ha	ha
Beer	197,830.00	91.00	N/A[2]	0.0000
Beverages, Alcoholic	6,624.50	3.05	N/A[2]	0.0000
Beverages, Fermented	34.00	0.02	N/A[2]	0.0000
Wine	993.20	0.46	8,200	0.0001
Coffee	150.05	0.07	1,982[1]	0.0000
Tea	8,051.00	3.70	1,322[1]	0.0028
Total	**213,682.75**	**98.29**	**N/A**	**0.0029**

1 Vietnam and Indonesian data used as products import from these countries

2 Accounted for in the grains footprint

Other foods

Other foods	New Zealand consumption (1956)	Average per capita	Yield	Ecological footprint per person
	tonnes	kg	kg/ha	ha
Oil crops	6,506.92	2.99	189.85	0.0158
Pulses	9,052.88	4.16	2,877.00	0.0014
Spices	262.50	0.12	5,357.10	0.0000
Sugar and Sweetener	109,275.91	50.26	89,465.00[1]	0.0006
Treenuts	956.75	0.44	2,018.10[1]	0.0002
Vegetable oils	91.65	0.04	672.30	0.0001
Honey	0.00	0.00	N/A[2]	0.0000
Total	**126,146.60**	**58.02**	**N/A**	**0.0181**

1 Values for Australia were used; the majority of these products are imported from Australia

Total Crop land

Food type	Ecological footprint per person	Ecological Footprint for Wellington
	ha	ha
Fruit	0.0098	1,349.89
Vegetables	0.0121	1,672.16
Grains	0.0339	4,685.38
Beverages	0.0029	399.83
Other food crops	0.0181	2,500.06
Total	**0.0767**	**10,607.31**

Grazing Land

Meat and Meat products

Meat and meat products	New Zealand consumption (1956)	Average per capita	Yield	Yield	Ecological footprint per person
	tonnes	kg	kg/Animal	kg/ha	ha
Bovine Meat	106,764.23	49.11	173.7	451.62[1]	0.1087
Meat, other	989.30	0.46	173.7	1789.11[2]	0.0003
Mutton and Goat meat	94,636.00	43.53	11.1	114.33[2]	0.3807
Offal	6,496.50	2.99	0.0	N/A[3]	0.0000
Pigmeat	34,094.00	15.68	67.0	690.1[2]	0.0227
Animal fats	38,089.63	17.52	0.0	N/A[3]	0.0000
Total	**281,069.65**	**129.28**	**N/A**	**N/A**	**0.5125**

1 2.6 animals per hectare, based on monitored Lower North Island farms (MAF, 2007)

2 10.3 animals per hectare, based on monitored Lower North Island farms (MAF, 2007a)

3 Offal and other animal fats are surplus parts of the animal, so are already accounted for in meat cropland

Poultry and Eggs

Poultry and Eggs	New Zealand consumption (1956)	Average per capita	Yield	Yield	Ecological footprint per person
	tonnes	kg	kg/Animal	kg/ha	ha
Poultry Meat	922.00	0.42	17.41	232.41[1]	0.0018
Eggs	38,655.44	17.78	16.94	226.12[2]	0.0786
Total	**39,577.44**	**18.20**	**N/A**	**N/A**	**0.0805**

1 Based on 43 m^2 per 1 kg of chicken meat (Vale & Vale, 2009, pg 40)

2 Based on 240 eggs per hen (Egg Producers Federation of NZ (Inc), 2010)

Dairy Products

Dairy Products	New Zealand consumption (1956)	Average per capita	Yield	Ecological footprint per person
	tonnes	kg	kg/ha	ha
Butter, Ghee	37,541.00	17.27	890.00	0.0194
Cheese	9,990.00	4.60	890.00	0.0052
Cream	3,555.00	1.64	890.00	0.0018
Milk, excluding butter	367,983.41	169.26	1,759.00	0.0962
Total	**419,069.41**	**192.76**	**N/A**	**0.1226**

Total Grazing Land

Food type	Ecological footprint per person	Ecological Footprint for Wellington
	ha	ha
Meat and meat products	0.5125	70,870.70
Poultry	0.0805	11,126.96
Dairy products	0.1226	16,959.05
Total	**0.7155**	**98,956.71**

Total Food footprint 1956 – FAO estimated data

Food footprint	Energy	Consumed	Crop land	Grazing land	Ecological Footprint per person	Ecological Footprint for Wellington
	ha	ha	ha	ha	ha	ha
Fruit, vegetables and grains	0.0086		0.0767		0.0853	11,801.31
Animal products	0.0261			0.7155	0.7416	102,560.81
Total	**0.0347**	**0.0000**	**0.0767**	**0.7155**	**0.8269**	**114,362.12**