The Ecological Footprint of International Tourists in New Zealand

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ABSTRACT

Ecological Footprint Analysis (EFA) is a technique that was first developed by Wackernagel as a Ph.D. thesis in 1994, then further developed in combination with Rees and published (Rees & Wackernagel, 1995). EFA is employed in this study to assess the resource utilisation of international tourists visiting New Zealand. Tourism is one of the fastest growing industries in the world and the ecological sustainability of tourism is becoming more important term for managing tourism. This is becoming increasingly important with tourism identified as particularly as a significant contributor to carbon emissions.

This study uses EFA to assess whether international tourists visiting New Zealand behave in a sustainable manner. Tourists are surveyed and classed into high, mid and low budget tourist types to gain a detailed account of their behaviour with particular reference to food, accommodation, transport, services, activities attractions, goods and waste. The EFA helps to identify areas of a tourist's trip that have the greatest impact on the environment, thereby identifying ways to improve the sustainability of tourism in New Zealand. It was found that tourists generally consume more whilst on holiday than they do at home and more than New Zealand residents. The results show that international tourists' behaviour is sustainable and New Zealand has the ecological carrying capacity to allow the number of international tourists to increase without incurring any significant ecological costs to the country.

It was found that there is a positive relationship between 'high' income tourists and their ecological footprint and that independent travellers have a larger ecological footprint than the package travellers; however, package travellers have a larger food and housing ecological footprint than independent travellers. The energy footprint was the largest out of the six land types of a tourist's ecological footprint. Food is the consumption category that is the largest contributor to a tourist's ecological footprint.

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This project would not have been possible without the constant support, encouragement and willing participation of many colleagues, friends and family.

I would like to thank my two supervisors; Associate Professors John Holland and Ed Minot. Not only did John guide me through every aspect of this research, but was also very encouraging which was important and helped me to stay positive. John's flamboyant personality and his many stories about his experiences made coming into House 39 a pleasure every day. I greatly appreciate Ed Minot's supervision and for being so generous with his time. Ed's input into the analysis and the mechanics of this study was absolutely indispensable and his knowledge and understanding of statistics was so helpful. I would also like to thank Dr. Alisdair Noble for helping me with the statistical side of this study.

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-Ad Majoram Dei Gloram-

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ACRONYMS

ANOVA	Analysis of Variance
CAM	Commercial Accommodation Monitor
DTS	Domestic Tourism Study
EECA	Energy Efficiency and Conservation Authority
EF	Ecological Footprint
EFA	Ecological Footprint Analysis
EVA	Economic Value Added
FIT	Free-Independent Traveller
IVA	International Visitor Arrivals
IVS	International Visitor Survey
LSD	Least Significant Differences
MJ	Megajoules
PCA	Principal Component Analysis
RTO	Regional Tourism Organisation
SIT	Semi-Independent Traveller
TNZ	Tourism New Zealand
TSA	Tourism Satellite Account
VA	Value Added
WTO	World Tourism Organisation
WTTC	World Travel and Tourism Council
YE	Year Ended
YHA	Youth Hostel Association

CHAPTER ONE:

INTRODUCTION

Location: The Remarkables, South Island, New Zealand. M. Holden

1. Background

Tourism is one of the major industries in the world and reaches to every corner of the globe. There is a growing body of literature that highlights the tourism industry as a key contributor to carbon emissions, particularly due to air travel and associated social, economic and environmental impacts at destination areas. Visitors have particularly detrimental effects on destinations if the carrying capacity of the area has been breached.

Ecological Footprint Analysis (EFA) draws on this carrying capacity concept. The ecological footprint is a conservative estimate of the amount of biologically productive land and sea area required to regenerate the resources humans consume and assimilate their associated waste (Wackernagel & Rees, 1995). The extent of the impact of tourism on the environment is closely linked to the ecological carrying capacity of the destinations. The EFA can therefore be a useful tool to assess the ecological sustainability of tourism (Shimada, 2006). EFA is a unique indicator of sustainable tourism since it incorporates travel related impacts, carrying capacity assessment and energy accounting of a tourist's trip (Hunter & Shaw, 2007). The method applied in this research identifies the resource consumption of tourists in six categories: food, accommodation, activities/services, goods, transport and waste. Each of these groups is supported by predetermined land area (built-up land, fossil energy, forest, cropland, pasture and fisheries) required to assimilate the carbon dioxide emissions and waste produced. EFA provides a hypothetical land area in global hectares (gha) to estimate the resource demands of a tourist. If the average ecological footprint (gha) of the international tourist exceeds the biocapacity of New Zealand, it can be assumed that international tourism, at this rate, is unsustainable.

The tourism industry directly and indirectly constitutes almost 10% of New Zealand's GDP and is one of New Zealand's largest industries ($19 billion) (New Zealand Tourism Board, 2007). Internationally, New Zealand is renowned for its dramatic and stunning landscapes, unique culture, friendly and passionate people and adventurous and daring adventure activities. Traditionally, tourists are drawn to New Zealand by their perception of New Zealand as being "clean and green" a reference to the country's unpolluted air and water. Tourism marketing specifically targets a certain tourist type who would make the most of the touted "100% Pure New Zealand" experience (Tourism New Zealand, 2003). It is important that tourism's marketing scheme has credibility and substance, so there must be evidence to suggest that New

Zealand is in fact “clean and green”(Patterson & McDonald, 2004). A key attraction to New Zealand is the authenticity of its unique environments. This suggests that there is a need to monitor the authenticity of the environments to ensure that the tourism industry does not depreciate it.

1.1 Problem Statement

From the study of the literature there appears to be little data available on tourist consumption of goods and services that appears to be embedded in New Zealand’s natural resource base. Broadly speaking, tourist consumption includes food resources, transport, accommodation, shopping, activities and their itinerary.

1.2 Aim and Objectives

The aim of this study is to identify and quantify international tourists’ consumption of goods and services and evaluate the ecological sustainability of the New Zealand tourism industry using Ecological Footprint Analysis (EFA).

To achieve this aim the following objectives have been identified:

1. Develop ecological footprint model.
2. Quantify the resource use of visitors through a survey.
3. Calculate tourists’ footprint in New Zealand.
4. Analyse results and make policy recommendations regarding the sustainability of the New Zealand tourism sector.

1.3 Importance of Research

The information gathered from the survey and analysis of the EFA results will provide the New Zealand Tourism Board with an insight into tourist utilisation of resources in New Zealand. This will help to identify which aspects of tourism are unsustainable, and how to minimise tourist impact. The aims of the New Zealand Tourism 2015 strategy are to improve information to help businesses meet standards that include the environmental elements, and help tourists

make more environmentally sound choices. The strategy also aims to take a leading role in initiatives in areas such as transport, energy use, waste reduction and management and conservation. All of these areas are explored and analysed in this research.

1.4 Thesis Outline

A summary of the content of each chapter within this thesis is described in brief below:

Chapter One: States the aims, objectives and problem statement of this study.

Chapter Two: Review of literature on tourism sustainability, Ecological Footprint Analysis and the current state of tourism in New Zealand.

Chapter Three: Outlines in detail the survey methods applied in this study, how the tourist sample was identified and how the ecological footprint is calculated. Also includes limitations to the methodology and sampling.

Chapter Four: Results of the research using descriptive statistics, uni-variate and multivariate statistical analysis.

Chapter Five: Discussion of results and comparison of the findings of this study with other research.

Chapter Six: The conclusions drawn from the study and recommendations for policy and tourism management to reduce the environmental impacts of tourists in New Zealand.

CHAPTER TWO:

LITERATURE REVIEW

2. Tourism and the Environment

In the main, through researching literature on tourist impacts on the environment and ways of evaluating these impacts, it was found that the literature focused on three main concepts:

- Carrying Capacity
- Lifecycle Approach
- Sustainable Tourism

The following sections focus on explaining these concepts and their application to tourism.

2.1 Impacts of Tourism

Tourism inevitably impacts upon destinations. Concern over the ecological effects of tourism came to the fore during the 1960s and 1970s, after realising that the industry was capable of transforming destination regions in detrimental ways (Fennell, 2008). There is a growing body of literature on the environmental impacts of tourism that clearly depict the mounting concern of how tourists are impacting on environments around the globe (Becken, 2001; Buckley, 2003; Fennell, 2008; Gossling, Hansson, Horstmeier, & Saggel, 2002; Gossling, Peeters, Ceron, Dubois, Patterson, Richardson. 2005; Hunter & Shaw, 2007; Patterson & McDonald, 2004). Specific examples include the unregulated development of hotels in London that threatened the quality of life in the City (Harrington, 1971 as cited in Fennell, 2008) and the battle between conservation and preservation on the Island of Gozo off the coast of Italy (Jones, 1972 as cited in Fennell 2008). While tourism has transformed much of the world's natural beauty into commercial enterprises, the industry may have initiated a cause for its own destruction (Crittedon, 1975 as cited in Fennel, 2008).

Tourism can provide a range of positive benefits to the regional and community development (Shimada, 2006), and has long been identified as a powerful tool for development, due to its ability to deliver 'win-win' outcomes for tourists and host communities (Patterson, 2005). Essentially, tourism is seen as a way to alleviate economic, social and cultural challenges facing

indigenous people. Since tourism has the potential to offer a fair exchange of value to indigenous and non-indigenous people, an increase in economic independence will be accompanied by a higher degree of self-determination and cultural pride as tourism provides the opportunity to break the restraints imposed by poverty. When comparing tourism with other forms of economic activity such as clear cutting timber from traditional indigenous land in rain forest regions, appropriately managed tourism is seen as a sustainable activity (Butler & Hinch, 2007). Residents of destination areas often want tourists to come for a change in lifestyle because of the benefits that the industry entails such as jobs, higher incomes, and better opportunities for their children (Wall, 1997). Tourism can also provide the needed funds for conservation, and in many cases this has led to an improvement in environmental protection. Many scholars associate tourism with a unique opportunity to balance economic growth with natural and historical conservation in poor and rural areas (Patterson, 2005).

Global demand for nature and adventure tourism and recreation continues to grow. Agencies accountable for the impacts and management of parks now have to devote an increasing portion of their time and resources to visitor management, often to the detriment of environmental management (Buckley, 2003). For tourism in areas that are particularly susceptible to external threats, such as national parks and protected areas, there are many potential ecological indicators, that have not been implemented. For example, there are many systems in place where management indicators have little ecological basis or significance and many ecological studies of recreational impacts that do not provide management indicators. In tourist destinations that have high visitation rates, land managers need information on visitor characteristics, visitor impacts, and the effectiveness of visitor management tools (Buckley, 2003). While visitors are often attracted by the environmental attributes of tourist destinations, these visitors can in turn degrade the environment (Johnson & Tyrrell, 2008).

Patterson and MacDonald (2004) found that the tourism sector ranked fifth largest for the total amount of energy used and CO_2 emissions released within New Zealand, when internal energy use was considered. The total amount of land directly and indirectly occupied by the tourism sector was estimated to be 873 525 ha, ranking sixth largest out of 25 economic sectors. The implications for the Kyoto Protocol and energy policy are critical. Conventional analysis and policy responses tend to ignore the “tourism sector” as it is not considered to be a sector. For climate change policy, this is an unfortunate oversight as tourism is the second largest energy user and the largest producer of CO_2 emissions. This together with the fact that tourism is the

fastest growing sector in New Zealand's economy means that serious attention needs to be given to energy use and CO_2 emissions by the sector (Patterson & McDonald, 2004).

The use of fossil energy is one of the major environmental problems associated with tourism travel. There is a broad consensus that the tourism industry should be sustainable; however, the question of how to achieve this remains debatable. Policy changes designed to reduce emissions from the tourism industry are frequently seen as disagreeable, especially since there is a widely held belief that environmental levies could reduce tourism revenues (Gossling et al., 2005). An example of this kind of policy approach is an emissions trading tax, that was suggested by the previous New Zealand government that aimed to reduce New Zealand's total greenhouse gases to support and encourage global efforts to reduce greenhouse gases (Ministry for the Environment, 2007). Becken (2001) found that tourism contributes at least 5.6% to the New Zealand energy demand which is higher than its 4.9% contribution to GDP in 2000. The dominant energy consumer category from within the tourism sector found in this study is transport air and car travel.

Booth and Mackay (2007) synthesised the literature and published research associated with tourism and recreation in New Zealand in a report prepared for the Ministry of Tourism. They found that, in order to reduce or control visitor impacts in natural areas, managers must have some knowledge about the relationship between visitor numbers/types, impacts and management responses. There is a significant research gap addressing New Zealand's tourism impacts and developing a better understanding of off-site benefits such as the effects upon the local host communities. Researchers from a wide range of disciplines have studied environmental impacts of visitors but results from investigations of specific aspects of ecological effects are rarely integrated. This is largely due to the fact that these studies are site-specific and this makes it difficult to generalise results. Occasionally, research has combined the study of visitors (social science) with their impact (ecological science); however, very little research is done on the impacts on natural features, wildlife and environmental quality (Booth & Mackay, 2007). New Zealand's Parliamentary Commissioner for the Environment (1997) identified three principal adverse environmental effects associated with tourism:

1. Loss of quality of some relatively unspoilt parts of New Zealand's natural environment.
2. Loss of amenity values from incremental development, which can also affect communities and lifestyles, especially in places where the proportion of visitors to residents is high.
3. Pressure on infrastructure resulting in significant costs to local communities.

This report suggests that more research be undertaken, particularly on environmental indicators for tourism effects, domestic and international travel and activity patterns, and the limits of ecological systems on which tourism depends (Parliamentary Commissioner for the Environment, 1997).

2.1.1 Carrying Capacity

The ecological footprint (EF) concept is closely related to the ecological concept of carrying capacity. Ecological footprints are expressed in hectares per capita, whereas carrying capacity is generally expressed in units of individuals per hectare, making one concept the opposite of the other (Bicknell, Ball, Cullen, & Bigsby, 1998).

When discussion focuses on impacts within a tourist destination, it is usually based on some form of carrying capacity concept. The carrying capacity is frequently defined as;

> "the amount of tourism damage a site can assimilate without long-term damage which can be measured against the total number of tourists using the site to determine whether social optimum has been exceeded and the site is being over utilised" (Pg 7. Patterson, 2005).

Tourism impacts are of little concern when the impact level is low. Once undesirable impacts reach a certain level, it is likely to provoke a reaction from either the local residents or visitors or both. At this point one or more elements of capacity has been reached or exceeded. Therefore, to avoid at least some negative impacts associated with visitor numbers, it is essential that capacity limits are identified and monitored. Without the identification of the capacity limits of a destination, and the guarantee that this is not exceeded, there can be no sustainable tourism, and the long-term tourism is not certain (Butler, 1997).

Historically, carrying capacity has been studied from the point of view of a nation's ability to provide enough resources (e.g. agricultural land and water) and the basic necessities (food and water) for the population (Vali, 2002).

McDonald and Patterson (2004) argue that the carrying capacity concept is a controversial interpretation of the EF as a sustainability indicator. The idea is relatively straightforward when applied to well defined biological population such as the number of hectares required to support a herd of deer. This idea is more controversial when applied to human populations in the 'Limits to Growth' study, which projected a decline in human population as the globe breaches its carrying capacity. Some components of footprinting argue that the total embodied land area

required by a population should not 'overshoot' its biocapacity (McDonald & Patterson, 2004). The difficulty with carrying capacity indicators is the inability to link them directly to management of specific impacts, and there are no comprehensive applications of carrying capacity (Butler, 1997). Furthermore, the challenge is that tourism related studies on carrying capacity are limited to the direct impacts from tourism that can be observed, recorded and controlled, within the destination. This spatial limitation means that in staying within the local carrying capacity does not imply that tourism is sustainable on a global scale (Patterson, 2005). The carrying capacity is only obtainable for resources that are left undisturbed by human use and sustaining resources at the carrying capacity level is generally not a practical option for tourism (Johnson & Tyrrell, 2008). However, it is increasingly important for managers and practitioners to ensure that the development of tourist destinations and sound planning guarantee the safety of the resource base first, even over the needs and expectations of visitors (Fennell, 2008).

2.1.2 Lifecycle Approach

A key concept for tourism industry representatives, policymakers and researchers is the tourist destination cycle (otherwise known as the *Butler Cycle*) that was developed by Butler (1980). The destination cycle is based on the principle that increases in visitation rates to an area can be followed by a decrease in visitation as the carrying capacity of the destination is reached. Tourist destinations undergo a fairly similar transformation over time from early expansion and involvement through to consolidation and stagnation as the structure of the industry changes to accommodate higher visitation rates and competing resorts (Fennell, 2008). As the impacts from tourism development (including crowding effects from increased arrivals) become more apparent, the appeal of a destination deteriorates. It is shown in Fig. 1 how growth in arrivals flattens and ultimately reduces the benefits to the local economy and leads to a period of decline. Retrospective examination and restoration of visitor impacts and restoration of tourism impacts on host communities and ecosystems are rarely successful (Patterson, 2005).

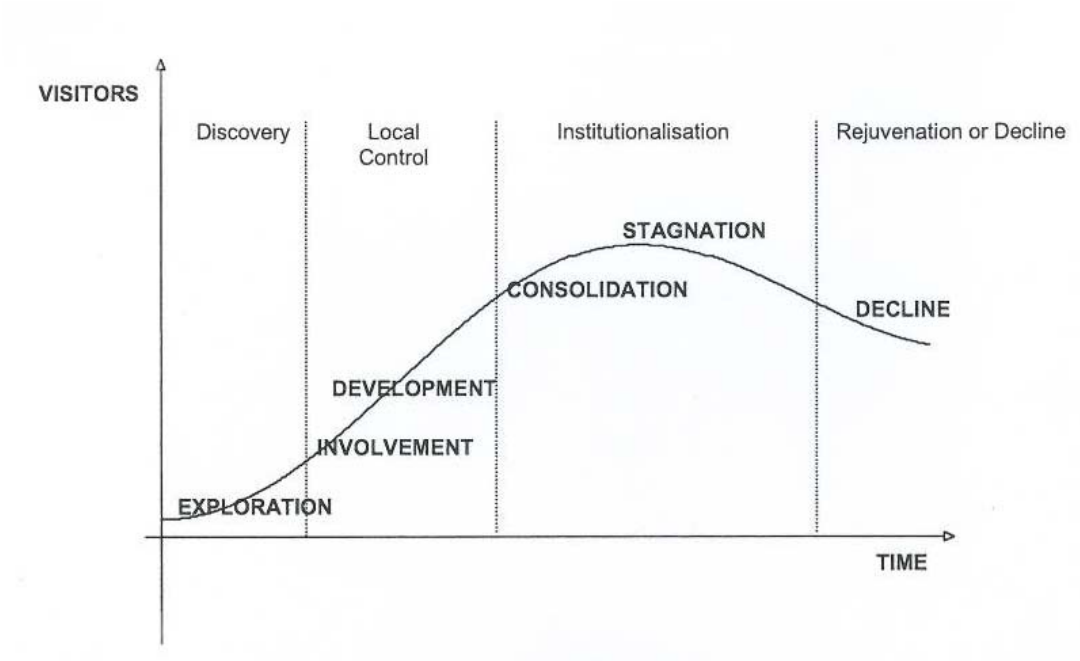


Fig. 1: Butler's destination life cycle (cited in Patterson, p. 12. 2005).

The significance of the Butler's model is that in many cases tourism properties suffer from this sequence of rapid development and later decline which is equivalent to commercial products in general (Fennell, 2008).

2.1.3 Sustainable Tourism

Environmentally sustainable tourism is thought of as a level of tourism that is based on a sustainable or steady state environment and is related to the concept of carrying capacity (Johnson & Tyrrell, 2008). An environmental sustainable optimum is the maximum level of a desired outcome (such as economic profit and quality of life), and the abililty for an environment and associated benefits to maintain a steady state over time. When applying the sustainability concept to tourism it incorporates the number of visitors, size of industry profits, quality of tourist experience, number of jobs, quality of life for residents, the health of the environment, or some combination of these. It is unlikely that all may be sustained simultaneously (Johnson & Tyrell, 2008).

In this study, Ecological Footprint Analysis (EFA) focuses on ecological sustainability of tourism, therefore primary emphasis is placed upon maintaining a certain level of environmental quality. Secondary emphasis is on the economic viability of the tourism industry. The number of tourists to an area can complicate the economic benefits. Often the environmental quality attracting tourists can degrade through high visitation rates by breaching the carrying capacity of the destination area. A third element to sustainable tourism is considering the social well-

being of local residents, who can either be positive towards or in conflict to the industry goals (Johnson & Tyrrell, 2008). Sustainable tourism is about the pursuit of goals and measuring progress towards them and no longer just about the economic benefits. So for sustainable tourism to be successful, planners must consider how tourists value and use natural environments.

2.2 Ecological Footprint Analysis

This thesis sets out to explore the ecological sustainability of tourism in New Zealand using ecological footprint analysis. This term is often used to refer to the impact on an environment by those who enter it.

Ecological Footprint Analysis (EFA) draws from the carrying capacities of a defined population within an area, in this case, international tourists in New Zealand. New Zealand is internationally renowned for its nature based activites and visiting sites. EFA can be used to define the ecological carrying capacity of these tourist destinations within New Zealand. This study will compare the ecological footprint of tourists from different origins and different tourist types (based on the tourist's income and travelling style).

For the purpose of this report, ecological footprints are defined as the impression a tourist makes on the environment in which they are travelling, in terms of how they get around the country, where they stay, what they do and buy and what they eat. Ecological footprints also encompass the effect this has on the wider community, specifically New Zealand.

2.2.1 Concept of EFA

Protection and conservation of natural capital and it's ability to renew or regenerate itself is the fundamental meaning of ecological sustainability. Therefore it is important to obtain reliable measures of the supply and demands of humans on natural capital and to track progress, set targets and drive policies towards ecological sustainability (Wackernagel et al., 2005).

Indicators to assess measurements of this natural capital are necessary since monetary values alone to value ecosystem services (refer to Glossary, Page 113) have limitations and uncertainties (Wackernagel et al., 2005). Humans may be able to increase the population size beyond the carrying capacity by removing other species, importing other resources from other places or through improvements in technology. Analysts are changing their interpretation of

natural resources from being “free goods of nature” to being forms of “natural capital” and the flows as types of essential “natural income”. These include species, ecosystems and other biophysical entities that are produced and required for resource flow (Rees & Wackernagel, 1995).

Unsustainable is the point at which natural capital is degraded rather than protected, so humans are living on nature’s interest rather than living off nature’s capital. EFA provides a means to measure how nature’s resources are utilised and compare this consumption with the carrying capacity of the earth (Chambers, Simmons, & Wackernagel, 2002). An ecological footprint is commonly used as an indicator of sustainability. It measures the ecological cost (in land area) of supplying all the goods and services to a human population. In doing so, it accounts for direct land requirements such as agricultural production, roads and buildings, and also such indirect requirements as the goods and services that people consume (McDonald & Patterson, 2004).

Effective sustainable management of resources requires a transition of mindsets to measuring what we value (Chambers et al., 2002). Indicators are designed to package data to simplify complex and detailed information. This can be achieved in a variety of ways, by choosing key topics, by eliminating issues which are regarded as irrelevant or by aggregating weightings or conversion factors. The quality of life and the health of the environment are two important indicators (Chambers et al., 2002).

There are currently two methods employed to calculate the EF of individuals, cities and nations, namely the Wackernagel and Rees approach and the input-output approach. The following sections explore each of these.

2.2.1.1 Wackernagel and Rees Approach

The EF reflects the demands of a population on natural resources, also described as natural capital in a land-based measure. The basic idea is that EFA is based on the fact that every individual, process or activity uses ecosystem services provided by nature and consumes resources that nature generates. The EFA translates all these impacts into biologically productive land. The ecological footprint calculator estimates the size of productive land required to produce these resources (e.g. food, goods, services and energy) and land occupied by infrastructures (e.g. roads and buildings) as well as the land to assimilate waste and greenhouse gases (CO_2) emissions produced by activities including the processing/transporting products. The ecological footprint estimates the area of productive land required for the activity

and resource in different productive land types. Different activities, food types and resources consumed require different types of land that have different qualities and productivities (Shimada, 2006).

The resulting EF is expressed in global hectares, which is a measurement used to quantify biological productivity on a global scale. The measurement is on a global scale because trade is global. This unit is used primarily to report the biocapacity of the earth and to make conclusions about local biological demands that are independent of local biological productivity factors. It is the area-weighted (specified to the productivity of the specified region's productive land and water) average productivity of biologically productive land and water in a given year (Global Footprint Network, 2009). A 'global hectare' is a hypothetical measure of land area, used as an estimate only of the ecological impacts.

Equivalence and yield factors are applied to both footprint and biocapacity calculations. The equivalence factor translates a specific land type (e.g. cropland, pasture or forest) into a universal unit of biologically productive area, a global hectare. These are calculated on a yearly basis, for example cropland had an equivalence factor of 2.21 in 2003, which is twice as productive as a hectare of land with world average productivity. Yield factors account for the difference in production of a given land type across different nations. For example New Zealand produces more meat on average than a hectare of pasture in Jordan. These differences could be due to natural factors such as precipitation, soil quality or management practices (Kitzes, Peller, Goldfinger, & Wackernagel, 2007). Moreover, different land types have different productivity, for example a hectare of cropland, is more productive than a hectare of much less biologically productive pasture land. Thus, more than one hectare of pasture would be required to provide the same biocapacity as one hectare of cropland. Hence, when converted to "global hectares", a global hectare of cropland would occupy a smaller area than a global hectare of pasture land. Since world bioproductivity varies slightly from year to year, the value of the global hectares may change slightly from year to year (Global Footprint Network, 2009). The EF methodology is not a comprehensive indicator of environmental impacts, but has value for comparing emissions, waste production and resource consumption elements (Peeters & Schouten, 2006).

2.2.1.2 Limitations of Wackernagel & Rees Approach

Wackernagel and Rees EF calculations and their interpretation of sustainability have their drawbacks since it is based on broad assumptions(Patterson, Niccolucci, & Marchettini, 2008).Therefore this method is not intended to encompass all aspects of sustainability. They acknowledge that, despite great improvements in accuracy and resolution over the past decade of methodological development, there are still short-comings that include a lack of data availability for some ecological demands that underestimate society's full demand on nature (Gossling et al., 2002; Wackernagel et al., 2005).

The weightings with equivalence factors are based upon a subjective assessment and do not take into account social impacts, aspects of scarcity or economical dynamism (Peeters & Schouten, 2006). Some categories receive identical weight even if the environmental impacts differ, which can oversimplify the impacts. For example, land use by infrastructure has the same weight as land use by agriculture, irrespective of the fact that designating land for roads is clearly more environmentally destructive than designating it for pasture (van den Bergh & Verbruggen, 1999).

Problems such as nuisance (noise, vibration, and safety issues) and direct effects of chemicals on health are not taken into account (Peeters & Schouten, 2006). Also the EF is essentially static in nature and cannot reflect the nature of ecological or social change, so should be including discounting to be of any use to sustainability issues (T. Patterson, 2005; Peeters & Schouten, 2006). Another limitation is that the components of the EFA equations lack transparency to general audiences (Patterson, 2005). The hypothetical land area generated as an indicator of environmental impact has the risk of being interpreted as actual or real not only by the general audiences but also by politicians, environmentalists and academic researchers (van den Bergh & Verbruggen, 1999).

The Wackernagel approach looks only at the direct inputs that go into producing and consuming products. This approach only covers first and second order indirect land requirements and is, therefore, not a full reflection of environmental impacts (Patterson, M. personal communication, 8th May 2008).

2.2.1.3 Input-Output Approach

Input-output analysis was developed in the 1930s and 1940s by Wassily Leontief and has been modified and improved considerably since that time (Bicknell et al., 1998). The input-output analysis is an economic tool that can be used to study how various sectors of a regional or national economy are related (Bicknell et al., 1998). This type of analysis is now being promoted as a systematic and standardised method for the calculation of EF and was first developed by Bicknell *et al.* (1998). The EF input-output analysis method draws upon many of the ideas and principles of the Wackernagel and Rees method to track the flow of useful land. It attempts to situate the analysis in a rigorous mathematical framework (McDonald & Patterson, 2003, 2004).

The method consists of two main components: products are purchased and consumed; the first step of the model is to calculate the land required to produce them. Land is required in the process of making products such as plastics and paper packaging of biscuits. Manufacturing also produces carbon dioxide, a major air pollutant, and this is factored into the EF. This method looks at the entire production chain of each product to estimate the carbon dioxide produced. The next step is to calculate out how much land is required to be planted in trees to remove this carbon dioxide from the atmosphere. The final step in the calculation of the footprint is to add these two components together to determine a total personal footprint. The footprint is calculated on the basis of the amount and types of products consumed. Production data of typical inputs into these products are obtained from Statistics New Zealand's input-output tables (McDonald & Patterson, 2003). This ecological footprint method can be used to make visible the hidden ecological cost of an activity or population.

The primary advantage of the input-output approach is that it provides a standard method of analysis that can be updated or applied to alternative populations in a uniform manner. Another advantage of this method is that it allows a detailed examination of a country's ecological balance of trade and provides an indication of how reliant a particular population may be on imports to sustain consumption (Bicknell et al., 1998). This method has been employed by the Ministry for the Environment to calculate the Ecological Footprint of New Zealand. To achieve this objective, a modified form of input-output analysis was developed using data collected by statistics New Zealand. This approach provides a detailed breakdown of the agricultural, forest

and degraded land embodied in the goods and services consumed in any country (Bicknell et al., 1998) so the ecological consequences of human activity are easily determined.

This input-output study is the first comprehensive assessment of the environmental impacts of the tourism sector in New Zealand and was conducted by Patterson and MacDonald (2004). The aim of this study was to assess the indirect and future environmental effects, as well as the previously researched direct impacts of tourism. Economic-environment input-output accounts of the tourism sector were constructed and divided into eight indicator variables: energy use, water use, land use, water discharges, nitrate discharges, phosphorous discharges, Biochemical Oxygen Demands (BOD) discharges and CO_2 emissions. These projections were divided according to direct, indirect and total impacts, as well as across the domestic and international visitor markets (Patterson & McDonald, 2004). A breakdown of the CO_2 demands from the tourism sector in New Zealand showing a snap shot into the complexity and extensive detail of the input-output methods can be seen in Fig. 2.

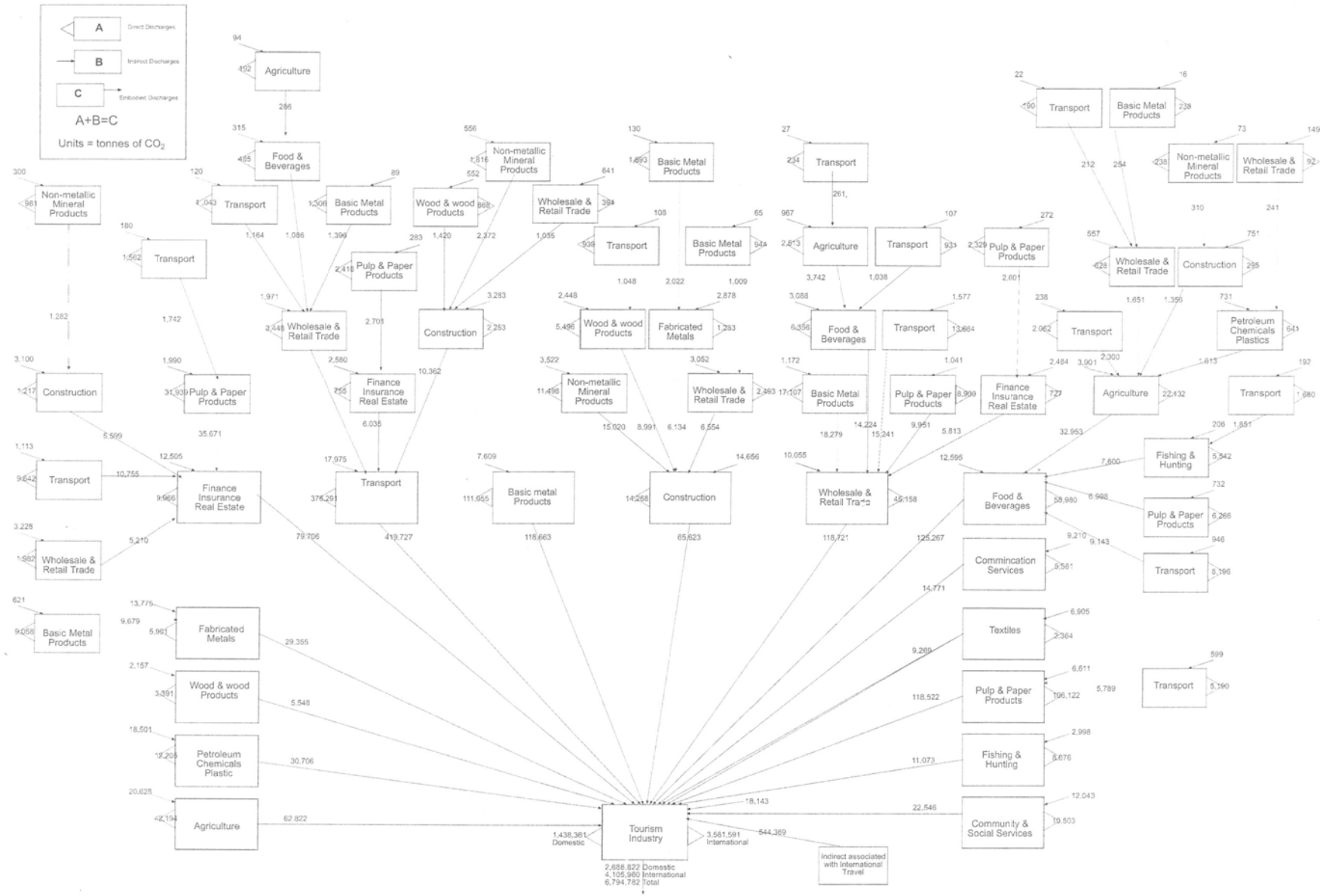


Fig 2: Input-output diagram showing the direct and indirect CO_2 outputs from the tourism sector in New Zealand. Source: (Patterson & McDonald, 2004).

2.2.1.4 Limitations of Input-Output Approach

There are several limitations and assumptions associated with this method of calculating the ecological footprint. An assumption made is that each industry produces a single product and all outputs uses the same processes and technology. This can create a problem for an individual wanting to apply this ecological footprint analysis to a particular product or service. This technique also has fixed proportions and weightings like the Wackernagel and Rees method, and therefore does not reflect fluctuations in economic activities. Other limitations of this method include technicalities such as not being able to include imports into the calculation, excluding unpaid work from the method and using monetary values for flows of goods and services. These can result infalse conclusions about the impact of different industries and distort actual physical linkages between industries (Bicknell et al., 1998).

This method requires input-output matrices to be constructed and therefore requires specific data such as the amount of land that goes into each sector. Furthermore, this method requires rigorous algebraic calculations as well as previous knowledge and experience with input-output analysis (Patterson, M. personal communication, 8th May 2008). Due to limited time and lack of resources, which goes beyond the requirements of this research, this method will not be used in this study.

2.2.2 Global Ecological Footprints

Global ecological footprints vary between countries and are quantified nation by nation. The differences between nations account for the differences in biologically productive and mutually exclusive areas required to provide for the nation's resource supplies and the ability to absorb wastes using existing technology. The area of the footprint depends on the population size, material living standards, technology used and ecological productivity (Wackernagel et al., 1999)

The WWF Living Planet Report (2008) has recognised New Zealand as having the sixth highest ecological footprint per capita in the world (Fig. 3). New Zealand increased their average ecological footprint from 5.9 gha/per person in 2006 to 7.7 gha/per person in 2008. However, New Zealand's biocapacity is 50-100% greater than its ecological footprint, so New Zealand is still living within its carrying capacity and has an ecological reserve of 6.4 gha/per person. A country is in ecological debt if it is consuming resources faster than the replacement rate, or in other words has an ecological footprint that is higher than its biological capacity (World Wildlife Fund, 2008).

Biocapacity is the area available to produce resources and assimilate emissions. Biocapacities are not evenly distributed around the world. The countries with the most biocapacities are United States of America, Brazil, Russia, China, Canada, India, Argentina and Australia which collectively contain 50% of the total world biocapacity. Three of the eight countries with the largest biocapacity, United States, China and India are ecological debtors, with their national footprints exceeding their own biocapacity. The ecological footprints of high, medium and low-income countries were assessed and the average ecological footprint of a high-income country (6.4 gha/per person, population of 972 million) is significantly higher than medium (2.2 gha/per person, population of 3,098 million) and low-income countries (1.0 gha/per person, population of 2,371 million).

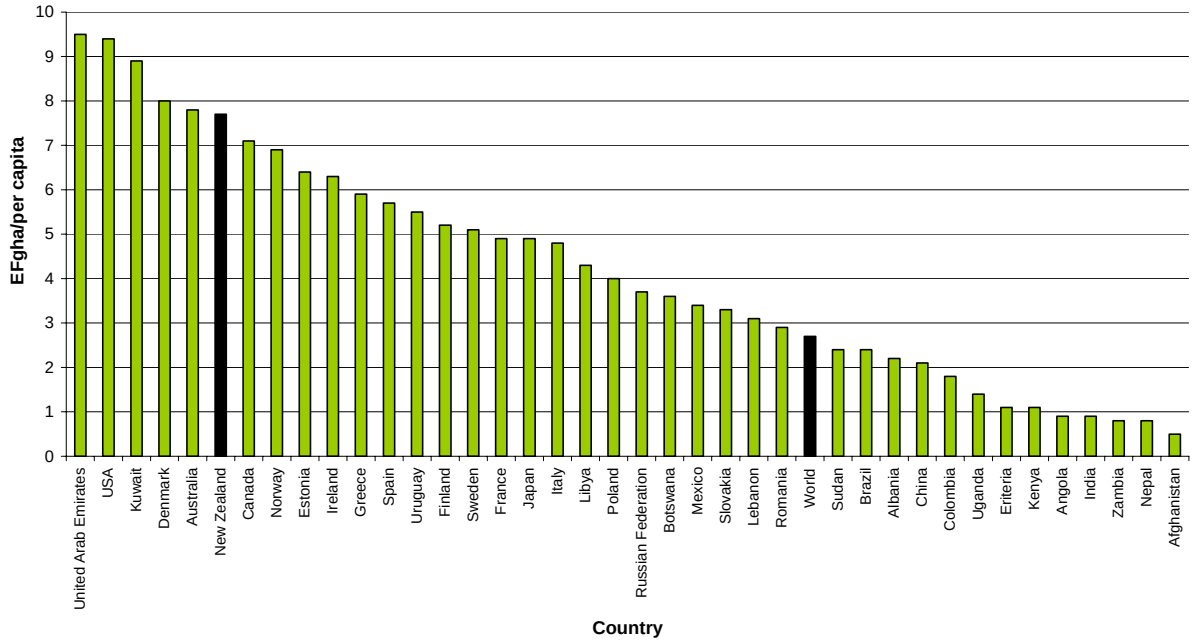


Fig. 3: Ecological footprints of individuals in 39 nations compared with the global average footprint using the 2005 ecological footprint data (World Wildlife Fund, 2008).

From Table 1 it can be seen that energy land (carbon emissions and land to assimilate emissions) was the highest contributor to the ecological footprint of the high-income countries, such as Europe, North America, some countries in Asia-Pacific, Middle East and Central Asia. The WWF report claims the largest human induced pressure on the planet continues to be carbon emissions from fossil fuel use. Here in New Zealand, according to the Ministry of the Environment, the principle growth in carbon emissions since 1990 has come from increased

carbon dioxide from the energy sector, mainly transport and electricity generation (World Wildlife Fund, 2008). It can be seen from Fig 3 that New Zealand sits just behind USA, United Arab Emirates, Kuwait, Denmark and Australia due to its demand on the resources and ecological services provided by its environment both locally and globally.

Table 1: The 2005 ecological footprints of main visitor countries to New Zealand (World Wildlife Fund, 2008).

Country	Total EF (gha/per capita)	Carbon	Cropland	Pasture	Forest	Fishing Ground	Built up land
Australia	7.8	1.98	1.93	2.82	0.94	0.08	0.06
United Kingdom	5.3	3.51	0.87	0.21	0.46	0.08	0.2
USA	9.4	6.51	1.38	0.3	1.02	0.1	0.1
Japan	4.9	3.68	0.58	0.04	0.24	0.28	0.08
Korea	3.7	2.47	0.66	0.04	0.19	0.31	0.06
Germany	4.2	2.31	1.21	0.09	0.36	0.04	0.21
New Zealand	7.7	2.22	0.73	1.9	0.99	1.7	0.05

2.2.3 Ecological Footprinting of Tourism

It has been suggested that ecological footprint provides a unique, global perspective on sustainability that is absent with the use of locally derived sustainable tourism indicators (Gossling et al., 2002; Hunter & Shaw, 2007). Currently, sustainable tourism is a concept that is still in the early stages of development. Ecological footprinting provides an estimate of the demands upon the biophysical productivity and waste assimilation capacity of nature imposed by foreign visitors exploring countries. Typically, the interpretation of sustainable tourism adopts a narrow perspective on tourism-related demands on the environment. The interpretation is limited to the quality of the local environments in the short term. In contrast the ecological footprinting analysis technique adopts an outward looking perspective. It considers a wider range of potential or actual environmental impacts beyond the immediate geographical area when designing studies of tourism's demands on natural resources. Subsequently this way of interpreting sustainable tourism could provide better guidance to policy makers and tour-operators by identifing the most appropriate form of tourism for a particular area (Hunter, 2002). Ecological footprints can provide for travel-related impact components, carrying capacity assessment, energy accounting and life cycle analysis. Considering travel is an important part of the tourism industry, the environmental impacts of tourist travel in sustainable tourism have been relatively unexplored (Hunter & Shaw, 2007).

It has been pointed out in a number of publications that transport (particularly air travel) is responsible for the majority of the environmental impacts associated with long-distance tourism, for example 90% of a typical journey's contributions to climate change (Becken, 2002; Gossling et al., 2002). There have been several studies focussing on the effectiveness of using EFs as a sustainable tourism indicator (Gossling et al., 2002; Patterson, 2005; Patterson et al., 2008; Shimada, 2006; Johnson, 2003; Hunter & Shaw, 2007; Peeters & Schouten, 2006).

The tropical Seychelles islands were chosen as a study site to assess ecological footprint analysis on tourism (Gossling, Hansson, Horstmeier, Saggel., 2002). It was found that if this study on the Seychelles Islands had used other sustainable tourism approaches, the outcome may have been a positive one. This is through encouraging and financing large land areas which are conserved in protected areas so that the environmental impacts can be monitored. However the global impacts are a more pressing issue for the Seychelle Islands. The environmental impacts of long-distance travel will have detrimental consequences for ecosystems, contributing to global warming and the energy component of the EFA is significantly large. The large ecological footprint indicates that the Seychelles are dependent on large ecological hinterland to maintain their tourism industry. The results of this study suggest that air travel, from an ecological perspective, should be actively discouraged to minimise the size of the ecological footprint (Gossling et al., 2002).

Patterson *et al.* (2008) has used the ecological footprint analysis to compare ecological footprints of residents and tourists in the Province of Siena, Italy. In this study Patterson *et al.* (2008) describe the ecological footprint of tourists, residents and biocapacity over time as a dynamic feedback mechanism, which informs environmental managers the status of the broader biophysical context of Siena's tourism carrying capacity. Furthermore, ecological footprints are used to identify the importance of addressing 'overshoot' (extending past the area's carrying capacity) before it occurs. It was found that excluding arrival transport, the EF of a tourist equivalent resident (5.36 gha/person) is only slightly higher than that of local residents (5.47 gha/person). The most significant difference between tourists and local residents is due to local transport (Patterson, 2005; Patterson et al., 2008).

Shimada (2006) studied the ecological footprint of Japanese tourists visiting New Zealand. The results from this study indicate that transport is the largest component of the ecological footprints, contributing to 30.5% of the total EF. It was concluded that the ecological footprint of Japanese tourists in New Zealand is ecologically unsustainable, resulting in an ecological

deficit of 0.011gha/traveller/day. The energy footprint of Japanese tourists is the largest of all the six land types (the six land types are; Forest land, Cropland, Energy land, Pasture Land, Built-up land and Fisheries land), and was much larger than that of New Zealand residents. Shimada (2006) also found that each type of traveller (e.g holiday travellers, business travellers, or visiting friends or relatives) and each travel style (e.g. package travellers, free-independent travellers) influenced tourist's impact on New Zealand's environment. For example all package travellers stayed in hotels and as a result had a larger housing footprint than other travelling styles. The age of travellers had an effect on EF size, where younger travellers tended to have a smaller EF than elderly travellers. Japanese travellers were found to have a larger EF than other international travellers in New Zealand with accommodation, goods and activities (Shimada, 2006).

Johnson (2003) researched the ecological footprint of tourism in Ontario, Canada. This research focussed on categorising tourists by their accommodation choices (tourist type) and this was used as a key comparison for tourists EFs. The findings of this study are that the largest ecological impacts were from transportation, specifically by air travel. It was suggested that the ecological costs of transportation are an important part of the measurement of tourism sustainability. The amount of space provided per guest in different accommodation types was also a significant influence on the size of the tourists' EF. Physically large accommodation types such as a hotel had small amounts of space per person, per day. This allowed these types of facilities to perform better in the accommodation EF analysis than the smaller facilities such as Bed and Breakfast. The application of EF as a sustainable tourism indicator in this research proved to be effective due to the analysis of the impacts of the entire trip by including as many key areas of ecological impacts as possible (Johnson, 2003).

Hunter and Shaw (2007) conducted a general EF calculation to assess the EF of international tourists in New Zealand. This calculation excludes all components of the 'tourist product' thereby excluding information about accommodation, activities, waste, food consumption, and transport. The EF was used as an indicator for sustainable tourism in New Zealand using data from Becken (2002) and the World Wildlife Fund average per capita EF for New Zealand for 1999 (8.68 gha). This study explores a detailed examination of the energy use and carbon dioxide emissions associated with air travel to New Zealand in 1999. Becken's data was used to estimate in gross EF terms the impacts of New Zealand's international tourism trade. It was estimated that the total EF per international tourist to New Zealand was 2.19 gha as shown in Table 2.

Table 2: Average EF per international tourist per year to New Zealand in 1999 (length of stay 18 nights) (Hunter & Shaw, 2007).

Step		
Transit Zone		
2	Energy Use per tourist (55.6PJ/1,591,650 visitors)	34.9GJ
3	Required Forest Land	0.48 ha
4	Air Transport EF on forest land	1.30 ha
5	Air Transport EF in world average space	1.76 gha
Destination Area		
6	Host Country per capita EF for average length of stay (18 nights)	0.43 gha
Gross EF		
	Sum of (5) and (6) above	2.19 gha

Sources: Becken (2002), World Wildlife Fund (2000) as cited in (Hunter & Shaw, 2007)

Hunter and Shaw (2007) were able to be extend the analysis to individual source countries such as the average net EF per UK tourist (length of stay 28 nights obtained from the Tourism Research Council New Zealand, 2004) in1999 which came to 4.15 gha, and 84% of this EF is accounted for by the transit component.

In the case of New Zealand, international tourism generally involves long flights and it is also a country with a high per capita national footprint, resulting in large net and gross tourism EFs. It was concluded that ecological footprint analysis provides an indication of the overall ecological impact of tourism products on global biological resources. It was suggested that perhaps it is more important to collect 'real world' data for resources consumed by tourists, including low-impact eco-tourism holidays of various kinds and the luxury hotel-type holiday resorts (Hunter & Shaw, 2007).

Peeters & Schouten, (2006) break up the tourism industry into three main elements: leisure activity, accommodation and transport. All of these elements have impacts on the environment due to energy use, discharge of waste, and the use of finite resources and space. The ecological footprint is a useful indicator of environmental impacts; it can provide insight into the most important causes of these impacts as well as the best ways to address them. The benefit of using this indicator is its ability to integrate a multitude of very different environmental impacts into one parameter. Therefore it makes it possible to measure the impacts from the main elements of tourism, transport, accommodation and activities, with one indicator (Peeters & Schouten, 2006).

2.3 Tourism

If we don't offer ourselves to the unknown our senses dull.
Our world becomes small and we lose our sense of wonder.
Our eyes don't lift to the horizon;
Our ears don't hear the sounds around us.
The edge is off our experience,
and we pass our days in a routine that is both comforting and limiting.
We wake up one day and find that we have lost our dreams in order to protect our day.
-Letters to my son-
Kent Nertum

In 1991 the World Tourism Organisation defines a tourist as;

> "a visitor who travels to and stay in places outside their usual environment for at least one night but not more that one consecutive year and whose purpose of visit is other than the exercise of an activity remunerated from within the country or region visited" (Becken, 2001; Collier & Harraway, 2001; Patterson & McDonald, 2004).

Every person is a visitor once they venture beyond their own horizons. For travellers there may be goals: to know and appreciate more about the world, other cultures, languages and species. Also travellers are often intent on improving their own lives and sometimes the lives of others (Patterson, 2005). The tourism product is complex in nature and includes everything the tourist purchases, sees, experiences and feels from the time he/she leaves home until the time he/she returns. It includes the journey to and from the destination, accommodation and travel while at the destination, and everything they have purchased such as food, beverages, souvenirs and entertainment (Collier & Harraway, 2001). Tourism is divided into a range of sub-markets which must be identifiable and measurable so that trends may be monitored. The most common method of segmenting tourism statistics is by the purpose of the travel, as follows:

- Holiday
- Business
- Visiting Friends and Relatives
- Other, e.g. study, sport events, medical (Wanhill, 1997).

Each grouping constitutes different demands. For example; holiday tourism is paid for with discretionary income and is therefore sensitive to aggressive pricing policies. It is commonly resort based, seasonal and receptive to promotional campaigns. Business tourism however, is much less price-sensitive and city-oriented. They are short stay travellers and not susceptible to marketing unless for trade fairs, exhibitions and conferences. Around 70% of international arrivals around the world are for holiday purposes, 14% for business and the remaining 16% are for visiting friends and family and other purposes (Wanhill, 1997).

Collier and Harraway (2001) explain that there are different tourism types: experiential tourism, adventure tourism, nature or eco-tourism, cultural tourism, heritage tourism, event tourism and conference and convention tourism. Experiential tourism is an umbrella term for tourism products which range from visitor experiences to natural, ecological, adventure or cultural pursuits. This term is primarily for individuals who seek to find meaning in life or other cultures. Adventure tourism involves participating in adrenalin-pumping activities such as bungy jumping or jet boating. Eco-tourism and nature tourism are effectively different.An eco-tourism based holiday is typically nature-oriented, active, educational and hidden away in the countryside, and it emphasises environmental education and protection. In comparison, nature tourists are either a 'specialist' committed to the quality and intensity of the nature-based experience or 'generalists' who engage in a nature-based activity as part of their holiday. Cultural tourism generally involves a group of people discovering another culture on study tours, and may incorporate performing arts, festivals and other cultural events. Heritage tourism involves people who seek to learn more about their past or family history. Event tourism is where people travel to a destination because of what is happening at that destination rather than what is there. Conference and convention tourism is generally a group of people meeting at a set place at a set time to discuss a topic that is of common interest to all involved (Collier & Harraway, 2001).

Tourism is an important industry in almost every region of the planet, touching the lives of most of the world's population. As the world's single largest industry (Patterson, 2005) the travel and tourism economy contributed US$3.5 trillion in 2000, which is over 11% of the global GDP, and 9% of all capital investment. The industry is predicted to create 5.5 million new jobs worldwide by 2010 (WTTC, 2003).

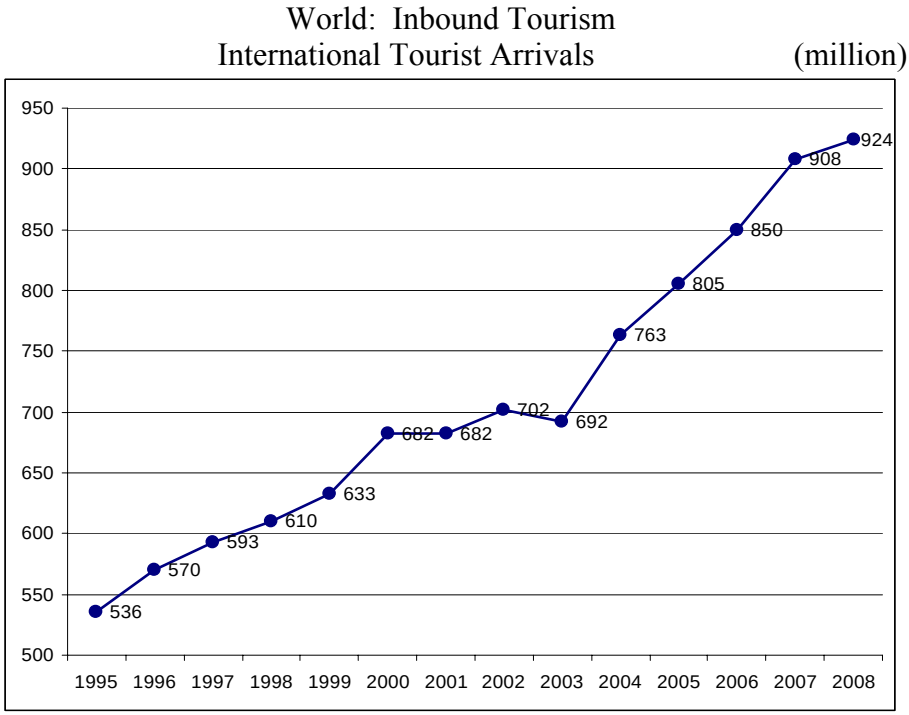
2.3.1 International Tourism

The World Tourism Organisation has defined an international tourist as;

> "a visitor who travels to a country which is different from their usual residence for at least one night but not more than a year." (Collier & Harraway, 2001).

In 2008, international tourist arrivals worldwide reached 924 million, which was up 16 million (+2%) from 2007 as shown in Fig. 4. However due to the recent financial crisis in the world economy, and oil price fluctuations, the tourism demand slowed down significantly. So much so that growth was negative in the last six months of 2008 in Europe and Asia. Germany is ranked as the worlds leading spender on international tourism, spending a total of $US83.1 billion

(World Tourism Organisation, 2009). Tourism growth in New Zealand and the resulting economic benefit depend highly on external events such as the recent global economic recession, and the terrorist attacks on the United States in September 2001. Both of these events affected and will affect visitor arrivals in New Zealand considerably, at least in the short term. Forecasts for the year of 2009 are showing that the growth in international tourist arrivals has slowed drastically worldwide (World Tourism Organisation, 2009).



Source: World Tourism Organisation (UNWTO)

Fig. 4: International tourist arrivals worldwide for the years 1995-2008.

International tourism is one of New Zealand's largest export earners. In the year ending March 2007 international visitors contributed 8.8 billion dollars in expenditure contributing 18.3% of total export earnings. Every one in ten people in New Zealand are employed in tourism related roles (New Zealand Tourism Board, 2009).

The International Visitor Survey, conducted by the Ministry of Tourism collects data on key tourist behaviour and information on all international tourists that come into New Zealand. From this International Visitors Survey, information on country of origin, expenditure, length of stay, demographic information and reason for visiting are collated and analysed by the Ministry of Tourism. From this data New Zealand's top 10 international tourist markets are able to be identified as shown in Table 3. It can be seen in Fig. 5 that Australia is by far the largest

international tourist market for New Zealand and contributes up to one-third of the total expenditure by all international tourists (International Visitors Survey, 2009).

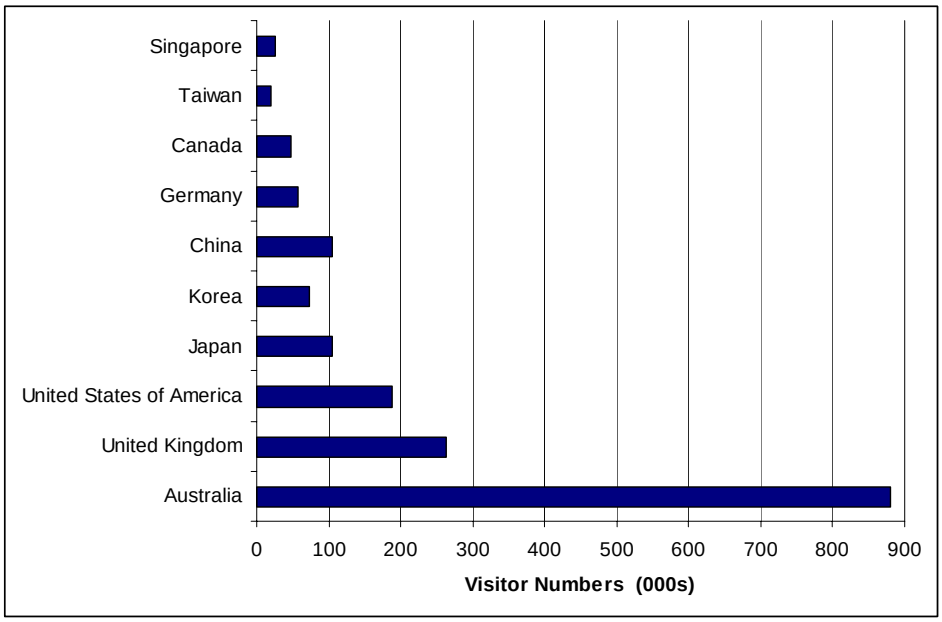


Fig. 5: Year ending Sept 08 of the top 10 markets of international tourists who visit New Zealand from the International Visitors Survey (2009).

In New Zealand the demand by international travellers for accommodation is very seasonal where over two-thirds of all visitors arrive between October and March. The most common type of accommodation by all international visitors in New Zealand is Hotels which accounts for 45% of all accommodation choices. The next most common accommodation type is private homes which accounts for 42%, followed by Motels (27%) (Collier & Harraway, 2001). International travellers are not just attracted to New Zealand for its natural beauty and diverse landscapes which provide sightseeing opportunities. New Zealand also provides the opportunity to engage in many recreational activities associated with the landscapes such as bungy jumping, ski and snowboarding, scenic flights, sky diving, boat cruises, kayaking and diving (Collier & Harraway, 2001). The variety of activities in New Zealand are shown in Fig. 6 and are associated with the international tourist product in New Zealand, emphasising the ability to 'do' as well as 'see' in New Zealand. While New Zealand capitalises on its natural beauty, there is also regional diversity that offers the opportunity to develop regional marketing 'themes'. This has proven to be attractive for tourists who are tempted by New Zealand's variety and seek to experience as many themes as possible, despite the relatively small country (Becken, 2001).

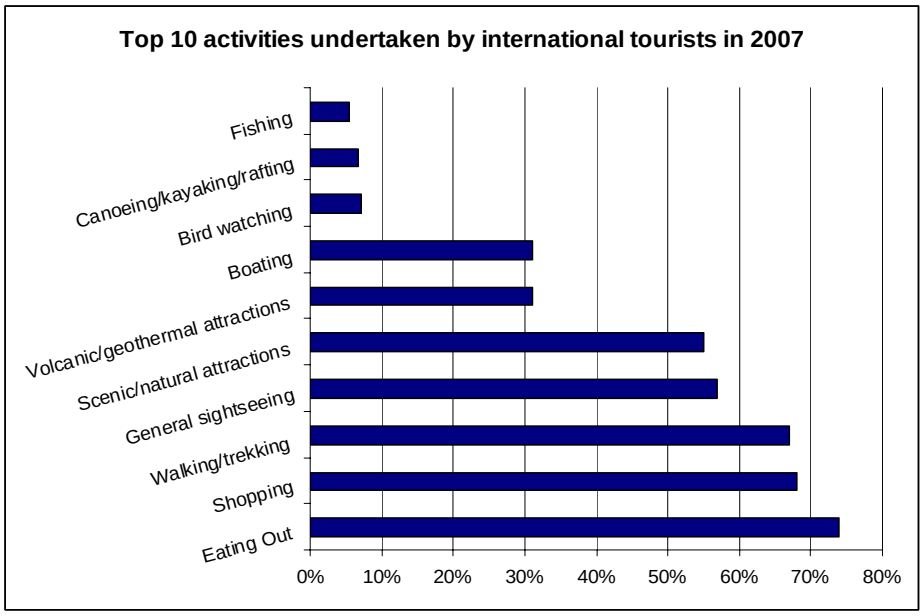


Fig. 6: Top 10 tourist activities undertaken by international tourists while in New Zealand.

2.3.2 Tourist Activities

Travel has a way of stretching the mind.
The stretch comes not from the travel's immediate rewards,
The inevitable myriad new sights, smells and sounds,
But with experiencing firsthand
how others do differently what we believed to be the right way.
Ralph Crawshaw

A tourist's holiday is composed of a broad selection of travel choices and the associated energy use, resource demand and environmental impact (Becken & Simmons, 2002; Statistics New Zealand, 2001). Tourists rarely travel to a destination for the sake of it, they will travel for what they can see, do and experience. What draws people to a place is an attraction which can either be natural or man made. It has been found that today's tourists are more interested in doing things rather than seeing, so there are often activities associated with attractions (Collier & Harraway, 2001). Adventure tourism is a rapidly expanding sector of the tourism industry internationally. New Zealand is internationally recognised as a country where adventure tourism and sports are undertaken by a large proportion of the resident and visitor population (Bentley, Page, & Macky, 2007).

Tourist attractions are composed of diverse products and services; therefore, there is no clear cut definition of what constitutes a tourist attraction. Becken (2001) categorised tourist destinations when visiting New Zealand into attractions, activity and entertainment. Tourist activities are generally more energy intensive than attractions in terms of energy use per tourist. The marketing of tourism in New Zealand focuses increasingly on the activity part of the tourist

experience. The main draw card of New Zealand as tourist destination is activities that take place in the natural settings. Many of these activities are undertaken with a tour operator and require a considerable amount of energy. Entertainment establishments are the largest energy consumers on an annual basis (Becken, 2001).

2.3.3 Tourist Types

Becken and Simmons (2008) categorised tourists into five different tourist types: coach tourists, free independent travellers (FIT), backpackers, camping tourists and home visitors. The tourist types were able to be defined using transport and accommodation data provided by the International Visitor Survey (IVS). This research assesses the sustainability of the tourist types using the concept of yield. These tourist types made it possible to assess information on financial yield measurements using Value Added (VA) and Economic Value Added (EVA) sustainable yield, using CO_2 emissions particularly from transport within New Zealand and the public sector. Value added is a common concept in Tourism Satellite Accounts where total income (which is equivalent to tourist expenditure) is broken down into intermediate input from other industries and value added input by the tourism industry. The economic value added concept is the measurement of cash flow from tourists.

- *Value added (VA) = Income – Expenses on intermediate inputs*
- *Economic Value Added (EVA) = (Income – Total expenses – Tax + Interest) – (WACC * Total Capital)*

Tourists were interviewed about their activities and expenditure over the preceding 24 hours; from this information each respondent was then allocated to a type. Becken and Simmons (2008) categorised tourists into 'tourist types' based on expenditure and general tourist behaviour. From the IVS, general observations of data on tourists allowed 'tourist types' to be identified. A total of 74% of coach tourists are from Asian countries whereas Free Independent Travellers (FIT) are mostly likely to come from Australia, USA and England. Camping tourists typically come from England, Australia, USA and Germany. Finally, home visitors are most often from Australia and England.

Other research has revealed that the nationality of tourists is not an adequate way to identify tourist types since it does not determine travel behaviour, and therefore energy consumption. However, it is plausible by general observations of tourists that the culture of the visitor has at least some influence on their choice of travelling style. This is the case for Asian tourists who are more likely to go on coach tours than other nationalities (Becken, 2001).

2.3.3.1 Break down of tourist behaviour

Detailed information on daily spending revealed that overall coach tourists are the largest spenders mainly due to spending on hotel accommodation which averages $80 per night. Home visitors spent the least and their largest expenditure was on recreational activities and retail. Backpackers and camping tourists spend substantially more on industries such as 'supermarkets' than other tourist types. It was also found that backpackers and camping tourists spend a substantial amount on industries that are categorised by higher-than-average financial yield, for example recreational activities, pubs and taverns and the retail sector. Camping tourists spend a substantial amount on rental vehicles. All of these factors collectively mean that backpackers and camping tourists generate a positive EVA and are high yielding financially (Becken & Simmons, 2008).

Public sector yield is how much each tourist type uses public services, attractions and activities. It was found that backpackers and camping tourist are most likely to make the most of publicly provided attractions. On average every camping tourist and backpacker will go bushwalking twice per trip; also, backpackers are the most frequent visitors of museums, art galleries and free attractions. Coach tourists make less use of public attractions, but participate more in cultural and Maori-related activities such as cultural performances or visit a Marae. This trend is most likely to be linked to a commercial operation. Overall FITs imposed the least cost on the public sector due to low visitation rates to these attractions (Becken & Simmons, 2008).

Extensive travel into more remote areas is beneficial for development; however, it comes with an environmental cost, which in this case is measured through CO_2 emissions. It was found that coach tourists are the largest user of air transport, camping tourists dominate road travel, and home visitors travel the least distance. The camping tourist produces the most CO_2 emissions during their stay in New Zealand, followed by the backpacker and coach tourist (Becken & Simmons, 2008).

2.3.3.2 Overall assessment of 'tourist types'

A comparison of tourist types in New Zealand based on the yield indicators results in a complex interaction of trade-offs to find the "optimal" tourist type. This "optimal" tourist type has proved to be particularly difficult to identify. For example coach tourists are the largest spenders and generate the greatest Value Added in tourism because they spend the most on accommodation; however, they contribute the least to the financial sustainability of tourism because they spend the most on lower-than-average financial yield, such as accommodation. In

comparison the backpacker and camping tourist spend their money in those industries that provide greater financial yield (Becken & Simmons, 2008).

Backpackers and camping tourists make the greatest use of publicly provided tourist attractions. This comes at a cost since the Department of Conservation spends a net $79 million annually to provide visitor services such as huts and signage.

Overall it was found that the assessment of tourist types depends on a decision maker's preference for rating of sustainability and on the overall policy directions (Becken & Simmons, 2008). This research is particularly interesting since it provides a detailed breakdown of the consumer perspective of the tourist. It highlights both the costs and benefits of the importance of tourists, and provides new insight into the sustainability of tourism in New Zealand.

2.4 Tourism New Zealand Profile

MANAAKITANGA:
Sharing exceptional and natural hospitality,
Knowledge and beliefs, on the basis
Of mutual respect between host and visitor

The New Zealand tourism industry has been growing steadily. New Zealand prides itself on labelling New Zealand as the 'youngest country on earth' as a selling point followed on by the promise of beautiful scenery and diverse landscapes. Renowned for its dramatic and stunning landscape, New Zealand has a unique culture, friendly and passionate people and an adventurous and daring spirit that captures the visitor. Marketing initiatives, such as Tourism New Zealand's partnership with global media giant Discovery Channel, provide access to the ideal traveller subset (Tourism New Zealand, 2003). Not only are the natural wonders of New Zealand being used to sell the country to the world but also the activities that take place in these natural areas which are a draw card for the adventurous tourists. Visitors to New Zealand are one of New Zealand's top foreign exchange earners, and visitor numbers reach up to 3 million. With this growth, there is an increase of pressure to ensure we continue to provide a destination that meets visitor expectations, while at the same time protecting New Zealand's environment for the future. The New Zealand National Tourism Strategy 2010 is developed to address the implications of tourism growth and how it can be managed at a sustainable level. Tourism New Zealand is focussed on targeting the right type of visitor for the New Zealand experience. They have identified this ideal visitor to be;

> "Someone who travels regularly; participates in a wide range of tourism experiences; actively participates in a natural environment; is environmentally and culturally aware; and seeks authentic and new experiences – and then wants to share them with others. We refer to these travellers as 'interactive travellers'. These travellers are also high users of technology, are leaders with liberal attitudes and have a global mindset. That is, they are aware they are part of a larger world and like to keep themselves informed of what is happening in it."
>
> (Tourism New Zealand, 2003, p. 13)

The 100% Pure New Zealand message and activity designed for marketing New Zealand to the world is specifically planned to attract a subset of visitors who will best identify with New Zealand and have the ultimate '100% Pure New Zealand' experience. So the aim is to increase positive word of mouth among international visitors, and the campaign must work to attract opinion leaders who will then tacitly 'market' New Zealand for the marketers and tourism businesses. By narrowing down the target market, New Zealand's resources go further, marketing is more efficient and New Zealand stands to benefit in the long term.

Basic statistical information on tourism in New Zealand is derived from the departure cards that every person entering or leaving the country has to fill out. The International Visitor Survey (IVS) is undertaken continuously by Tourism New Zealand (TNZ). Similarly, the Domestic Tourism Study (DTS) exists for domestic tourists. Tourist nights in different commercial accommodation types are recorded through the Commercial Accommodation Monitor (CAM). From these surveys key tourist information on demographics, country of origin, travel patterns and expenditure is collected. The Tourism Satellite Account (TSA) is an independent report by Statistics New Zealand and provides data about tourism's contribution to New Zealand's economy. Tourism is a major employer and a highly valuable earner of GST for the country. The industry directly contributes to government funds which are used to maintain the state sector. New Zealand's infrastructure and resources such as roading and conservation management are all funded by tourism (Tourism New Zealand, 2003)

2.4.1 Organisation of Tourism in New Zealand

Be faithful in the small things,
It is in them you will succeed
-Mother Theresa-

To be able to influence appropriate changes for the sustainability of tourism in New Zealand, it is important to understand how such a complex industry functions. The small to medium enterprises can really influence how tourists behave and these really make up the tourism industry. There are a number of organisational bodies involved in New Zealand's tourism

industry. Tourism New Zealand is involved with marketing New Zealand to overseas markets. The Ministry of Tourism provides policy advice to Central Government and other public stakeholders such as the Ministry of Transport and the Ministry for the Environment. The Department of Conservation plays an important role in tourism where they administer around a third of the country's areas which includes key visitor areas such as Milford Sound, Mt Cook National Park and Franz Josef Glacier. They also oversee visitor numbers and management which is a big responsibility. Furthermore, they influence whether concessions can be granted for the development of activities to take place in sensitive natural areas (Becken, 2001).

On a regional level, there are 26 Regional Tourism Organisations (RTO) that work to promote their regions both domestically and internationally. They also influence travel behaviour of tourists once they have arrived in New Zealand. For the private sectors there are 12 corporate entities in New Zealand which include Air New Zealand, Auckland International Airport and Tranzrail. Ultimately the economic benefits associated with tourism are spread out over a large number of New Zealanders (Becken, 2001).

CHAPTER THREE:

RESEARCH METHODS

3.1 Introduction

A survey questionnaire was used to gather information to calculate a consumption-based ecological footprint of tourists visiting New Zealand.

In order to gain an understanding of the resource consumption behaviour exhibited by tourists, a pilot study was undertaken in Taupo in August 2008. This pre-study was conducted by staying at a backpackers for three days. During that time observations were made of the eating habits of tourists, as well as conversing with international tourists about places visited in New Zealand, most popular mode of transport, country of origin, length of stay in New Zealand, activities and general spending behaviour. In addition to specific behaviour of individual tourists, information was also collected on more general tourist behaviour from meetings with experienced managers and workers at backpackers, motels, hotels, luxury apartments and motor inn accommodation types in Taupo. Taupo's most popular bars, restaurants, and cafés were also visited to collect a record of menus, and by asking experienced waiting staff in such places general information about the differences in dining behaviour between nationalities. This pilot study was particularly useful for determining tourist eating and dining behaviour to help with the design of the survey instrument.

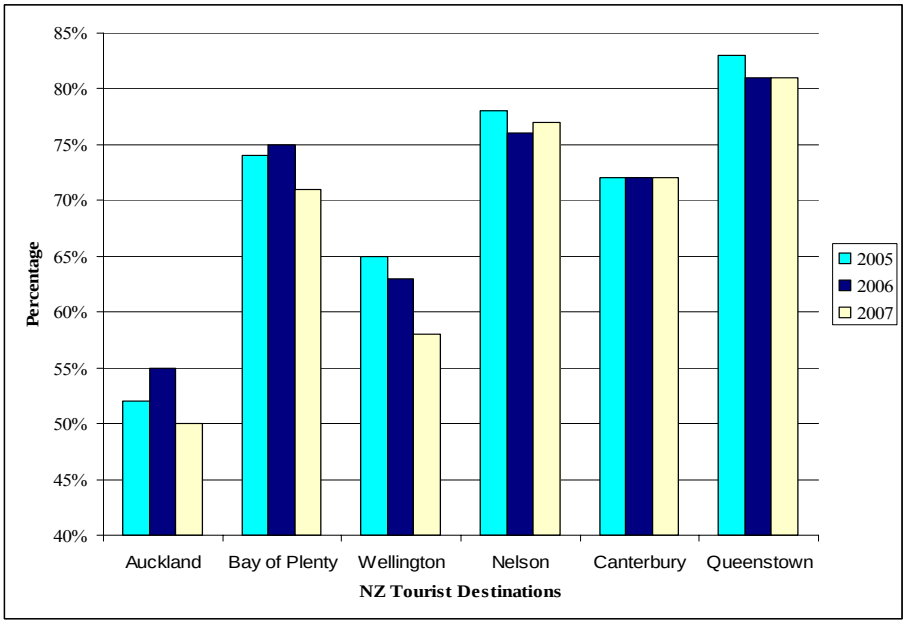
The actual survey for this research was conducted in Queenstown in September, 2008 where a total of 236 international tourists filled out a survey each. The information gathered via the survey was processed to give descriptive statistics of the tourist situation in Queenstown. The differences in footprint size between the three focus groups within the sample i.e. high budget tourists, medium budget tourists and low budget tourists, were analysed. The foundation of these three categories is based on their income category. The secondary aim is to cross-tabulate ecological footprint data with country of origin and travelling style to identify which tourist types hold the highest demand on New Zealand's natural resources. The demographic questions in the survey provide important information about tourists. For example the income category provides an insight into how monetary resources influence consumption behaviour of tourists in New Zealand.

3.2 Study site for survey

Queenstown is situated in the South Island of New Zealand and was the place chosen to survey tourists. Queenstown was chosen as the optimal place within New Zealand to intercept tourists during their trip because of its reputation as one of the most popular tourist destinations in New Zealand. It is also hailed as the Adventure Capital of the world. Queenstown sits within an area called the Wakatipu Basin, which also contains Lake Wakatipu, The Remarkables ski field, Coronet Peak and Arrowtown which can be seen on the map in Appendix three. The survey sample were handed out in all the main areas within this Wakatipu Basin, including; Queenstown, The Remarkables ski field, Coronet Peak and Arrowtown.

Queenstown attracts a wide range of international visitors due to a vast array of activities and attractions for people of all ages, from the adrenaline junkies to nature lovers to visitors wanting a relaxing holiday. Queenstown provides activities for both the winter and summer seasons. The Queenstown area provides sightseeing tours, guided bush walks, winery tours, boat cruises on Lake Wakatipu, bungy jumping, ski and snowboarding during the winter, jet boating, a Kiwi encounter, and relaxing spas. The town centre holds 170 bars, cafes and restaurants and accommodates large numbers of tourists that choose to visit Queenstown, with all accommodation types available. Figs 8 and 9 prove that Queenstown is the ultimate place in New Zealand to target a wide range of tourist types for the purpose of this research.

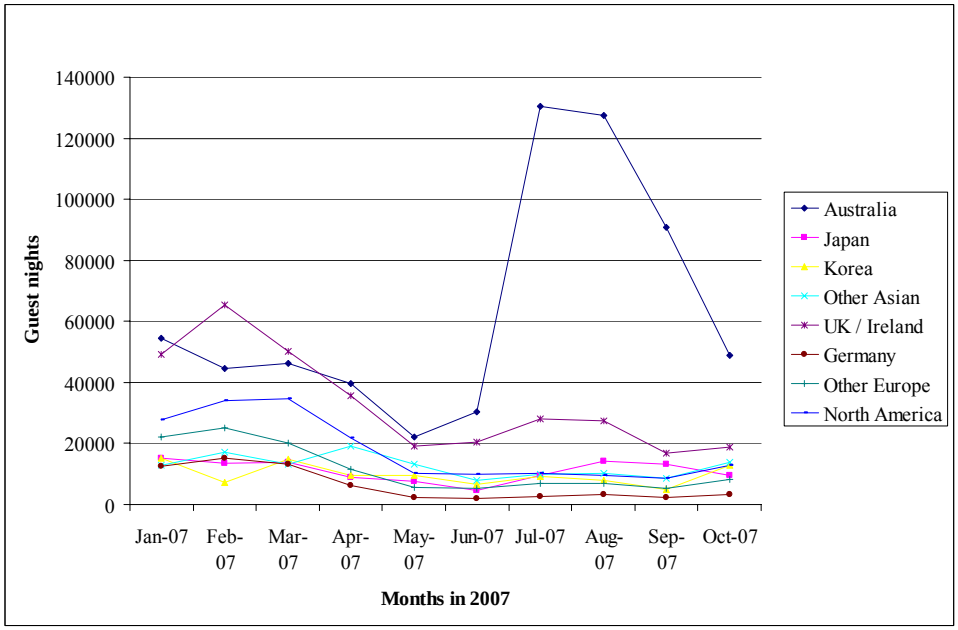
The Queenstown area is compared with other popular tourist destinations in New Zealand in Fig. 7. It can be seen in both Figs. 7 and 8 that Queenstown is the optimal site in New Zealand for the purpose of this study. It can be seen in Fig. 8 that, over the past three years, Queenstown holds the highest percentage of international visitors in New Zealand.



Source: (Ministry of Tourism, 2009a)

Fig. 7: Percentages of the number of international tourists in each area.

In September 2007 there were a total of 246,808 guest nights for international tourists in Queenstown. This provides a sufficient number of tourists in the September month to be able to conduct a survey during this time of the year. It is shown in Fig. 8 below that there is a significant peak in tourist guest nights during the winter months from July to September in Queenstown. This is mostly due to the ski season and opening of the ski fields in the area.



Source: (Ministry of Tourism, 2009b).

Fig. 8: Seasonality of tourist numbers in Queenstown

3.3 Questionnaire Design

3.3.1 Design of Survey Instrument

The questionnaire is designed to get specific data that is required for the ecological footprint calculator. It was also designed to obtain information on the specific resource consumption patterns of international travellers when in New Zealand and extracts general demographic information about the tourists (refer to Appendix One).

The questionnaire has 23 questions, of which eight are general questions. The survey elicits information for the seven categories prescribed by the Ecological Footprint calculatori.e. accommodation, services, tourist activities, water usage, transport, food and goods. Tourists were given the option to choose amongst different accommodation types since energy consumption varies among the different accommodation types (Becken & Cavanagh, 2003; Becken, *et al.,* 2001). There is also a question about meal sizes as a result of gathering information in Taupo. It was found that the meal sizes for breakfast, lunch and dinner vary amongst the different nationalities. Therefore, questions based on food consumption are broken up into an option of small, medium or large meal sizes. The questions in the survey are organized into the separate ecological footprint categories and flow in an order to the logical reasoning of the respondent. Once one category has been addressed, it is important that all related questions should come up before a second category is raised (Iarossi, 2006).

Making the questionnaire attractive and easy so that tourists will be willing to take time out from their trip to fill it in was an essential part of the planning process to ensure an optimum response rate. This was achieved by scaling down the four-paged survey into an A5 sized booklet. Brightly coloured surveys are less likely to get lost amongst other papers and are more attractive to the respondent (Fink & Kosecoff, 1985).Sunshine yellow paper was used for this survey instrument. The first page of the booklet explains to the respondents that the information gained by each response will remain confidential and anonymous and the data will be used for the purpose of this study only.

3.3.1.1 Translation of Questionnaire

The objective of this study is to sample a range of tourists of different nationalities; therefore it is essential for the survey to be as simple and specific as possible. This is to ensure that a question can be understood by the different nationalities and does not have a different meaning in different cultures which would significantly reduce the ability to compare results and increase sampling error (Iarossi, 2006). Japan is the third largest nationality of tourists that visit

Queenstown in September (refer to Table 3). The survey was translated into Japanese to ensure the sample population does not exclude such an important tourist market.

3.3.2 Pilot Study

A pilot study was conducted around Palmerston North, where 12 surveys were randomly handed out to international tourists in three of the accommodation types: a hotel, motel and backpackers. A total of six surveys were returned, and the results were analysed to ensure the questions asked were relevant for all tourist types and can be understood across the different nationalities. Adjustments were then made prior to the survey being distributed.

Once the survey had been adjusted from the pilot study, it was then translated into Japanese and was pre-tested to ensure the questions are accurate and can be understood by Japanese tourists. The questions in English are kept on the Japanese survey to ensure there is no confusion or misinterpretation through translation for each question.

The translated survey was tested by several Japanese students, a Japanese language education professional, and a Japanese New Zealand citizen who just recently had family come over from Japan, and was assured that this survey could be understood by the visiting family. The Japanese language education professional and Japanese students all agreed that the survey will be able to be understood by Japanese tourists.

3.3.3 Survey Sample Selection

The surveys were given out with a free-postage envelope so that the tourists have the option to either hand back the surveys in person or mail it in the post from within New Zealand. The surveys were dropped off to all accommodation types in Queenstown, where tourists could leave the surveys with the reception staff at the desk and then be picked up or mailed back to the Institute of Natural Resources at Massey University. They were also handed out to tourists in popular tourist spots around the Queenstown area, where the tourists were approached and asked if they would like to undertake the survey. The samples were taken from only one person per group, but it is accepted that in this research there will be some similarities among the tourists and some of the responses are not completely independent. The popular tourist spots chosen for this survey are shown in the map of the Wakatipu Basin in Appendix Three, and seen in Fig. 9 below.

Fig. 9: Photo of The Remarkables ski field where some of the tourists were surveyed. K. O'Connor.

3.3.3.1 Sample Population

The number of tourists selected represents the total number of tourists (based on guest nights) in Queenstown during September using September 2007 data from the Ministry of Tourism database as an estimate for numbers (as shown in Table 3 below). A random sample of 722 surveys was delivered to tourists in Queenstown from September 13th to 20th, 2008.

The tourist types that are used in this study were able to be categorised and identified using the International Visitors Survey (IVS), Commercial Accommodation Monitor (CAM) and the survey of International Visitor Arrivals (IVA) from the Ministry of Tourism database, as shown in Tables 3 and 4

Given the information shown in Table 3 and Table 4 about tourist expenditure and country of origin the top six markets are; Australia, United States of America, United Kingdom, Japan, Korea and Germany.

Table 3: Number of tourist guest nights and country of origin at any given day in Queenstown in September 2007 for each accommodation type.

Queenstown Sept 2007	Australia	USA	UK	Japan	Korea	Germany
Hotels	1220	111	222	177	67	22
Motels	733	67	133	107	40	13
Hosted	47	4	9	7	3	1
Backpackers	537	49	98	78	29	10
Caravan Parks	495	45	90	72	27	9

Source: (Ministry of Tourism, 2009b).

Table 4: Expenditure of tourists on "holiday" from the top 10 tourist markets in New Zealand in 2007.

Top 10 Markets	Average Expenditure (NZD)	Total Expenditure ($m)	Expenditure %	Cumulative %
Australia	2,325	686	21	21
UK	3,744	531	16	36
United States Of America	3,941	508	15	52
Japan	3,216	239	7	59
China, People's Republic Of	2,809	169	5	63
Germany	4,608	181	5	68
Korea, Republic Of	2,236	135	4	73
Canada	2,810	72	2	76
Taiwan	2,914	38	1	77
Singapore	2,732	32	1	78
Other	3,373	745	22	100
Total (Autobase)	**3,114**	**3,340**	**100**	

Source: (Ministry of Tourism, 2009a).

The IVS is conducted by the Tourism New Zealand and supplies key information about tourist behaviour when in New Zealand such as transport modes, places visited, attractions/activities, demographic information, motivation for visiting New Zealand, and most importantly for the purpose of this study, country of origin and expenditure. IVS are carried out annually by interviewing international travellers that are 15 years and older, and quotas are pre-specified for each month, the interviews being spread through out the month, quarter and year (Ministry of Tourism, 2009a).

The CAM provides regional data on the supply and demand of the accommodation sector. It is a compulsory census and all accommodation establishments of a certain size are required to fill out the survey forms which are sent out on a monthly basis by Statistics New Zealand. Statistics New Zealand processes and outputs the data for the Regional Tourism Organisation (RTO).

The IVA is conducted by New Zealand Customs Service and analysed by Statistics New Zealand. IVA is both a census (by collecting arrival and departure cards) and a survey (samples selected out of these arrival and departure cards). The results from YE Sept 07, using specific monthly data from the IVS and CAM surveys, were used to determine the most important tourist markets for this research (Ministry of Tourism, 2009).

3.4 Research Ethics

All research conducted within Massey University must be assessed by the Research Ethics Office as to the potential risk that may be involved to the researcher, general public, or Massey University. This study was assessed as low risk and the appropriate notification was given by the Massey University Research Ethics Office.

3.5 Data Analysis

3.5.1 Ecological Footprint Analysis (EFA)

The EFA was performed using a modified Excel spreadsheet from Redefining Progress, which could be downloaded from their website. It is, however, no longer available to the public, since the Redefining Progress team are currently building a more enhanced ecological footprint calculator that is still in the process of being completed and not yet available to the public. Therefore the modified Excel spreadsheet that is used in this study is their earlier calculator; permission was granted by the Redefining Progress team to use the calculator for this research. This same calculator has been used in previous studies for calculating the ecological footprints of a sample of Japanese tourists in New Zealand (Shimada, 2006), and a sample of tourists in Canada (Johnson, 2003).

This Excel spreadsheet was originally produced by Mathis Wackernagel, Chad Monfreda, Diana Deumling and Ritik Dholakia and published in 2003. The spreadsheet has been redesigned to suit calculating the Ecological Footprint of tourists, since the original calculator was for household consumption only. The method for modifying the Excel spreadsheet was also used by Shimada (2006) in order for the Ecological Footprint to encompass New Zealand's unique environments and energy sources. The following changes were made to the spreadsheet:

- Equivalence and yield factors were modified to take into account the differences in New Zealand land productivity.

- The sources and composition of electricity generation was altered to suit New Zealand's energy sources. New Zealand relies heavily on renewable energy sources (e.g. Hydro), so the percentages were changed according to New Zealand's situation;
- The built-up land for transport was altered to the New Zealand railway and road networks and the transportation usage to calculate the land area used by each tourist;
- Entertainment activities/attractions during the travel were added to the services categories, since the activities tourists do and see is one of the three main components of the "tourist product" (Collier & Harraway, 2001);
- The national average recycling rate for New Zealand was applied to calculate the land used for the assimilation of waste produced by tourists.

The resulting spreadsheet calculates the ecological footprints of international tourists by assimilating data of each resource consumed by the international travellers during their stay in New Zealand. It estimates a hypothetical annual ecological footprint (gha) of a tourist. The ecological footprint calculator was originally set up to calculate EF per month, so monthly data must be put into the calculator. Therefore, each tourist's trip is translated into a month's worth of consumption. The monthly ecological footprint is multiplied by 12 by the calculator to get the annual footprint (gha/year) if the tourist continued to consume at the same rate as they do during their visit to New Zealand. The resulting 'global hectare' is an estimate only of how much land a tourist uses when taking into account their consumption behaviour while in New Zealand.

The ecological footprint of tourists in New Zealand in global hectares (gha) is possible using "equivalence factors" and "yield factors". The equivalence factor represents the potential productivity of land in New Zealand regardless of current management practices, relative to the world average potential productivity of all bio productive areas. Yield factors, however, describe the extent to which the bio-productivity of New Zealand is more (or less) productive than the global average. It reflects current technology and management practices, in addition to the renewable resource productivity of New Zealand. Each country has its own set of yield factors, one for each type of bio productive area. New Zealand's average pasture yield factor is 5.24, and for arable and forest land the average yield factors are estimated to be 2.09 and 0.61 respectively. For built-up land, an average arable land is applied (Loh, 2000 as cited in McDonald & Patterson, 2003).

Thus, the ecological footprint in global hectares was generally obtained by the following formula:

$$EF\ (gha) = Area\ (ha) \times Equivalence\ factor\ (gha/ha)$$

Ecological footprint of built-up land includes previous productivity, so the formula to calculate global hectare is adjusted using the yield factor.

$$EF_{built\text{-}up}\ (gha) = Area_{built\text{-}up}\ (ha) \times Equivalence\ factor_{built\text{-}up}\ (gha/ha) \times Yield\ factor_{cropland}\ (-)$$

The daily ecological footprints of tourists can be used to compare with the national average per capita per day, and national average per capita per day of the countries from which the tourists have come. This will give an indication of how much more resources a tourist consumes and productive land required by the average international tourist than the local residents and their everyday living.

It is important to note that the weightings of the ecological footprints for this research will be different to other ecological footprint results due to differences in calculations. This is true when comparing results with the New Zealand EF (per capita) and other nationalities from World Wildlife Fund (2008) and World Wildlife Fund (2006), as well as comparisons of results from Shimada (2006), Johnson (2003) studies.

3.6 Ecological Footprint of the Main consumption categories

The ecological footprint calculator is separated into six main consumption categories. These are: food, housing/accommodation, transportation, goods, services/activities, and waste. Each of these categories requires a certain amount of fossil energy land, arable land, pasture land, forest, built-up land and/or sea sequestered by each tourist. The data gathered from the surveys was not in the format required for input into the EF spreadsheet. Therefore several types of data needed to be manipulated from their raw form (see appendix two for detailed calculations).

3.6.1 Food

Information on food consumption by tourists was gathered when in Taupo, a popular tourist destination in New Zealand. It was found that tourists from all nationalities eat the some form of starch products, meat, fruit and vegetables; however, it was the different ways in which food is

prepared and meal sizes that differ between the nationalities. The ecological footprint of food was calculated using three different meal sizes for each meal type (i.e. breakfast, lunch and evening meal). There are 20 different meal sizes within the food consumption category. All of the food categories require energy land and cropland. The dairy food types (cheese, yoghurt, milk, etc) and beef require pasture and fish requires the aquatic area.

3.6.2 Housing/accommodation

The ecological footprint of the energy consumed by accommodation was able to be calculated by using data from previous research on energy sources for each accommodation type. It was found that the energy requirements for each accommodation type and energy intensity per visitor night varied (Becken *et al*., 2001; Becken & Cavanagh, 2003). Therefore the energy consumption was calculated by gathering information on the type of accommodation used and number of nights each traveller stayed in each accommodation type. The composition of New Zealand's electricity generation was required in the ecological footprint calculator where 55% of New Zealand's electricity is generated from hydropower, 7.7% from geothermal, 26.4% from gas, 6.9% from coal and 4.0% other renewable sources (comprised of wind, bio-gas, wood and waste heat) in 2007 (Ministry of Economic Development, 2008). These electricity sources are important since each requires a different type of productive land.

To calculate the ecological footprint of the accommodation and housing category, the built up-land used specifically by the tourists is also included in the calculator. The amount of built-up land used by tourists includes hotels, motels, other accommodation, shops and restaurants are from Patterson & McDonald (2004) which totals to 1535 hectares. This total amount of direct land use by tourists is then divided by the total number of international guest nights (IVS. YE June 08: 47,485,911 guest nights). Thus the total amount of land used is 0.3233m^2 per visitor night. Water is also included in this category, which encompasses direct water usage only, such as bathroom, laundry, and kitchen usage.

3.6.3 Transportation

The transport category includes domestic transport only, since the CO_2 emissions and overall environmental impact of international flights to and from New Zealand are a global issue, so therefore not considered in the analysis. Transport is divided up into eight common modes of transport. The total distance travelled by each mode of transport for each tourist was able to be estimated by information gathered from the surveys. The built-up land required by international travellers was able to be calculated from the area covered by the sealed roads, distances of the

railway network in New Zealand, and total vehicle kilometres travelled (vkm) per year (obtained from Transit New Zealand and Ministry of Transport).

3.6.4 Goods

The "Goods" component of the EF comprises of two aspects of a tourist's trip:

1. It looks at the number and weight of goods purchased by tourists during their stay in New Zealand.
2. It looks at the "use" of an asset during the tourist's stay. For example, beds in a Hotel room were brought and used only by tourists, so therefore each tourist is then allocated a certain weight of the bed according to where the tourist stayed, and the length of stay. This weight was calculated using the following formula:

Average asset weight Use/tourist = (Life span of asset (obtained from Inland Revenue General Depreciation Rates) × Occupancy rate of accommodation type (obtained from Ministry of Tourism) × 365 (number of days in a year) / Average weight of that asset) × length of stay

Assets include anything a tourist may use while staying at the accommodation type such as; computers, bench tops, beds, desk, drawers, wardrobe, microwave and electronic appliances.

3.6.4.1 Goods Purchased:

It was assumed that the weight of the goods purchased by tourists during their stay in New Zealand will be the average weight that was estimated by weighing souvenirs and New Zealand made products in a New Zealand souvenir shop. A set weight was established for each type of purchase a tourist buys and each good was weighed with the same scale. The numbers of items purchased by tourists for each good type was obtained via the survey.

The data on goods purchased during an international traveller's stay in New Zealand was gathered via the survey. The weights of goods purchased by tourists were obtained by weighing "typical" New Zealand souvenirs and New Zealand made cosmetic products at a souvenir shop. The lists of all goods weighed are listed in the Appendix under the list assumptions. The spreadsheet included 15 different types of goods under this category. All productive land types except sea were required for goods, depending on the nature of the asset.

3.6.5 Services/activities

All the services including postage, laundry, telephone calls and activities during a tourist's trip are calculated in this category. A total of 23 activities were included within this category. All activities and services required built up and energy land. Also each activity required different amounts of energy (MJ/tourist); this data was obtained from Becken & Simmons (2002).

3.6.6 Waste

There is no available information on the amount of waste produced by tourists in New Zealand, so the amount of waste was assumed to be the same as that produced by an average New Zealander. This same assumption was made by both Shimada (2006) and Patterson (2005) for their research on the EF of tourists, due to a lack of available data on waste produced by tourists. The New Zealand average waste generation was applied in the calculation as well as the average percentage of waste that is recycled per household in New Zealand, again assuming a tourist will be the same as an average New Zealander. There are 5 different waste types included in this category. All waste types require both energy land and built-up land for landfill (or land to assimilate the waste). Forest was required for paper and cardboard. The size of the productive lands for the assimilation of waste reduces if the waste is recycled.

3.7 The Ecological Footprint for Land Type

3.7.1 Energy Land

The fossil energy land represents the hypothetical amount of land required to sequester CO_2 emissions from the burning of fossil fuels. Fossil energy footprint is calculated by multiplying the amount of products consumed (kg) with the energy intensity (MJ/kg) and the carbon sequestration ratio (m^2/MJ).

3.7.2 Cropland (or arable land)

The cropland footprint is calculated by the quantity of products consumed (kg) multiplied by the footprint intensity of the primary product (global m^2/kg) and the conversion factor from primary to secondary product (kg primary product/kg secondary product). The conversion factor is used because the quantity of secondary product (e.g., bread) is not the same as the quantity of primary product required (e.g., wheat) and is only included for secondary (manufactured) products.

3.7.3 Pasture

The formula is the same for pasture land as the one for cropland, they only differ in productivity.

3.7.4 Built-up land

The same equivalence and yield factors as cropland were applied in built-up land.

3.7.5 Forest Land

The forest land includes farmed or natural forests that can yield timber products. The ecological footprint of forest land is calculated by using the average wood density of 600kg/m^3 and the 6,469 global m^2/m^3 of roundwood. The waste factor of wood is also included in the calculation; for example, the waste factor for firewood is equal to 0.53. This means that for each kg of firewood, one needs 0.53kg of roundwood. In this firewood category the waste factor is significantly smaller than 1 since twice as much firewood can be produced than roundwood per m^2 and year (Wackernagel, *et. al.,* 2003).

Forests also secure other functions as well, such as erosion prevention, climate stability, water management, and, if managed properly, biodiversity protection (Wackenagel, *et.al.,* 1999). Thus, the ecological footprint of water is also included in the forest land category. Water production can be the secondary function of the forest, so the water function of the forest is included in this calculation (Wackernagel, *et. al.,* 2003).

3.7.6 Fisheries

The fisheries ecological footprint was used for food consumption only. The ecological footprint for eating fish is higher than the footprint of other meat types.

3.8 Statistical Analysis

Descriptive information from the returned surveys was entered into a database spreadsheet in Excel. The data for food and goods were translated into weights (Kg), and accommodation information was translated into energy sources, specified by the ecological footprint calculator, then each respondent's EF was calculated.

SPSS is the statistics programme used for the analysis of the data in this study. The data in Excel was transferred into SPSS where the survey information is coded for analysis. SPSS is used to identify relationships and interactions between the consumption categories' EF and land data EF against income categories of respondents, country of origin, age, gender, travelling style, reason for visiting and length of stay.

The data is statistically analysed using crosstabulations, one-way Analysis of Variance (ANOVA) and two-way ANOVAs. Principal Component Analysis (PCA) was used for multivariate statistical analysis which identifies the underlying factors affecting the EF of respondents. Collectively, this analysis identifies the causes of particular tourist behaviour that results in a larger EF, the areas of concern regarding environmental impacts and ultimately helps to identify ways of mitigating this impact. The relationships between demographic information of tourists and their ecological footprints are analysed by conducting a one-way ANOVA using the Least Significant Differences (LSD) test at a 95% confidence level.

3.9 Limitations of Survey

There are several limitations for this research.

3.9.1 Resource and Time Constraints:

This study was prepared and conducted within 13 months (February 2008 to March 2009), so missed the peak tourist season in New Zealand which is November to March for the survey. There was a limit in money resources, since the research budget was limited; sample size had to be limited due to the amount of money required for postage envelopes. Time also means money; therefore, the sample size was restricted down to the total amount of surveys able to be handed out within 7 days. Limited time and money also restricted this research to one sample area (Queenstown) only. If more time was available, a survey sample conducted in Rotorua would have been useful data.

3.9.2 Assumptions Made:

Many assumptions were made about resource requirements, energy requirements and waste production of tourists. EFA calculator is originally made for household consumption where individuals filled in the blanks for their household. Calculating the EF of a collective sample of tourists meant making assumptions about each tourist. For example;

- Energy use in accommodation was determined by the accommodation type, not specific resource use and behaviour of tourists.
- Food allergies and special diets were not taken into account, except if the tourist was vegetarian.
- The weight of food consumed by tourists was determined by the size of meal eaten by each meal type (breakfast, lunch and dinner).

- Random eating habits such as snacks were not incorporated into the calculation.
- Waste production and recycling habits are not specific to individuals and was assumed to be the same as an average New Zealander.
- Weight of purchases made by tourists while in New Zealand was assumed

A detailed breakdown of calculations and assumptions made for EFA can be found in Appendix Two.

There is a trade off between the complexity of the survey, length of survey and sample size. The more questions asked, and thereby more information about resource consumption, the less likely a tourist will be willing to fill in the survey. Furthermore, the questions were kept simple so that tourists from different nationalities would interpret the questions the same.

Lastly, the EFA which results in a global hectare for each tourist, determined by consumption behaviour, is an estimation of hypothetical land area for each tourist. It is not the absolute land area required, due to using general numbers and many assumptions.

3.9.3 Sampling Limitations

It is important to recognise the bias that will inevitably occur in the random sampling method. The sampling method for this research was to sample just one person per travelling group. However, in some cases there were some similarities and connections between respondents.

It is also important to note that the type of tourists sampled may not be a good representation of the average tourists that visit New Zealand. The time and place at which the tourists were sampled could influence this, particularly when using only one sample area. If, for example, another survey was conducted in Rotorua, the sample might consist of a different sort of tourist.

CHAPTER FOUR:

RESULTS

4.1 Survey

Of the 722 surveys that were handed out to tourists, 255 surveys were completed and returned. Of the 255 responses, 19 surveys were unable to be used because they failed to comply with the definition of an international tourist as defined by the World Tourism Organisation. So 205 completed and viable surveys were handed back during the eight days that was spent in Queenstown and 32 surveys were mailed back to the Institute of Natural Resources, Massey University. A total of 236 viable surveys were completed and returned giving a response rate of 33 %.

The results of the survey have revealed an over representation of long stay tourists in the survey, where the average length of stay is 111 days. This number is not a fair representation of all tourists. Since the average length of stay for the average tourist in New Zealand is 21.9 days (Ministry of Tourism, 2009a). Therefore the results for products purchased, accommodation guest nights, activities participated in by tourists, and comparing the demographic data with data from the IVS, CAM and IVA surveys have been weighted according to the number of days each tourist spent in New Zealand.

4.1.1 Background of Travellers

The demographic profile of the tourists that responded to the survey is presented in summary in Table 5. Some of the more important information gathered from the survey is a total of 58% of respondents are aged 18-29, which suggests an over-representation of the younger age group. The most common income category from the survey is <$20,000 (33%) which could be a consequence of sampling a younger age group of tourists. Another significant finding shown in Table 5 is that 77% of respondents are in New Zealand on holiday. The majority of respondents do eat meat, and amongst the respondents the most popular travelling style is a Free-Independent Traveller (67%).

Table 5: Demographic information of respondents and tourist types (n=236).

Demographic data of respondents		Number	Percent
Gender	Male	114	48
	Female	122	52
Age Category			
	18-29	137	58
	30-39	42	18
	40-49	25	11
	50-59	18	8
	60+	10	4
	No response	4	1.7
Income Category (NZD)			
	<20,000	79	33
	20,000-40,000	39	17
	40,001-60,000	22	9
	60,001-80,000	34	14
	80,001-100,000	22	9
	100,001-140,000	22	9
	140,001-180,000	6	3
	180,000-200,000	3	1
	200,000+	4	2
	No response	5	3
Diet			
	Non-vegetarian	225	95
	Vegetarian	11	5
Travelling Style			
	Guided Package Tour	8	3
	Package Traveller	17	7
	Semi-Independent Traveller	50	21
	Free-independent Traveller	159	67
	Other	2	0.8
Reason for Visiting			
	Holiday	182	77
	Business	6	3
	Visiting friends/family	5	2
	Education	3	1
	Working Holiday	40	17

4.1.2 Nationality

Australia, at 39% of respondents, was the most common tourist nationality surveyed in September. This would be due to the numbers visiting New Zealand for the skiing/snowboarding season, since 82% of all Australians surveyed went skiing/snowboarding at least once during their visit. United Kingdom came through as the second largest nationality group from the survey (32 %). Due to relatively small sample sizes of all other nationalities (as shown in Table 6), the nationalities were grouped into nationality categories instead of individual countries to increase the sample sizes. The grouping of different nationalities is also used by the Ministry of Tourism when comparing number of visitors and country of origin (as shown in Table 7).

Table 6: Nationalities of tourists surveyed.

Nationality	Number	Percent
Australia	94	39
United Kingdom	76	32
U.S.A	11	5
Japan	9	3.8
Canada	8	3
Germany	6	2.5
Argentina	4	1.7
France	3	1.3
New Caledonia	2	0.8
Malaysia	2	0.8
Columbia	2	0.8
Thailand	2	0.8
Czech Republic	2	0.8
Finland	2	0.8
Italy	2	0.8
Spain	2	0.8
South Africa	1	0.4
United Arab Emirates	1	0.4
South Korea	1	0.4
Slovenia	1	0.4
Denmark	1	0.4
Mexico	1	0.4
Slovakia	1	0.4
Hong Kong	1	0.4
Brazil	1	0.4
Total	236	100%

Table 7: Grouped nationalities visiting Queenstown in the September months averaged over the past seven years from Commercial Accommodation Monitor (CAM) giving an averaged total of international visitors (average number of nights spent in Queenstown for Sept N = 142,728) and 2008 this study (n = 236).

Nationality	CAM (Sept average nights 00-07)	CAM (% of total international)	Survey Number	Weighted Survey %
Australia	73,684	52	94	62
United Kingdom	14,131	10	76	18
North America	9,215	6	19	3
European*	20,084	14	16	3
Asia	30,780	22	13	4
South America	N/A	N/A	8	3
Eastern European	N/A	N/A	4	0.5
Other	4,834	3	6	4

Source: (Ministry of Tourism, 2009b)

* Is amount of tourists from 'Total European' for CAM

4.1.3 Length of Stay

The average length of stay from the survey is 111 days and the median is 26 days. The survey shows that 17% of respondents were in New Zealand on a working holiday and 90% of those tourists stayed in New Zealand for more the 30 days (as depicted in Table 8), averaging 250 days in New Zealand. These tourists skew the average since 77% of all respondents came to New Zealand for a holiday and stayed an average of 80 days. Fifty six percent of all respondents stayed in New Zealand for up to 31 days as shown in Fig. 12.

Table 8: Frequency of the length of stay categories and the reason for visiting New Zealand (n = 236).

	Length of stay categories							
Reason for visiting	**<5**	**5-7**	**8-10**	**11-13**	**14-16**	**17-19**	**20-29**	**>30**
Holiday	2	30	26	7	13	7	28	69
Business	0	1	0	0	0	0	1	4
Visiting Friends/Family	0	2	0	0	1	1	1	0
Education	0	0	0	0	0	0	0	3
Working Holiday	0	0	0	0	0	2	1	37

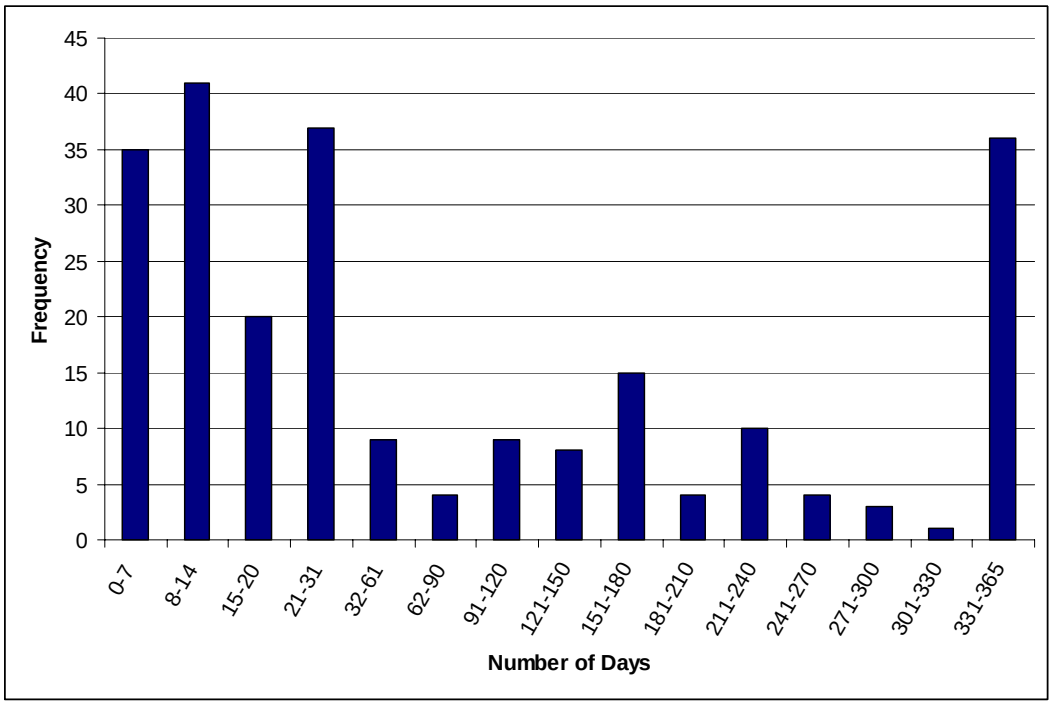


Fig. 10: Frequency distribution of the length of stay from the results of respondents (n = 236)

4.1.4 Accommodation

The 'Other' category consists entirely of respondents staying at either owned or rented properties. It is shown in Table 9 that the backpackers/hostel was the most popular accommodation type. Staying at a bed and breakfast was the least popular, comprising of only two per cent of all accommodation choices made. It is important to note that the frequency of times accommodation types were visited reflects the fact the tourists can choose more than one type during their stay.

Table 9: Number of times tourists chose to stay at each accommodation type (n = 236).

Number of tourists for each accommodation type	Frequency	Percent
Hotel	68	15
Motel	41	9
BB	10	2
Luxury	22	5
Backpackers/Hostel	116	26
Hosted	16	4
Camping	50	11
Friends/Family	46	10
Other	72	17

The probability of a respondent choosing the hotel or luxury lodge accommodation type can be related to the number of days in New Zealand. It is shown in Table 10 that the proportion of a tourists' trip staying in a hotel and luxury lodge on any given day significantly decreases the longer a tourist stays in New Zealand (P-value: 0.000, f-value: 8.246, d.f. 2). Therefore, short stay visitors are more likely to choose to stay at a hotel, motel and luxury lodge than long stay tourists. Long stay tourists tend to spend a higher proportion of their trip staying in 'Other' accommodation types than any other type. A total of 54% of travellers in New Zealand on a working holiday stayed at an owned or rented property (Other). The 'Other' category also held the highest percentage of travellers visiting on holiday, followed closely by the most popular accommodation type for this survey which is backpackers/hostel.

Table 10: The proportion of time a tourist will stay at a chosen accommodation type when in New Zealand. Categorised by length of stay.

Number of days in New Zealand	0-31	32-180	181-365
Hotel	0.27	0.03	0.01
Motel	0.15	0.002	0.01
B&B	0.007	0.01	0.003
Luxury Lodge	0.13	0.00	0.00
Backpackers/Hostel	0.22	0.38	0.25
Hosted	0.03	0.08	0.02
Camping Ground	0.1	0.05	0.102
Friends/Family	0.03	0.07	0.08
Other	0.08	0.35	0.51
N	133	45	58

4.1.4.1 Number of people sharing a room

The purpose of gathering data on number of people sharing a room is to be able to calculate the amount of power and energy used for accommodation and housing for each tourist. It is also a good indication to the number of people travelling together. The average number of people sharing a room is 2.2 people, and the median is one person.

The majority of people surveyed shared a room with one other person (44%). The Backpackers/hostel accommodation generally holds 6-8 people in dormitory rooms, so there is an even spread of number of people with more than 5 people per room as shown in Fig. 11 . The Motel/Motor Inn accommodation types can hold 2-4 people in the rooms with single and/or double beds.

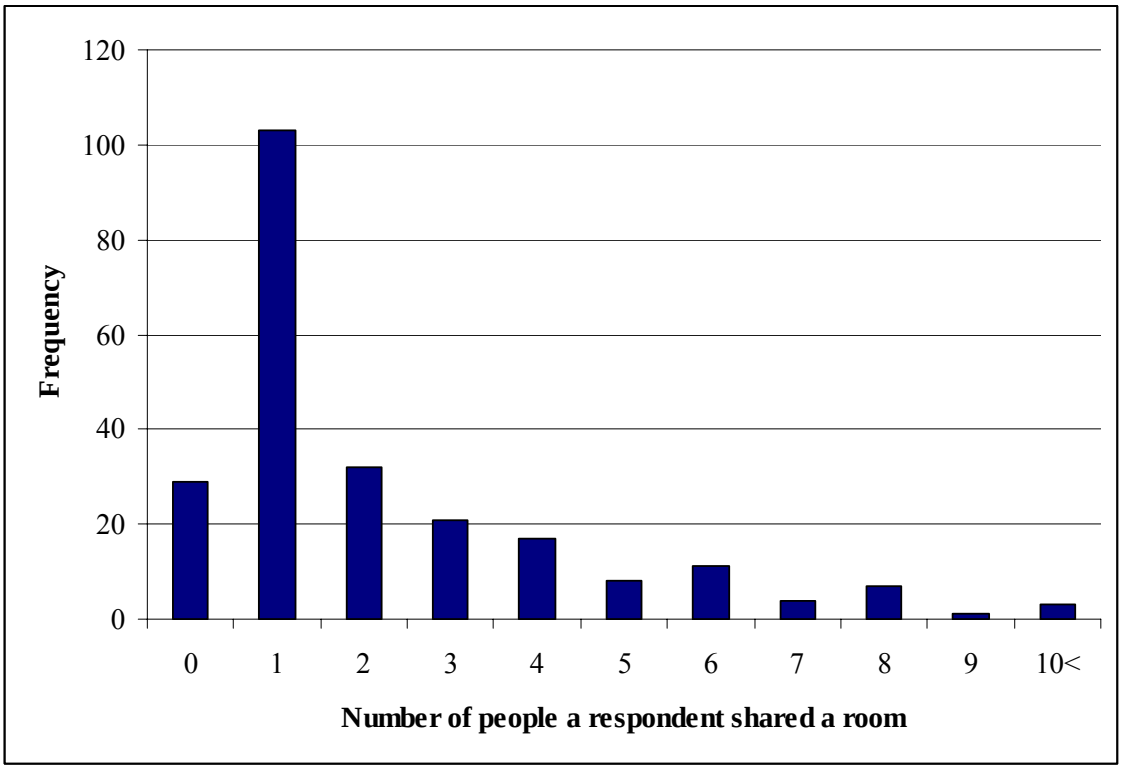


Fig. 11: Frequency distribution of the number of people the respondents shared a room (n = 236).

4.1.5 Services

The amount of money ($NZ) spent on services was collected as part of the Services category for the Ecological Footprint calculation. Overall the average monthly amount spent on the telephone (public or phone card) is $40, the average amount spent on dry cleaning is seven dollars and medical insurance and services is $56.

Tourists who earn $200,000 and more on average spend the most on dry cleaning, telephone and medical insurance and services as shown in Table 11. Tourists from Eastern Europe and countries in the 'Other' category on average spend the most on dry cleaning and telephone; however do not spend anything on medical insurance or services. It is the American tourists that spend the most on the medical services. Overall, the tourists visiting friends/family spend the most on all three services types. Also tourists visiting on a working holiday generally spend the least on dry cleaning and medical services, but spend a reasonable amount on the telephone.

Table 11: Average expenditure on Services ($NZ) (n = 236).

		Average monthly dry cleaning ($NZ)	Average monthly telephone ($NZ)	Average monthly medical insurance services ($NZ)
Income Category (NZD)	<20,000	9	40	35
	20,001-40,000	8	48	57
	40,001-60,000	12	53	20
	60,001-80,000	5	31	60
	80,001-100,000	8	37	27
	100,001-140,000	2	54	148
	140,001-180,000	0	7	33
	180,001-200,000	0	0	0
	200,000+	24	64	237
	No Response	0	11	123
Nationality	Australia	9	34	60
	United Kingdom	5	41	52
	America	5	54	137
	Asia	7	29	6
	European	2	24	33
	South American	9	35	45
	Eastern Europe	30	110	0
	Other	20	107	0
Reason for Visiting	Holiday	8	38	62
	Business	7	41	67
	Visiting Friends/Family	16	80	124
	Education	0	20	107
	Working Holiday	3	46	16

4.1.6 Shopping Behaviour

The most popular consumer products are cotton products (65%) followed by books, magazines and/or newspapers (62%) (as shown in Table 12). The most purchased product by tourists are cigarettes and other tobacco products, however, on any given day, an average tourist has a three per cent chance of purchasing cigarettes. This is because only 17% of respondents smoke and 87% of all tobacco products are purchased by tourists staying for more than 30 days in New Zealand. Therefore, the large numbers of cigarettes purchased by a small percentage of tourists were purchased over a long period of time, reducing the likelihood of purchase for an average tourist.

Overall the holiday and working holiday travellers purchased the most consumer products. Tobacco products and cosmetics are the most popular buys by these two tourist types, due to the average length of stay for a working holiday tourist is 250 days.

Table 12: Number of consumer products purchased from sample. (n = 236).

Product	Number of tourists	Percent	Likelihood a tourist will buy product (%)	Rate of purchases/ day/tourist
Jewellery/Accessories	99	42	8	0.015
Cotton Products	154	65	16	0.090
Wooden Products	53	22	2	0.012
Books/magazines/newspapers	146	62	16	0.088
Electronic Goods	68	29	1	0.009
Medicine/Health Supplements	90	38	4	0.025
Wool/Sheepskin/leather products	67	28	7	0.033
Cigarettes or other tobacco products	40	17	3	0.056
Cosmetic/soap/hand cream	128	54	18	0.099

4.1.7 Places Visited and Transport Modes

The most popular form of transport for tourists surveyed is the private or rented car (27%), followed by domestic air (23%) as shown in Table 13. It is shown in Table 14 that 59% of participants visited Auckland at some point during their trip, which makes Auckland a popular place to visit for tourists. Auckland, however, is the tourist destination furthest from Queenstown. Therefore, Auckland is a popular destination or departure point for domestic flights, with 65% of all domestic flights taken by respondents comprising of flights in or out of Auckland.

The bus tours are also a popular way of travelling around New Zealand, particularly on the 'Magic Travellers Bus' or 'Kiwi Experience'. These bus tours take tourists to all the sites New Zealand has to offer in a package deal, and have proved to be popular because it's a very economical and efficient way of touring the country and taking in all New Zealand has to offer. Taking the train was the least popular mode of transport used, and the 'other' category consisted of hitchhiking, cycling, taking a taxi or walking which comprised only 4% of all transport modes as shown in Table 13.

Table 13: Frequencies and percentages of transport modes chosen by tourists in survey (n = 236).

Transport Type	Total frequency	Percent	Weighted frequency	Weighted percent
Train	15	3	4	2
Car	150	27	79	33
Bus	117	21	50	21
Mini-bus/van	52	10	23	10
Ferry	64	12	25	11
Domestic Air	124	23	46	19
Other	23	4	9	4

The most popular tourist destination other than Queenstown is Christchurch (74%), followed by Auckland (59%), then Te Anau (53%) and the Milford Sound (51%), which is expected being so close to Queenstown as shown in Table 14. Wellington was also a fairly popular tourist destination comprising of 44% of all destinations chosen. The least popular places to visit by participants were Gisborne (7.6%) and New Plymouth (11%), followed by Hamilton (16%). On average, a traveller visited 9.3 places during their New Zealand trip.

Table 14: Total number and percentages of tourists visiting each destination from the survey (n = 236).

Places Visited	Frequency	Percent
Cape Reinga	41	17
Bay of Islands	74	31
Auckland	139	59
Coromandel	44	19
Tauranga	47	20
Hamilton	38	16
Rotorua	95	40
Waitomo Caves	50	21
New Plymouth	25	11
Gisborne	18	7.6
Taupo	82	35
Napier	41	17
Tongariro National Park	52	22
Wellington	105	44
Picton	89	38
Kaikoura	70	30
Nelson	84	35
Greymouth	101	43
Arthur's Pass	73	31
Franz Josef Glacier	116	49
Tekapo	67	28
Christchurch	175	74
Milford Sound	122	51
Queenstown	236	100
Te Anau	125	53
Dunedin	95	40

4.1.8 Water Consumption

The average time spent in the shower for all participants is 9.9 minutes (0.081 m^3); the average number of times per week a traveller does the laundry is 1.7 times or 0.28 m^3. On average the bath is used 1.6 times per week but only practised by 26% of participants and the highest users of the bath are the Asian tourists.

It is shown in Fig. 12 that the nationality which consumes the most water on average during their stay in New Zealand is tourists from the European countries. Australian tourists spend the least amount of time in the shower (average eight minutes), and overall use the least amount of water. This could be due to the tight water restrictions that are in place in Australia, and have carried on the same water use practises when in New Zealand.

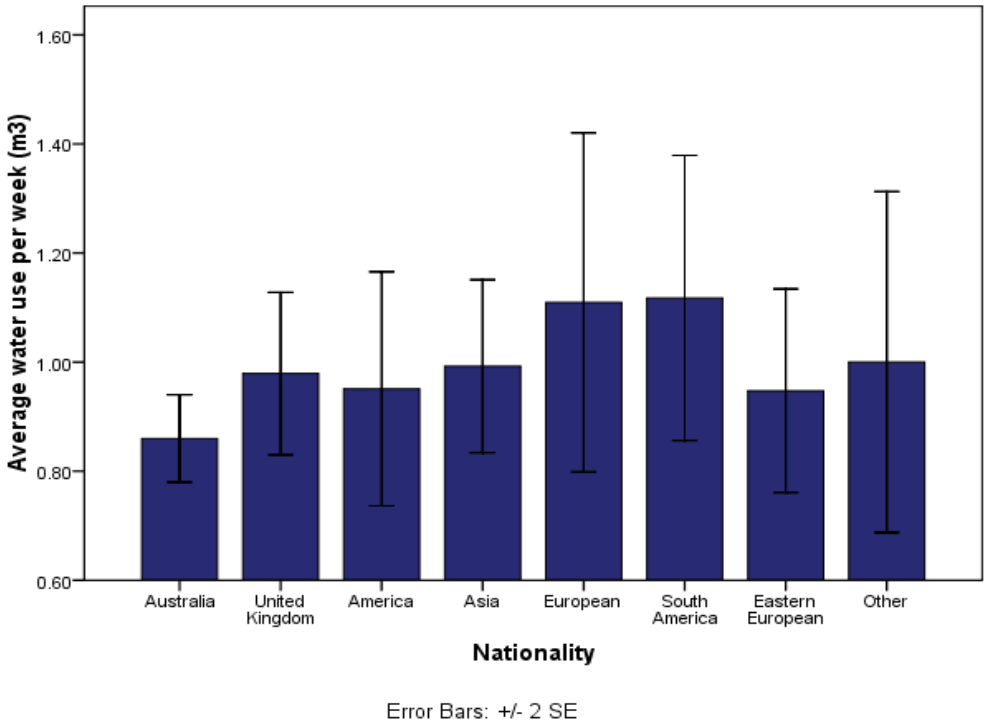


Fig. 12: Average weekly water usage (m^3) by tourists for each nationality (n = 236).

4.1.9 Diet

As shown in Table 5, only 5% of all survey participants were vegetarian. The average number of times a participant chooses to eat a certain meat type per week as shown in Table 15. On average, Australians choose not to eat pork, but will eat beef and chicken twice a week. Asian respondents chose to eat each meat type only once a week.

The number of tourists eating small, medium, or large sized meals is presented in Table 16. More Australian, American, Asians and 'Other' tourists prefered to eat larger meals than

medium or small. Tourists from the United Kingdom and Europe prefered to eat medium sized meals rather than small or large meals.

Table 15: Average number of times each nationality chooses to eat each meat type per week (n = 236).

Nationality	Beef per week	NZ Lamb per week	Pork per week	Chicken per week	Fish per week
Australia	2	1	0	2	1
United Kingdom	2	1	1	2	1
America	2	1	0	2	2
Asia	1	1	1	1	1
European	1	0	1	1	0
South American	1	1	0	2	2
Eastern European	1	0	1	2	0
Other	4	0	0	5	2

Table 16: Number of tourists from each nationality and their preferred meal sizes (n = 236).

	Small meals	Medium meals	Large meals
Australia	27	32	35
United Kingdom	13	38	24
America	5	7	9
Asia	1	4	7
European	3	10	3
South American	2	3	3
Eastern European	0	2	2
Other	1	1	4

4.1.10 Activities

The most popular activities for participants is heading out to the bar, shopping and/or casino as well as skiing and snowboarding (Table 17). This will be primarily due to the survey being conducted in Queenstown which is surrounded by three different ski fields and in September, which is towards the end of the peak ski season months. It was found that there is a 32% chance a tourist from the survey on any given day will participate in skiing or snowboarding and 38% chance a tourist will enter a bar, casino or shop. There is a nine per cent chance a tourist from the survey at any given day in the year will visit a nature attraction, and a six per cent chance a tourist will go on a boat cruise and hiking. The least common activity carried out by tourists is heliskiing. Heliskiing requires a helicopter to take participants to remote areas on the mountain slopes surrounding the Queenstown area, therefore is a costly activity and only for the experienced skiers and snowboarders.

The 'other' category consists of tourists playing golf, horse riding, paragliding, rafting, downhill mountain biking, scenic 4WD, abseiling, climbing, gondola, walking, caving and the luge which overall consists of only 11% of tourists. The energy intensities (MJ/visit) for each activity listed below in Table 17 can be found in Appendix Two.

Table 17: Number of tourists and total number of times tourists participated in activities (n = 236).

Activities	Number of tourists	Percent	Average rate/day	Likelihood the average tourist will partake in the activity (%)
Museum	110	46	0.03	3
Zoo/Wildlife/marine reserve	98	41	0.02	3
Nature Attraction	141	59	0.07	9
Hiking	133	56	0.07	6
Bungy jumping/canyon swing	79	33	0.01	1
Cinema/theatre/Maori performance	124	52	0.03	3
Ski/snowboarding	181	77	0.24	32
Historic Sites	120	51	0.06	8
Bar/Casino/Shopping	183	77	0.32	38
Fishing/Whale watching	81	34	0.01	2
Sailing	31	13	0.00	0
Jetboating	110	46	0.02	5
Heliskiing	28	12	0.00	1
Kayaking	75	32	0.01	1
Scenic Flight	53	22	0.01	2
Sky diving	67	28	0.01	0
Boat Cruise	119	50	0.03	6
Cycling	54	23	0.01	0
Other	27	11	0.01	2

4.2 Comparison of demographic survey results with International Visitors Survey (IVS) and International Visitor Arrivals (IVA).

A comparison between the International Visitors Survey (IVS) and the survey results could suggest whether or not the results represent New Zealand's international tourist market, and thus the validity of the results. The IVS data is averaged for the years 1998 – 2008, giving YE data to show the proportion of visitors through out the entire year, giving a general profile of tourist characteristics and trends.

The survey results do show some similar trends to the IVA and IVS, and overall provide a similar tourist profile to the tourism market in New Zealand. Both surveys show that Australia is the most important tourist market in New Zealand, the most common reason for visiting New

Zealand is a holiday, and a Free- Independent Tourist is the most common travelling style amongst visitors.

4.2.1 Demographics

Results from the IVA for September 2008 are; 47% of travellers arriving in New Zealand were female and 53% were male. Similarly, results from the IVS using YE Sept data (1998-2008) are that on average 46% of travellers were female and 54% were males. In this survey, 52% of respondents were female and 48% were male.

It is difficult to compare the survey's age cohort with IVA due to different methods of categorising travellers' ages, so have only used the IVS to compare survey results with. The most common age group of visitors for both the IVS and survey results is the 18 – 29 age category, and the least common age group is 60+ years, so over all show similar trends as presented in Fig. 13

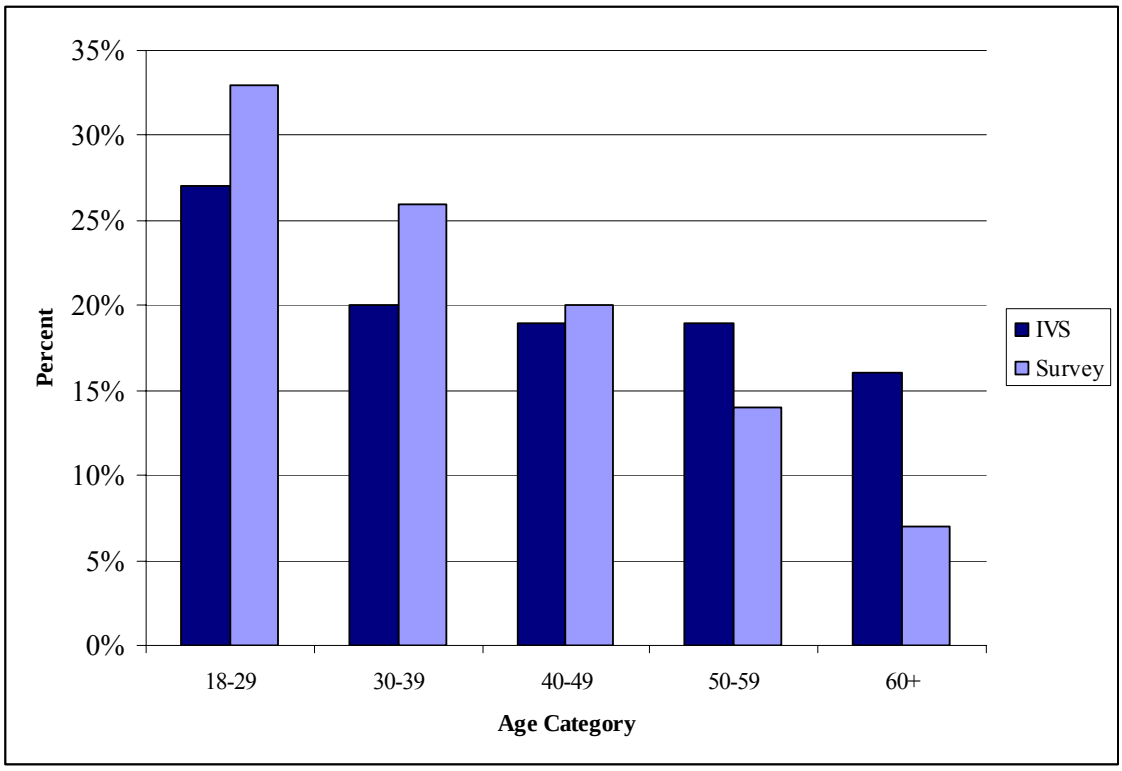


Fig. 13: Comparison of survey results (n = 236) , weighted by length of stay, with IVS using YE Sept 1998-2008 averages (n = 1,870,882) data for age categories of tourists.

4.2.2 Nationality

There are two main differences between the IVS and survey results. It is shown in Table 18 that the IVS results have a significantly smaller proportion of tourists from the United Kingdom to

the survey results. Also the European category in the IVS sample only includes Germany. The 'Other' category of the IVS sample has a fairly large proportion, so it is assumed that some of the other European countries could have been placed into the 'Other' category rather than under 'European', since individually each country may have had a fairly small sample size compared with Germany. The IVS categories did not include 'Eastern European' and 'South American' as significant categories, so therefore have also been placed in the 'Other' category.

Table 18: Numbers and percentages of visitors to New Zealand from the different nationalities using IVS, YE Sept data (n = 1,870,882) and comparing this with 2008 survey (n = 236). Survey % weighted by each respondent's length of stay.

Nationality	IVS Visitors (Avg YE Sept 98 - 08)	IVS %	Survey	Weighted Survey %
Australia	646,717	35	94	62
United Kingdom	223,814	12	76	18
North America	219,305	12	19	3
Asia	309,352	17	13	6
European*	50,239	3	16	3
Eastern European	N/A	N/A	4	0.5
South American	N/A	N/A	8	3
Other	421,455	23	6	4

Source: (Ministry of Tourism, 2009a)

*****IVS shows data from Germany only in the 'European' category, it is assumed that all other visitors from European countries are included in the 'Other' category.

4.2.3 Purpose of Visit

On average, 54% of travellers in New Zealand were in New Zealand on holiday in the IVS; however the results from the survey suggest that 83% of all tourists surveyed in Queenstown are on holiday This could be due to Queenstown attracting the holiday makers during the winter snow season. When comparing the IVS data and survey results, there is a higher proportion of tourists visiting friends and family for the IVS (24%) than this survey (1%) for the September month as shown in Table 19. The survey results had a fairly small number of business tourists also, compared with the IVS survey. Results from the IVA data giving data on international visitor arrivals during the September month, 2008 also show similar proportions to the IVS.

Table 19: Numbers of international visitors and their reason for visiting New Zealand are given using IVS YE Sept data (n = 1,870,882), are compared with Survey (n = 236). Survey % weighted by each respondent's length of stay.

Purpose of Visit	IVS (Avg YE Sept 98-08)	IVS %	Survey	Weighted Survey %
Holiday	1,007,133	54	182	83
Visit Friends And Relatives	445,869	24	5	1
Business	290,122	16	6	4
Education/Medical	57,161	3	3	1.6
Other (Working Holiday)	70,300	3.8	41	10

4.2.4 Travel Style

There are similar trends between the IVS and survey results for travelling style of tourists. Both surveys, however, show that the most common travelling style amongst the international tourists is a free-independent style and the least common is a guided package tour (Table 20). The IVA was not used to make comparisons since it does not gather data on the travelling style of tourists.

Table 20: Numbers and percentages of travelling styles in New Zealand using the IVS YE Sept data (n = 1,870,882) and comparing this with travelling styles from survey (n = 237). Survey % weighted by each respondent's length of stay.

Travelling Style	IVS (Avg YE Sept 98-08)	IVS %	Survey	Weighted Survey %
Guided Package Tour	121,907	6	8	6
Package Traveller	235,293	13	17	14
Free Independent Traveller	960,832	51	160	50
Semi Independent Traveller	552,849	30	50	28
Other	N/A	N/A	2	2

4.2.5 Length of Stay

It is shown in Fig. 14 that there are significant differences between the IVS data and results from the survey. A total of 48% of tourists surveyed in Queenstown were in New Zealand for greater than 30 days. In contrast, the results from the IVS suggest that the most number of tourists visiting New Zealand stay for less than five days as presented in Fig. 14. When comparing the other length of stay categories ranging from five days to 29 days between IVS and survey, they follow similar trends as shown in the graph. It is indicated in the IVS that the average length of stay is 21.9 days which is significantly shorter to the average length of stay from this survey which is 111 days.

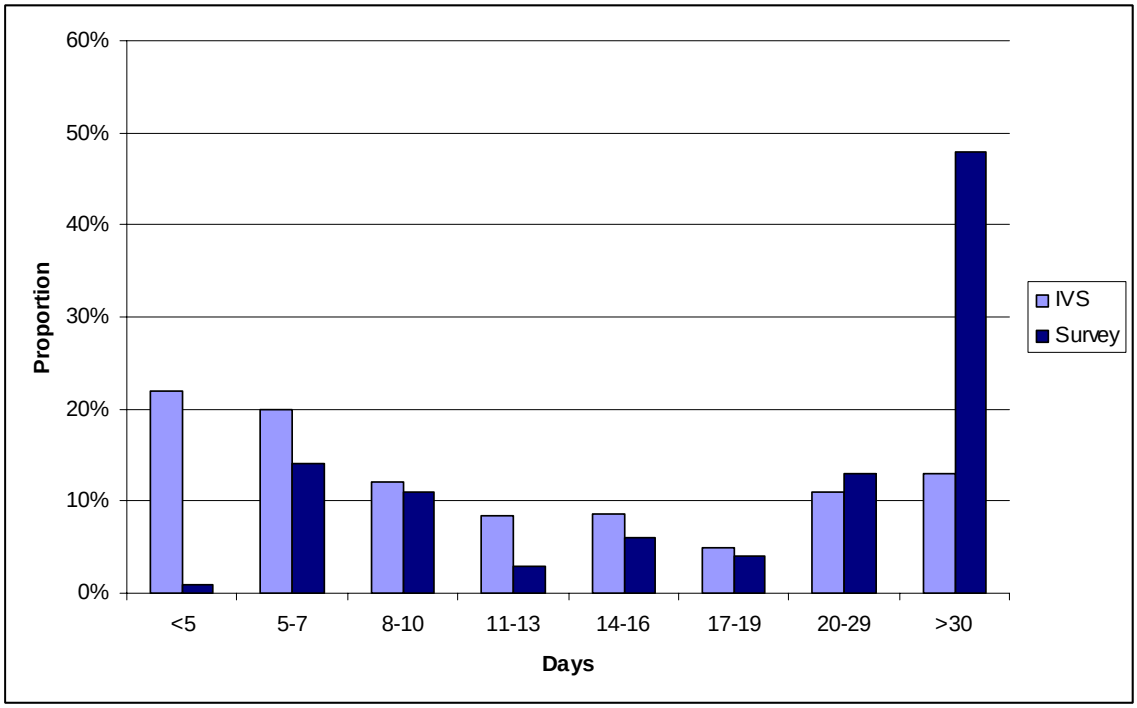


Fig. 14: Percentages of tourists and the length of stay for both data from IVS YE Sept data (N = 1,870,882) and survey (N = 237).

4.3 Ecological Footprint Analysis (EFA)

The average EF (gha) of the 236 international tourists surveyed in 2008 was 8.26 global hectares (gha) which was calculated using the information of tourists' behaviour while in New Zealand via a survey (Appendix One). The average New Zealand ecological footprint, calculated using the same calculator (Wackernagel *et al.* 2003) as this research is 5.9 gha per capita and biocapacity of New Zealand is 14.9 per capita (World Wildlife Fund, 2006).

The national average EF (gha/capita) is compared with the average EF (gha/tourist) from the 2008 survey in Queenstown in Table 21. On average the EF (gha/capita) for each nation is smaller than the average EF of tourists while in New Zealand. The amount of land required to support the lifestyle of tourists in their home country is smaller than when they visit New Zealand which is recognised in Table 21.

When comparing the ecological footprint (per capita) of the nation against the average ecological footprints from the survey, presented in Table 21, the weightings and overall calculation of the ecological footprints are different. This is due to the changes made to the calculator to take into consideration all aspects of the "tourist product" (Collier & Harraway,

2001) which are described in Chapter three. Therefore these changes need to be considered when comparing the ecological footprints of tourists and the EF of their home country.

Table 21: EF gha/capita and survey EF gha/tourist of Nationalities (excluding air travel)

Nationality	Nation's EF (gha/capita)	2008 Survey EF (gha/tourist)	N
Australia	6.6	7.8	94
United Kingdom	5.6	8.6	76
America	8.6	8.6	20
European	5.5	8.0	16
Asia	2.9	9.0	13
South American	2.1	7.7	8
Other	5.5	9.2	6
Eastern European	3.8	7.4	4
Average	**5.1**	**8.3**	**30**

(Source: World Wildlife Fund, 2006)

The Fossil Energy land (or energy footprint) was the largest component of the ecological footprint (66%) among the six land types from the survey. Food was the largest contributor out of the consumption categories to the overall EF. The second largest land type was cropland where food was the highest contributor to cropland area.

4.3.1 Main Consumption Categories for Nationality

The nationality with the highest Food EF (global m^2/day) was the 'Other' group as shown in Table 22. European tourists had a significantly smaller Food EF (global m^2) than Australia, United Kingdom, America and Other. Both Australia and Asia have a significantly larger Housing EF (global m^2) than tourists from the United Kingdom, America and Europe. It is shown in Table 22 that on average Europe has the largest Transport EF (global m^2) which is significantly larger than Americans. Lastly, Australians have the overall smallest Goods EF (global m^2) and is significantly smaller than tourists from the United Kingdom, America, Europe and South America.

Break downs of each consumption category within the EF are presented in Tables 24 to 27, and distribution of the average tourists' EF from survey is presented in Table 23. They give the average land area required to produce and absorb each resource consumed by the tourists who are categorised by nationality. A summary of the results of Tables 24-27 are presented in Table 22 below.

Table 22: Annual EF (global m^2) for each consumption category by nationality

Average EF (global m^2)	Australia	United Kingdom	America	Asia	European	South America	Eastern European	Other
Food	25,860	23,236	24,628	24,104	17,579	23,216	17,723	28,778
Housing	5,659	3,341	3,055	5,736	3,344	5,744	5,705	5,332
Transport	9,350	11,173	8,539	14,304	17,336	15,144	10,764	12,953
Goods	13,215	25,556	29,092	14,730	22,681	23,509	24,901	18,913
Services	20,343	20,693	18,683	26,989	17,674	12,332	15,380	23,900

Table 23: EF distribution for the average tourist from survey, 8.26 gha (n = 236)

Categories	Fossil Energy	Cropland	Pasture	Forest	Built-up Land	Fisheries	**Total**
Food	7.0%	12.1%	3.0%	0.0%	0.0%	4.7%	**26.7%**
Housing	4.4%	0.0%	0.0%	2.1%	0.2%	0.0%	**6.8%**
Transportation	13.6%	0.0%	0.0%	0.0%	1.4%	0.0%	**15.0%**
Goods	17.2%	1.9%	0.1%	3.8%	0.6%	0.0%	**23.6%**
Services	21.0%	0.0%	0.0%	0.0%	1.5%	0.0%	**22.5%**
Waste	3.6%	0.0%	0.0%	1.6%	0.1%	0.0%	**5.4%**
Total	**66.8%**	**14.0%**	**3.1%**	**7.6%**	**3.8%**	**4.7%**	**100.0%**

4.3.1.1 Food Ecological Footprint

The break down of the food EF and how much land is taken up by each food product, averaged for each nationality is shown in Table 24. Food is further broken down into different land types; for example, beef takes up Fossil Energy Land, Cropland and Pasture. Fish takes up Fossil Energy land and Fisheries land. It is also shown in Table 24 that both beef and fish have large land areas and are more energy intensive than dairy products or bakery products due to the substantial inputs of energy for grazing livestock, processing and food production.

Table 24: Breakdown of the annual footprints (global m^2) within food for each nationality.

Average EF/tourist (global m^2)	**Australia**	**United Kingdom**	**America**	**Asia**	**European**	**South America**	**Eastern European**	**Other**
Veggies, potatoes & fruit	635	631	633	633	631	569	605	640
Bread & bakery products	441	452	443	561	399	443	532	472
Flour, rice, noodles, cereal products	931	947	947	913	946	765	751	997
Milk, cream, yogurt, sour cream	984	983	983	950	963	754	838	1,005
Cheese, butter	513	521	540	570	565	536	756	645
Sugar	11	13	13	16	12	6	23	19
Vegetable oil	564	580	599	674	619	610	906	743
Margarine	83	83	84	100	75	65	105	96
Coffee & tea	75	74	74	73	73	62	66	76
Juice & wine	2,564	2,567	2,557	2,528	2,547	2,059	2,384	2,601
Beer	817	826	826	826	826	619	826	704
Eating out	8,548	6,031	6,090	5,724	3,270	4,673	4,376	10,618
Eggs	716	811	787	1,258	551	708	944	944
Meat								
Pork	236	328	291	831	332	114	346	50
Chicken, turkey	765	861	879	535	629	669	864	1,168
Beef	4,893	4,270	4,552	4,017	3,594	2,743	3,402	4,523
Fish	3,086	3,259	4,330	3,895	1,547	7,821	0	3,476
Food Total EF (global m^2) Avg	**25,860**	**23,236**	**24,628**	**24,104**	**17,579**	**23,216**	**17,723**	**28,778**

4.3.3.2 Housing Ecological Footprint

The housing category of the ecological footprint encompasses the energy requirements of running an accommodation business only, which is shown in Table 25. These data were obtained from Becken & Cavanagh (2003) and Becken *et al.* (2001), and provide a breakdown of what each accommodation type uses for their sources of energy and consequently each type uses different quantities of fuel sources. It is shown in Table 25 that electricity holds the largest land area for each tourist in all nationalities and Natural Gas is also a significant contributor to the overall housing EF.

Table 25: Breakdown of average annual footprints (global m^2) for energy requirements of accommodation.

Average EF/tourist (global m^2)	Australia	United Kingdom	America	Asia	European	South America	Eastern European	Other
Electricity (Kwh)	3,176	2,036	1,855	3,320	2,161	3,210	3,322	3,865
Natural gas	1,325	265	197	1,167	52	1,158	1,149	362
Liquid Petroleum Gas (LPG)	298	109	97	273	83	280	291	152
Firewood	69	31	30	62	28	68	74	35
Coal*	0	0	0	0	0	0	0	0
Water Use (m^3)	791	900	875	914	1,021	1,028	870	919
Housing Total EF (global m^2) Avg	**5,659**	**3,341**	**3,055**	**5,736**	**3,344**	**5,744**	**5,705**	**5,332**

***Coal was excluded from table, because numbers were so small.

4.3.3.3 Transport Ecological Footprint

The ecological footprints for transport are calculated using data on how far (Kilometres) each tourist travelled for each mode of transport. Domestic air is the most energy intensive form of transport; however, tourists travelling in a private or rented car and/or minibus/van travelled long distances so generally have an overall larger EF (gm^2/tourist) as shown in Table 26.

Table 26: Breakdown of average annual footprints (global m^2) for transport modes.

Average EF/tourist (global m^2)	Australia	United Kingdom	America	Asia	European	South America	Eastern European	Other
Bus (around town)	161	46	34	275	100	93	111	343
Bus (intercity)	155	800	10	227	76	201	82	347
Train (intercity)	211	6	18	29	26	186	0	413
Car (private or rented)	6,154	4,383	3,056	1,083	9,967	3,014	4,428	8,050
Minibus/van	1,744	2,374	1,946	8,990	3,612	7,768	2,393	0
Airplane	877	3,461	3,461	3,558	3,429	3,882	3,720	3,752
Sea Transport (ferry)	49	102	13	143	126	0	30	48
Transport Total EF (global m^2) Avg	**9,350**	**11,173**	**8,539**	**14,304**	**17,336**	**15,144**	**10,764**	**12,953**

4.3.3.4 Goods Ecological Footprint

As already mentioned, the goods EF is comprised of two aspects of a tourist's trip. Firstly, it consists of goods that are purchased during their stay and secondly, it encompasses the "use" of

goods such as furniture and appliances by tourists. The "Goods" category is broken down into wooden and plastic/metal furniture, major appliances and electronic equipment are all footprints for tourist "use" while in New Zealand, not purchases as shown in Table 27. The "use" of these goods encompasses larger EF areas than purchased goods which is also shown in Table 27.

Table 27: Breakdown of average annual footprints (global m^2) for Goods 'Use' and 'Purchases' by tourists.

Average EF/tourist (global m^2)	Australia	United Kingdom	America	Asia	European	South America	Eastern European	Other
Clothes and textiles								
cotton	1,226	1,502	1,523	876	1,568	1,767	1,522	2,331
wool	399	412	609	371	267	446	222	1,549
Furniture (wooden)	2,172	4,488	5,300	2,614	3,990	4,108	4,526	2,870
Furniture (plastic/metal)	1,166	2,428	2,890	1,412	2,174	2,232	2,439	1,536
Major appliances	4,416	9,201	10,283	5,349	8,235	8,455	9,240	5,821
Computers and electronic equipment	2,717	5,659	6,734	3,290	5,064	5,200	5,683	3,581
Small appliances	488	995	1,185	585	882	908	970	645
Newspaper/books/paper products	419	344	325	63	131	322	71	122
Metal items, tools	48	22	19	11	29	16	23	26
Medicine	51	60	93	19	47	14	48	0
Hygiene products, cleaning stuff	107	124	45	51	111	42	67	388
Cigarettes, other tobacco products	5	322	85	90	185	0	89	43
Goods Total EF (global m^2) Avg	**13,215**	**25,556**	**29,092**	**14,730**	**22,681**	**23,509**	**24,901**	**18,913**

4.3.3.5 Services Ecological Footprint

There are also two aspects to the Services EF. The first section of services encompasses the land area for laundry, telephone and insurance services as shown in Table 28. The second part of the Services EF is attractions and activities carried out by tourists during their stay. It can also be seen in Table 28 which attractions and activities are the most energy intensive for example Heliskiing (1300 MJ/tourist) so have a relatively large EF each time a tourist went Heliskiing. The size of the land area for each activity or attraction also reflects the number of times each tourist participated in the activity. For example ski/snowboarding was a common activity amongst all nationalities, averaging 22 times per trip for each tourist, so therefore have a large land area.

Table 28: Breakdown of average annual footprints (global m^2) for Services, Attractions and Activities.

EF Average/tourist (global m^2)	Australia	United Kingdom	America	Asia	European	South America	Eastern European	Other
Dry cleaning or external laundry service ($)	415	949	92	613	667	1,839	828	2,023
Telephone ($)	580	679	975	128	422	360	307	1,431
Medical insurance and services ($)	5,244	1,933	871	3,720	2,560	521	5,028	8,584
Entertainment/Activities/Attractions								
Museum	77	93	47	15	160	111	26	141
Historic sites, Parliament buildings, marae	78	58	30	0	33	72	42	134
Zoo/wildlife/marine park	97	94	62	111	96	137	36	82
Amusements (gondola ride, tram ride, cable car)	7	0	0	0	0	0	0	0
Nature Attraction (geothermal attraction, glow worm caves)	192	104	172	43	269	449	95	380
Performance (cinema, concert, Maori performance, theatre)	72	144	102	50	107	164	180	61
Entertainment (bar, casino, shopping, sport)	371	1,151	680	358	620	461	333	670
Scenic Flights	1,065	696	65	1,737	326	651	543	1,737
Air activities (air sports, whale watching by air)	294	1,748	525	226	1,066	1,377	677	1,083
Sailing	74	245	161	0	27	0	224	0
Jet boating	1,510	1,115	348	955	330	455	452	1,206
Boat Cruises	2,532	1,324	383	764	1,082	678	904	603
Motorised water activity (sea fishing, whale watching)	802	906	1,628	2,864	2,340	2,500	528	0
Heliskiing	743	1,254	1,046	8,303	104	490	0	0
Adventure activites: (bungy, climbing, kayak, mountain biking, luge, ski/snowboard, 4WD sport)	3,535	5,290	4,646	6,119	4,632	1,280	4,023	2,694
Guided walk	2,562	2,768	6,656	984	2,703	667	1,054	2,529
Nature activities (cycling, dolphins, horse riding, golf, lake/river fishing, walking, wildlife)	92	144	193	0	130	118	102	542
Services Total EF (global m^2) Avg	**20,343**	**20,693**	**18,683**	**26,989**	**17,674**	**12,332**	**15,380**	**23,900**

4.3.2 Nationality

The average EF (gm^2/day) for each nationality and their standard deviations are shown in Fig 15. The nationality with the highest EF (gha/tourist/day) is the 'Other' category and tourists from Asia (0.025gha/tourist/day) as presented in Fig. 15. 'Other' tourists come from South Africa, United Arab Emirates, New Caledonia and Malaysia. This category consists of only six tourists, so has a fairly small sample size, and therefore not an entirely accurate depiction of the EF (gha/day) size for an 'Other' category. However, the survey results for the 'Other' category are consistent with CAM results from the Ministry of Tourism, where only three per cent of all tourists visiting Queenstown during the September month belong to the 'Other' category as shown in Table 7. Tourists from America and the United Kingdom follow close behind with a mean EF of 0.024 gha/tourist/day.

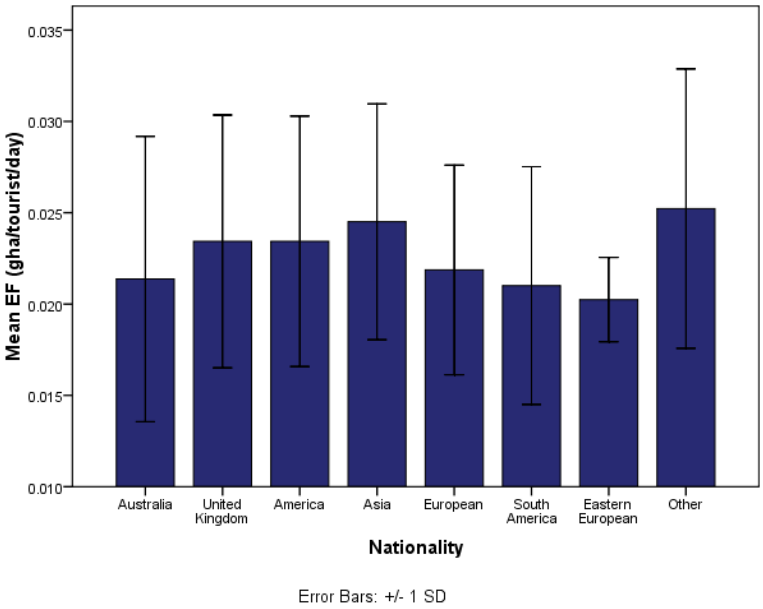


Fig. 15: Average EF (gha/tourist/day) for each nationality group.

When comparing the nationalities against two income categories (High and Low) America and Australia had a higher 'Low' ecological footprint than the 'High' category as shown in Fig. 16. Nationality is compared against the two income categories, and found that there was no significant differences between the means EF (gha) for different nationalities (df: 9, F-value: 1.011, Sig: 0.432); however, the differences between low and high income categories are valid.

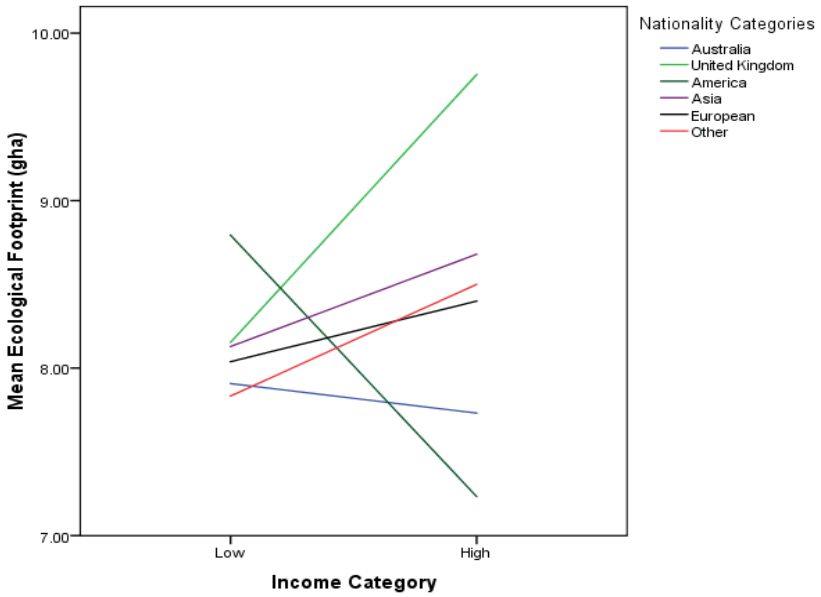


Fig. 16: 'High' and 'Low' Income ecological footprints for each nationality.

4.3.2.1 Land Use by Nationality

The average EF (global m^2/day) for each land use type are presented in Table 29. The 'Other' category had a significantly higher Cropland EF (global m^2/day) than tourists from Europe and South America. Australian tourists have a significantly higher Pasture EF (global m^2/day) than tourists from the United Kingdom, Europe and South America. In contrast, Australians have a significantly smaller Forest EF (global m^2/day) than tourists from the United Kingdom, America and Europe. Lastly the nationality with the highest fisheries EF (global m^2/day) are tourists from South America (22.7 global m^2/day) which was significantly higher than tourists from Australia, United Kingdom, Europe and Eastern. There were no significant differences by nationality for either Fossil Energy or Built-up Land EF (global m^2/day).

Table 29: Land Use EF (global m^2/day) for each nationality.

Nationality	Fossil energy	Cropland	Pasture	Forest	Built-up Land	Fisheries
Australia	136.5	35.0	9.1	13.2	8.4	11.4
United Kingdom	155.9	33.1	7.5	18.6	8.4	10.9
America	153.0	32.4	7.7	19.3	7.6	13.7
Asia	160.8	32.8	7.1	15.0	9.6	12.5
European	152.4	28.2	6.0	17.6	9.6	4.8
South America	134.0	24.7	4.8	15.8	8.1	22.7
Eastern European	142.4	29.7	5.9	17.0	7.4	0.0
Other	164.5	40.5	9.3	16.2	10.1	11.8

4.3.5 Income

Overall, the EF increases as income increases (Fig. 17); however, there is much variation. For example, respondents in the $60,001-$80,000 category have a lower median EF than those in $40,001-$60,000 category as shown in Fig. 17. As income increases from $80,000 onwards there is a slight increase in EF. It is shown in the results that tourists with a $200,000+ income have a significantly higher EF than tourists with an income ranging from <$20,000 to $100,000. These relationships can be seen in the box-plot in Fig. 17 (df: 9, F-value:1.668, Sig:0.098).

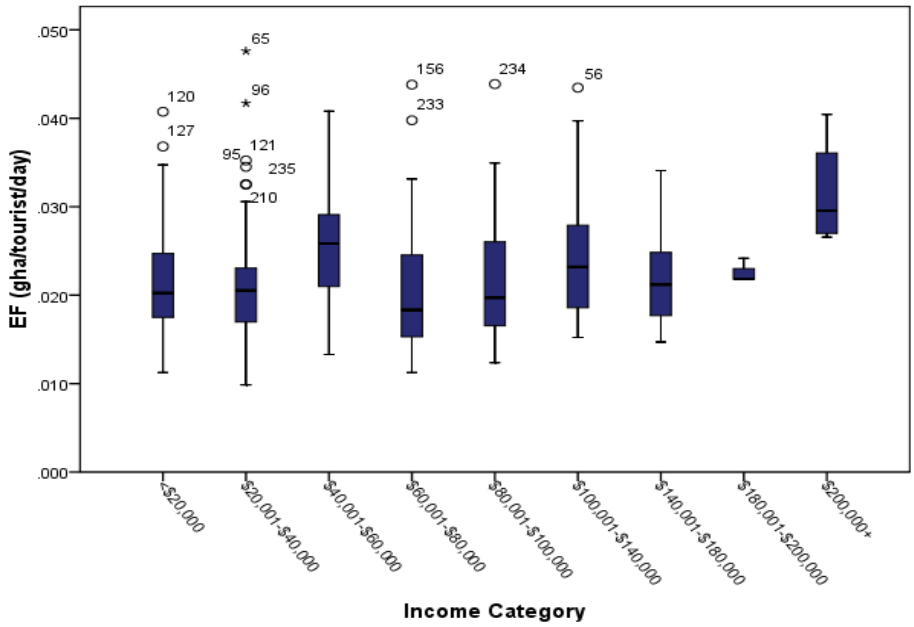


Fig. 17: Box plot showing the median and range of EF (gha/day) for each income category.

The income data are further categorised into 'low', 'mid' and 'high' categories, based on the size of the respondents' income. The means for each category which shows that income does influence the ecological footprint size are presented in Table 30. Results show that the tourists that fit in the 'High' income category have a significantly higher EF (gha) than 'low' income tourists (0.027<0.05), the means are presented in the table below.

Table 30: Average ecological footprints (gha) for each income category.

Income Category	Mean EF (gha)	Std. Deviation	Total N
Low	7.80 ± 0.24	2.15	80
Mid	8.22 ± 0.28	2.84	116
High	8.97 ± 0.45	2.75	35

High income tourists tend to stay longer than low income tourists (Table 31). Tourists with a 'high' income stay in New Zealand on average 29 days. While 'low' income tourists stay on average 162 days.

Table 31: Number of tourists in each income category and length of stay.

Length of Stay	Low	Mid	High
Short stay (<30 days)	18	80	32
Long stay (>30 days)	62	36	3

4.3.5.1 Main Consumption Categories of Income

The mean EF for income and the EF categories. For Food and Housing, the $200,000+ income EF (global m^2/day) was significantly higher than <$20,000 -$100,000 income categories, as

shown in Table 32. In contrast, the <$20,000 had the highest Goods EF (global m^2) and was significantly higher than the $60,000 -$200,000+ income categories. There were no significant differences amongst the income categories for both the Transport and Services EF (global m^2/day) which can be seen in Table 32.

Table 32: Average consumption categories EF (global m^2/day) of income categories.

Income Category	Food EF	Housing EF	Transport EF	Goods EF	Services EF)
<$20,000	62.3	10.0	21.7	57.9	46.6
$20,001-$40,000	58.9	10.1	25.9	53.7	57.3
$40,001-$60,000	64.1	10.9	38.2	52.7	73.6
$60,001-$80,000	66.6	16.2	32.7	36.9	45.9
$80,001-$100,000	68.3	15.1	30.5	36.4	52.8
$100,001-$140,000	75.0	19.7	34.2	28.2	69.5
$140,001-$180,000	95.8	15.5	27.5	26.3	43.5
$180,001-$200,000	101.4	14.0	9.5	27.6	58.6
$200,000+	98.7	22.6	52.6	27.8	98.9

4.3.5.2 Land Use by income

It is shown in Table 33 that Fossil Energy was the largest overall land area (gm^2/day) and Built-Up land had the smallest amount of land area for income categories. The $200,000 income category had a significantly higher Fisheries EF (global m^2/day) than <$20,000 to $140,000 income categories. The <$20,000 had a significantly higher Forest EF (global m^2/day) than income ranging from $60,000 to $180,000.

Table 33: EF (global m^2/day) land area for each income category.

Income Category	Fossil energy	Cropland	Pasture	Forest	Built-up Land	Fisheries
<$20,000	144.6	32.7	6.9	17.5	7.4	11.0
$20,001-$40,000	151.9	32.2	7.1	16.0	8.7	8.4
$40,001-$60,000	181.3	35.2	8.2	16.7	11.4	8.9
$60,001-$80,000	144.0	33.8	9.8	14.0	8.8	10.1
$80,001-$100,000	147.7	33.8	8.1	13.7	8.5	12.3
$100,001-$140,000	166.8	37.1	9.6	12.8	10.1	12.2
$140,001-$180,000	136.1	43.1	10.4	12.2	7.4	19.7
$180,001-$200,000	128.1	43.3	10.3	10.8	5.9	26.9
$200,000+	214.4	40.4	11.8	11.7	13.2	28.4

4.3.3 Travel Styles

Semi-Independent travellers had the largest average EF (0.024 gha/tourist/day) followed closely by Free-Independent Travellers (0.023 gha/tourist/day) as shown in Fig. 18. FIT and SIT have a significantly higher EF (global m^2/day) than Package Travellers (Sig: 0.002 and 0.004 respectively <0.05). (df: 4, F-value: 3.039, Sig: 0.018).

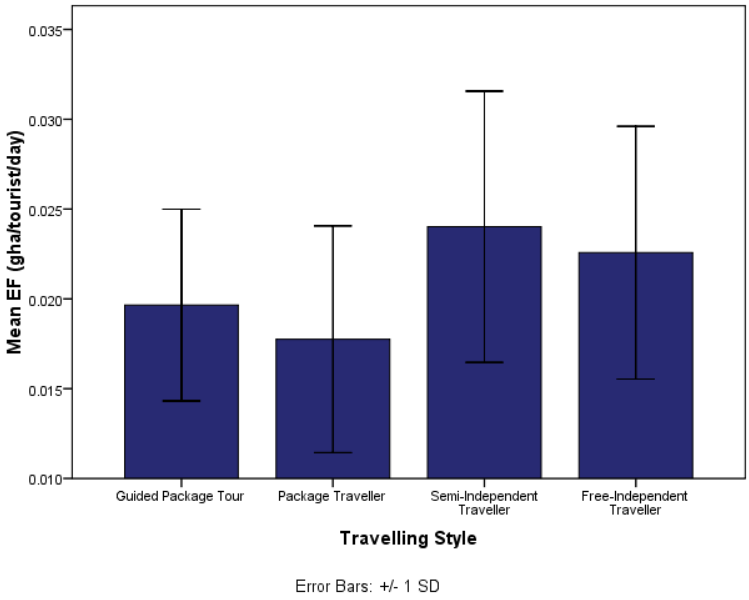


Fig. 18: Average ecological footprint (gha/day) with standard error for each travelling style.

4.3.3.1 Main Consumption Categories of Travel Styles

The average consumption categories EF (global m^2/day) for the different travelling styles of tourists as presented in Table 34. The FIT and SIT tourists had significantly higher Transport and Goods EF (global m^2/day) than Package Traveller tourists. FIT tourists had significantly smaller Housing EF (global m^2/day) than the Guided Package Travellers (0.002<0.05). Also SIT tourists had a significantly larger Food EF (global m^2/day) than the FIT (0.003<0.05). Lastly, there were no significant differences between any of the travel styles and the services EF (global m^2/day).

Table 34: Average consumption categories EF (global m^2/day) for each travel style

Travelling Style	Food EF	Housing EF	Transport EF	Goods EF	Services EF	Total N
Guided Package Tour	79.6	21.8	8.5	27.3	44.5	8
Package Traveller	70.2	16.8	11.2	11.7	53.2	17
Semi-Independent Traveller (SIT)	75.0	15.8	30.8	40.0	63.7	50
Free-Independent Traveller (FIT)	62.4	11.4	30.0	51.3	52.8	159

4.3.3.2 Land Use by Travel Style

The fossil energy land has by far the largest EF (global m^2/day) against all land types, and the SIT was the largest consumer of fossil energy land, followed closely by the FITas shown in Table 35. The FIT and SIT (0.008 and 0.005 respectively <0.05) travel styles had a significantly larger fossil energy land area than the Package Traveller. The SIT had a significantly larger cropland area and fisheries area than the FIT (0.013 and 0.030 respectively <0.05). The Package Traveller had a significantly larger Pasture land area than the FIT (0.015<0.05). For built-up

land both the FIT and SIT have significantly larger land area than both the Guided Package Tour and the Package Traveller. Lastly for the forest land area it was found that FIT and SIT travellers had a significantly larger forest EF (global m^2/day) than the Package Traveller.

Table 35: Average land use areas (global m^2/day) and travel styles.

Travelling Style	Fossil energy	Cropland	Pasture	Forest	Built-up Land	Fisheries
Guided Package Tour	117.7	38.4	9.9	13.2	4.9	12.5
Package Traveller	108.7	34.9	10.1	10.1	5.4	8.3
Semi-Independent Traveller	156.5	35.9	8.6	15.0	9.2	14.9
Free-Independent Traveller	149.5	32.0	7.5	17.2	8.8	10.3

4.3.4 Purpose of Visit

Tourists visiting New Zealand for educational purposes had the largest EF (global m^2/day) (0.026 gha/day), as shown in Fig. 19; however, there were only 3 tourists under the education category, so is not a significantly robust sample. Both the Business and Visiting Friends and Family sample sizes are also significantly small (n = 6 and n = 5 respectively), so therefore are not robust sample sizes for statistical analysis. Tourists on a Holiday had a significantly larger EF than tourists in New Zealand on a Working Holiday (0.016<0.05). (df: 4, F-value: 1.693, Sig: 0.152).

It was found that tourists in New Zealand on a Working Holiday will stay longer than any other category because 95% of Working Holiday tourists stay longer than 30 days, averaging 256 days in New Zealand. In comparison, Holiday tourists stay in New Zealand an average of 80 days.

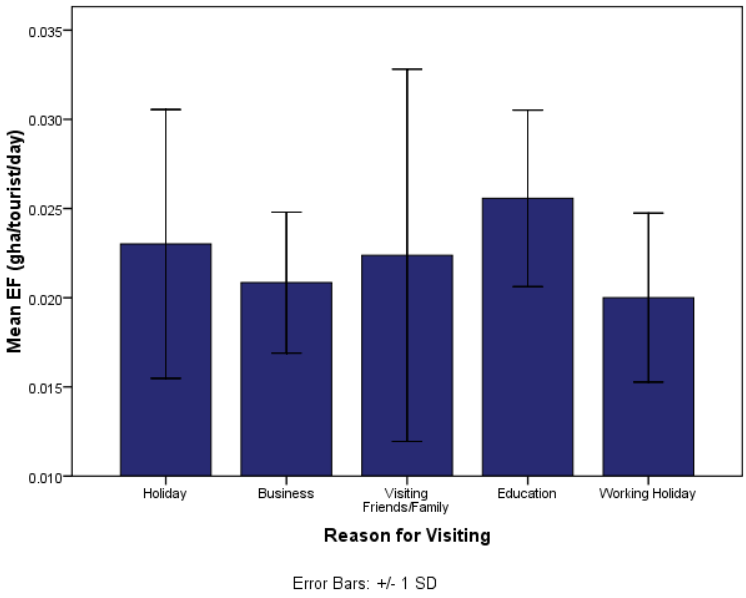


Fig. 19: Average EF (gha/day) for each Purpose of Visit with the standard errors.

4.3.4.1 Main Consumption Categories for Purpose of Visit

There were no significant differences between any of the purpose of visit categories for the food consumption category in the results in Table 36. However, Holiday tourists were generally significantly larger than Working Holiday tourists (except Goods) for all other consumption categories (Housing = 0.02, Transport = 0.008, Goods = 0.000 and Services = 0.004 <0.05). Tourists who were visiting friends and family had a significantly higher transport and housing EF than tourists on a working holiday. It is also shown in Table 36 that tourists visiting friends and family had the largest Housing EF (24 global m^2/day).

Table 36: Average consumption category EF (global m^2/day) against Purpose of visit

Purpose of Visit	Food EF	Housing EF	Transport EF	Goods EF	Services EF	Total N
Holiday	68.0	13.6	30.2	42.9	59.8	182
Business	55.1	16.0	27.6	51.8	43.6	6
Visiting Friends/Family	55.9	24.0	47.6	25.8	56.5	5
Education	68.6	13.9	23.8	66.3	66.3	3
Working Holiday	61.6	8.7	15.6	64.1	35.0	40

4.3.4.2 Land Use by Purpose of Visit

When looking at the land use (global m^2/day) component of the total ecological footprint against purpose of visit, which is shown in Table 37, there were only a few important factors to note. There were no significant differences between the means of cropland, pasture and fisheries land area. For fossil energy and built up land, tourists in New Zealand on holiday had a significantly larger land area than the working holiday tourists (fossil energy = 0.019 and built-up land = 0.001 <0.05). The fossil energy EF (149.3 global m^2/tourist/day) was the largest component of the total EFs for all reasons to visit New Zealand. Overall, pasture holds the smallest land area for each tourist which averages out to be 7.7 gm^2/tourist/day.

Table 37: Land use area (global m^2/day) for Purpose of Visit.

Reason for Visiting	Fossil energy	Cropland	Pasture	Forest	Built-up Land	Fisheries
Holiday	151.3	33.8	8.3	15.5	9.1	11.6
Business	141.6	28.8	7.2	16.9	7.3	6.7
Visiting Friends/Family	157.4	32.5	7.3	11.8	10.2	4.6
Education	169.6	36.8	9.0	21.4	8.1	10.9
Working Holiday	126.4	31.5	6.8	18.0	5.7	11.0

4.3.6 Age

Tourists aged between 50-59 years had the largest EF (gha/day) compared to any other age category, as shown in Fig. 20. Tourists in this 50-59 age cohort had a significantly higher EF (gha/day) than ages between 18-39 years. The 60+ age group had the lowest overall EF (gha/day); however, the 60+ category only had a fairly small sample size (n=10) (df: 5, F-value: 1.527, Sig: 0.182).

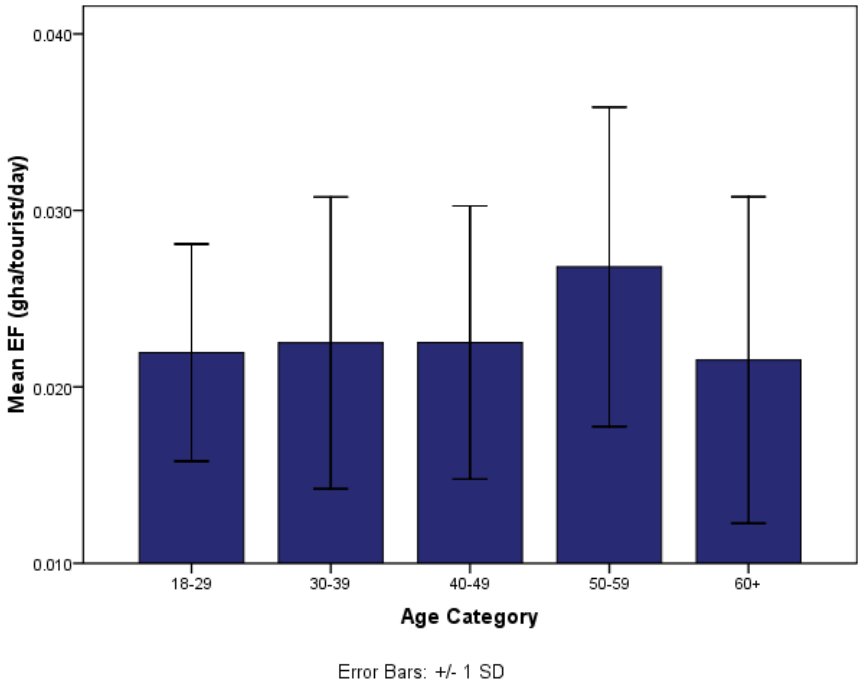


Fig. 20: Bar chart of the EF (gha/day) for each age group.

A two-way ANOVA was conducted on the average EF (gha) of gender against age, presented in Table 38 below. Overall females have a smaller EF (gha) than males, except for the 50-59 age category.

Table 38: Cross tabulation of the average EF (gha) of age and gender.

	18-29	**30-39**	**40-49**	**50-59**	**60+**	
Gender	Mean EF (gha/tourist)	Mean EF (gha/tourist)	Mean EF (gha/tourist)	Mean EF (gha/tourist)	Mean EF (gha/tourist)	Total Average
Female	7.7	7.93	7.85	9.89	7.06	8.17
Male	8.3	8.48	8.57	9.71	11.00	8.96
Total Average	8.02	8.20	8.21	9.80	9.03	

4.3.6.1 Main Consumption Categories of Age

The older age groups from 40 years and older had a significantly larger Food EF (global m^2/day) than ages ranging from 18-39 (0.034 and 0.000<0.05). The 18-29 age category is also significantly smaller than ages ranging from 30-59 years old for Transport, Housing and Services EF (global m^2/day). In contrast the 18-29 age category had a significantly larger Goods EF (global m^2/day) than all other age categories (30-60+ years old). A cross – tabulation of these main consumption categories against each age group is presented in Table 39.

Table 39: Average EF (global m^2/day) of consumption categories for age categories.

Age Category	Food EF	Housing EF	Transport EF	Goods EF	Services EF
18-29	63.8	10.5	22.5	55.5	51.3
30-39	60.6	15.1	35.8	40.2	58.9
40-49	74.3	18.2	39.6	24.7	53.5
50-59	86.9	19.1	34.7	30.3	82.7
60+	74.1	19.3	28.2	31.2	47.9

4.3.6.2 Land Use by Age

The mean land use area for each age category: comparisons between these age groups are made using a One-way ANOVA LSD test is conducted on the data presented in Table 40. The 50-59 age category generally had a significantly higher Fossil Energy, Cropland and Fisheries EF (global m^2/day) than the 18-29 age category. Tourists who are 50-59 years old also had a significantly higher Pasture land EF (global m^2/day) than all other age groups. For Fisheries, the 60+ category had a significantly higher land EF (global m^2/day) than ages ranging from 18-39. Lastly tourists who are aged between 18 and 29 have a significantly higher Forest EF (global m^2/day) than all other age groups.

Table 40: Land use EF (global m^2/day) by age categories.

Age Category	Fossil energy	Cropland	Pasture	Forest	Built-up Land	Fisheries
18-29	142.6	32.8	7.5	17.6	7.5	10.6
30-39	152.8	33.0	8.1	14.4	9.5	7.2
40-49	145.5	35.4	8.5	12.7	10.3	12.7
50-59	177.4	38.0	10.8	13.4	10.6	17.7
60+	134.4	29.3	8.3	13.7	8.5	21.0

4.3.7 Gender

It is shown in Fig. 21 that on average the male tourist had a larger average EF (0.023gha/day or 8.53gha/tourist) than female tourists (0.022gha/day or 7.9 gha/tourist). A one-way ANOVA using LSD shows that the difference between the means is not significant (df: 1, F-value: 3.525, Sig: 0.062).

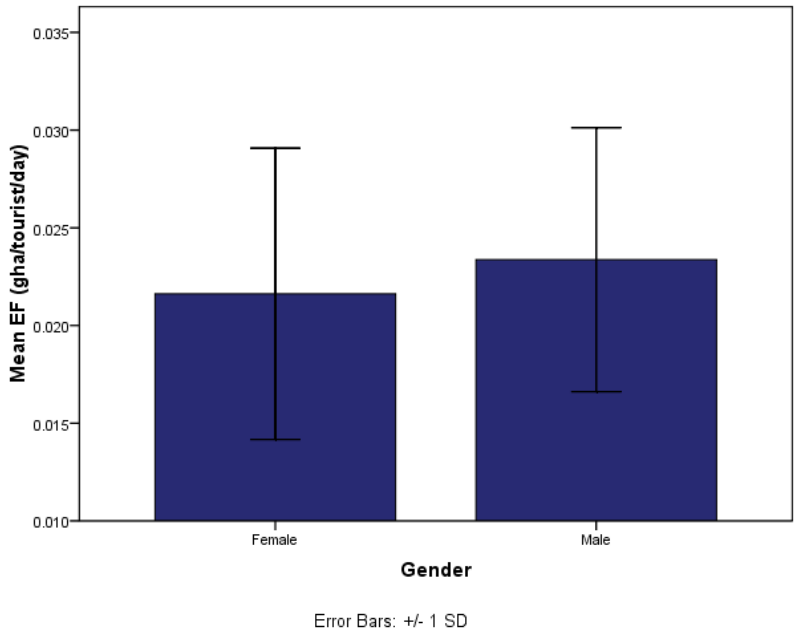


Fig. 21: The average EF (gha/day) for each sex.

On average, the male tourists have a larger EF (global m^2/day) for all consumption categories, in particular, males had a significantly higher Food EF (global m^2/day) than females (0.009<0.05) as shown in Table 41. The only exception was that female tourists had a larger Goods EF (global m^2/day) than males.

Table 41: Consumption category EF (global m^2/day) for each sex.

Sex	Food EF	Housing EF	Transport EF	Goods EF	Services EF
Female	62	12	28	49.5	50
Male	71	14	28	43.7	61

Males had a significantly higher Cropland and Pasture EF (global m^2/day) than females (0.000<0.05). Again overall male tourists had a larger EF (global m^2/day) than females except for the forest land use where females are slightly higher as shown in Table 42.

Table 42: Land Use EF (global m^2/day) for each sex.

Gender	Fossil energy	Cropland	Pasture	Forest	Built-up Land	Fisheries
Female	142	30.8	6.9	16.4	8.1	12.2
Male	153	35.9	9.2	15.7	8.9	10.2

4.3.8 Length of Stay

The length of stay is divided into two groups, short stay and long stay, which are shown in Fig. 22. The short stay tourists are tourists who stay in New Zealand for less than and up to 30 days

(n= 135); long stay tourists stay longer than 30 days (n=101). The short stay tourists had a higher EF (0.023 gha/day) than long stay tourists EF (0.021 gha/day) as shown in Fig. 22. After conducting a one-way ANOVA on the two means, the difference is found to be significant (df: 1, F-value: 4.963, Sig: 0.027).

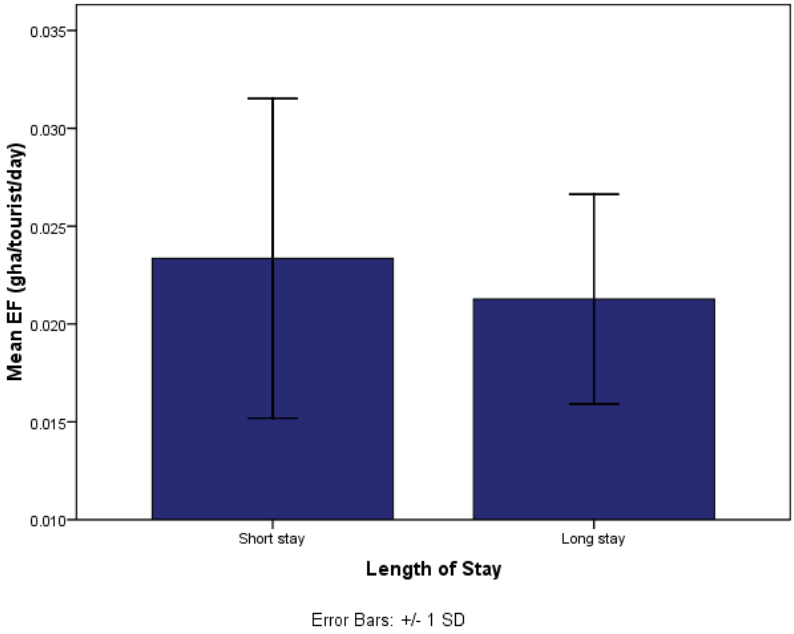


Fig. 22: The average EF (gha/day) for short stay and long stay tourists.

A slight negative linear regression of the EF (gha/tourist/day) which declines as the number of days spent in New Zealand increases is shown in Fig. 23.

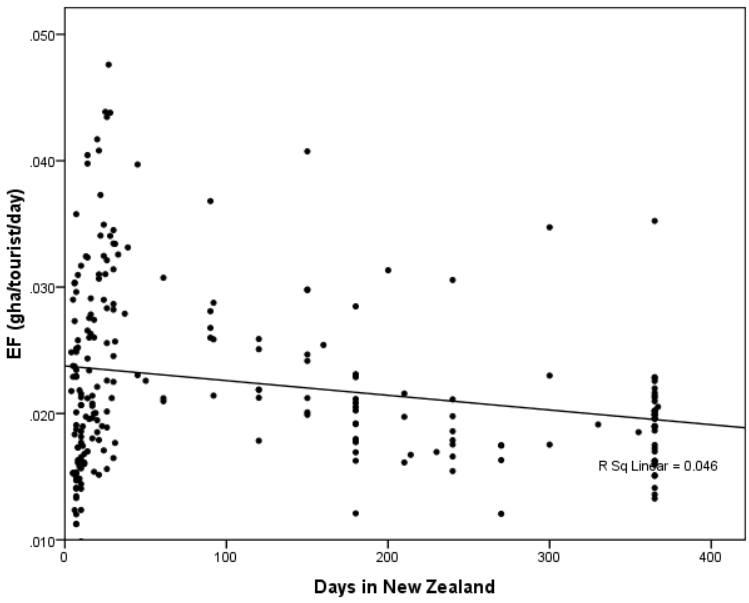


Fig. 23: Scatterplot showing the negative regression of EF (gha/day) and length of stay.

A comparison between length of stay and the average EF for each of the main consumption categories, tourists who stay in New Zealand for less than and up to 30 days generally had a larger EF (global m^2/day) than the tourists staying longer than 30 days, is presented in Table 43 below. For Housing, Transport and Services EF (global m^2/day), the short stay tourists are significantly larger than the long stay tourists. However in contrast to this, the long stay tourists had a significantly larger Goods EF (global m^2/day) than short stay tourists (0.000<0.05).There was no significant difference between the means for Food EF (global m^2/day).

Table 43: Average consumption categories EF (global m^2/day) for the length of stay

Length of Stay	Food EF	Housing EF	Transport EF	Goods EF	Services EF
Short stay	71	16	35	32	65
Long stay	61	9	18	76	42

Tourists who stayed for a short time had a significantly larger EF (global m^2/day) for Cropland, Pasture, Built-up land and Fossil Energy (.003, .001, .000 and .027 <0.05 respectively) as shown in Table 44. Once again, the forest land use EF (global m^2/day) is the exception where the long stay tourists had a significantly larger EF (global m^2/day) for forest land than the short stay tourists (0.000<0.05).

Table 44: Average land use EF (global m^2/day) for length of stay.

Length of Stay	Fossil energy	Cropland	Pasture	Forest	Built-up Land	Fisheries
Short Stay	154.8	34.9	8.8	13.5	9.9	11.7
Long Stay	137.1	31.1	6.9	19.5	6.6	10.6

4.4 Multivariate Statistical Analysis

4.4.1 Consumption Categories

The two axes; on the ordination plots in Fig. 24 and Fig. 25 explains 55% of the variance (32.8% on axis 1 and 23% on axis 2) of EF for tourists. Fig. 24 is a graphical representation of Table 45. The graph presents 55% of the variation in the consumption categories for the respondents. Each point is the correlation coefficient of the individual EF, and the consumption categories marked on the graph show why each marker is placed where it is. For example the high income tourists are scattered to the left of the graph where Housing and Food vectors lie, which means Housing and Food explains the variance of high income tourists. There is a mix of both high and low income tourists with Services and Transport, so regardless of income, both tourist types will spend time and money on both. The Goods component explains the majority of the low income variations.

In both Fig. 24 and Fig. 25, Services and Goods are at a 90˚ angle to each other. This means the two categories are independent of each other and in no way related. However the relationship between Goods and Housing is negative because their angle is greater than 90˚, therefore a tourist who spends lots on Goods will spend time in a low EF accommodation such as a Backpackers. The length of the vector is an indication of how well the category explains the variation of the EFs. The Food vector is shorter than the other vectors. This means that the variation in EFs is not well explained by the first two principal components, as for categories with long vectors (Goods) The correlation matrix shown in Table 46 present the strength of the relationship between the consumption categories. It is shown in Table 46 that the relationship between Goods and Housing is -0.4694 which is a strong negative correlation. In contrast, the relationship between services and housing is 0.05213 which is a weak positive relationship.

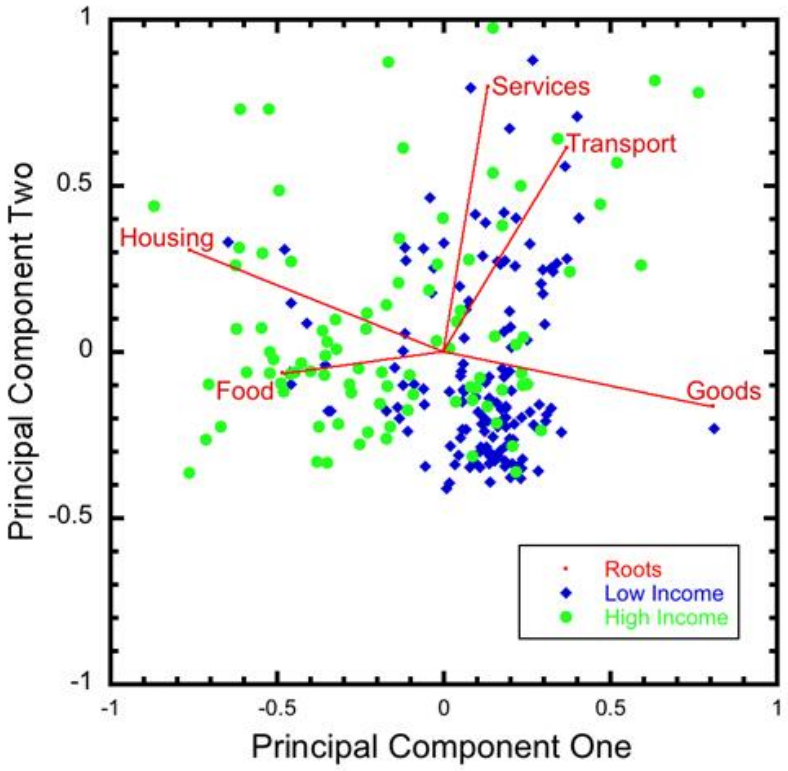


Fig. 24: Ordination plot for consumption category EF variables and 'high' and 'low' income.

Table 45: Principal component correlation coefficients for the consumption categories as plotted on fig 25 and fig 26.

Axis:	1	2
Food	-0.482	-0.065
Housing	-0.761	0.307
Transport	0.3709	0.615
Goods	0.8098	-0.163
Services	0.133	0.797

Table 46: Correlation Matrix Consumption Categories.

	Food	Housing	Transport	Goods	Services
Food	1	0.126	-0.083	-0.208	-0.039
Housing	0.126	1	-0.109	-0.469	0.052
Transport	-0.083	-0.109	1	0.107	0.164
Goods	-0.208	-0.469	0.107	1	0.053
Services	-0.039	0.052	0.164	0.053	1

The Ordination Plot shown in Fig. 25 is the relationship between travel style and consumption categories. The free-independent travelers are grouped to the bottom right of Fig. 25, which falls where the Good s category vector is. This means that the free-independent variations can be explained by Goods. The semi-independent and free-independent travelers are also scattered amongst transport and services. Package travelers lie on the same side of the graph as housing and food, which means that the variation of consumption EFs can be explained by high housing and food EFs.

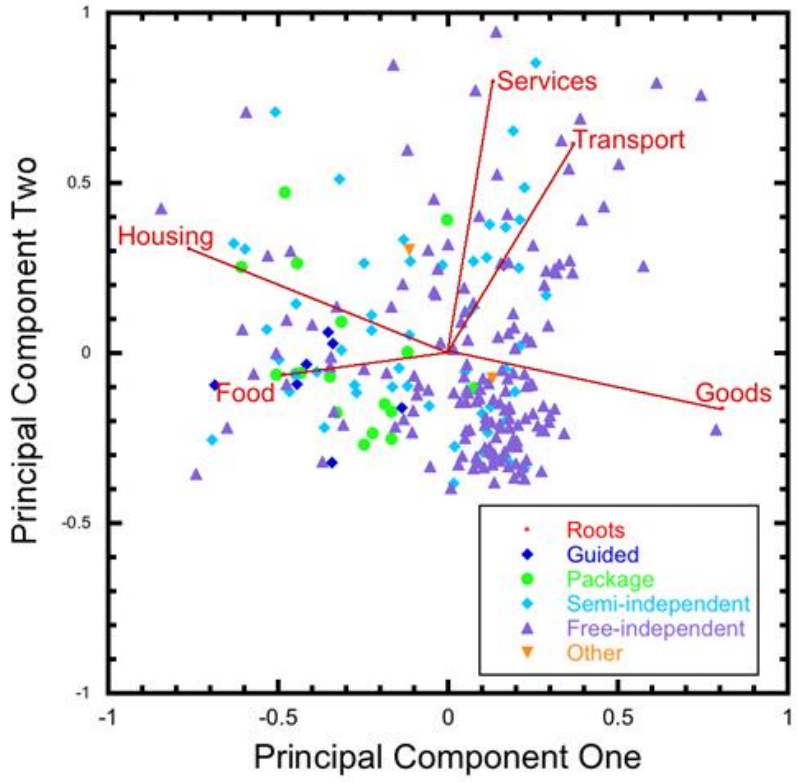


Fig. 25: Ordination plot for consumption categories EFs and travelling style.

4.4.2 Correlation Matrix of Land Use

The same principal applied in Figs. 24 and 25 is applied to Figs. 26 and 27. They are both the Principal Component Analysis for the Land Use EFs. Fig. 26 and Fig. 27 presents the first two land use principal components which contains 65% of the EF data (33% on axis 1 and 31% on axis 2, plots shown in Table 47).Again each point is the correlation coefficient of the land EF

for a particular tourist in the survey. It is shown in Fig. 26 that, for the income categories, there are no significant clusters of variables, but there is a single mixed cluster for all the income categories. This suggests that the land types (vectors) do not help to identify any obvious relationships behind the EF variations of income categories.

It is shown in Table 48 that Cropland and Pasture Land have a strong positive relationship (relationship = 0.82344), which is also evident from the vectors in Fig. 27. There is a weak positive relationship between fossil energy and cropland (0.10749) as shown in both Table 48 and Fig. 26, so they are unrelated to each other. The variations for fisheries in the first two principal components are not well explained which is evident from the length of the vector shown in Fig. 26 and Fig. 27. Lastly Fossil Energy and Built-up land have a negative relationship with Pasture and Cropland.

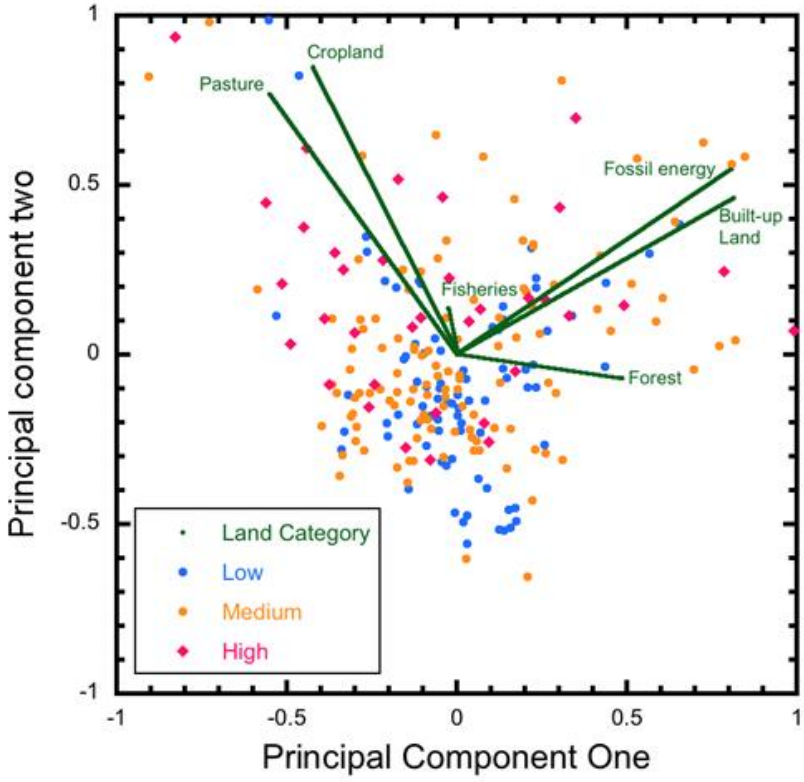


Fig. 26: Ordination Plot for Land Use EFs and income 'High', 'Mid' and 'Low'.

Table 47: Principal Component correlation coefficients for the Land Use EF variables, as plotted on Fig. 26 and Fig. 27.

Axis:	1	2
Fossil Energy	0.809	0.547
Cropland	-0.423	0.846
Pasture	-0.549	0.768
Forest	0.486	-0.069
Built-up Land	0.812	0.4599
Fisheries	-0.024	0.137

Table 48: Correlation Matrix for Land use data.

Land Use data	Fossil Energy	Cropland	Pasture	Forest	Built-up Land	Fisheries
Fossil Energy	1	0.107	-0.033	0.292	0.889	0.039
Cropland	0.107	1	0.823	-0.126	-0.009	0.115
Pasture	-0.033	0.823	1	-0.217	-0.107	0.009
Forest	0.292	-0.126	-0.217	1	0.116	0.025
Built-up Land	0.889	-0.0088	-0.107	0.116	1	-0.018
Fisheries	0.039	0.115	0.009	0.0247	-0.018	1

It is shown in Fig. 27 that the Fossil Energy, Built-up land and Forest explain most of the variations for independent travelers. The semi-independent travelers, package travellers and respondents on a Guided Package tour can be found mostly to the left of Fig. 27 where Pasture and cropland vectors lie.

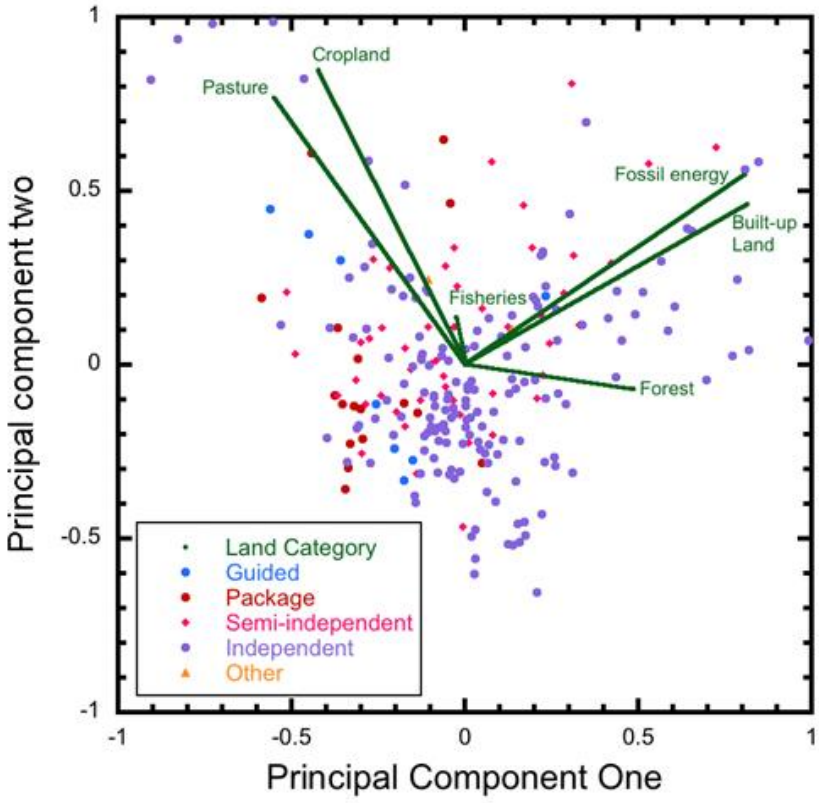


Fig. 27: Ordination Plot for Land Use EFs and travelling style.

CHAPTER FIVE:

DISCUSSION

5.1 Limitations to Research

The main limitations for this research were both time and money, which restricted the sampling time down to seven days spent in Queenstown and sampling area to one study site (Queenstown). In turn, this potentially limited the variety of types of tourists able to be sampled which creates a bias within the sample. For example, there is a possibility that the types of tourists sampled in Queenstown were all high spending adventure tourists, with the ability to spend a lot on activities and thrill seeking adventures. In contrast, a tourist destination like Rotorua attracts tourists seeking culture, history, entertainment and attractions. Many forms of adventure tourism attract a younger market (Collier & Harraway 2001), and 58% of respondents from the survey are aged between 18-29 years old. Furthermore, 77% of all respondents went skiing or snowboarding while they were in New Zealand. Queenstown is labelled the "Adventure Capital of the World" by New Zealanders and Travel websites such as Smarter Travel.com.

A drawback of this research was the lack of available information on waste produced by tourists and recycling habits, if any. The quantity and form of tourism waste is generally unknown everywhere. Wastes are a long standing problem for normal economic instruments. Waste by-products are generally considered public goods problems, so that the benefits are freely exploited by individuals, while the associated costs are passed onto the public. Questions still remain unanswered about whether the individual traveller should be held responsible for the full impact of their actions on sustainability. Since host destinations also benefit from tourist visitations, it is unknown whether responsibility for impacts should be divided between host and visitor. Or whether the host destination should be assigned all of the responsibility based on the assumption that social costs will be factored into prices (Patterson, 2005). This research found that waste contributed to approximately 5% of the tourist's overall EF. The EF of waste is reduced if the any of the paper, plastics, metals and glass products is recycled.

It was found that the sample obtained in this survey over represented tourists staying in New Zealand long periods of time. This encompasses all tourists who stayed in New Zealand for more than 30 days and up to a year. This is due to the fact that the probability of coming across

a long stay tourist in a place like Queenstown is much higher than surveying tourists staying for a week (short period of time). If however, the sample had been taken from exit and entrance points within the country such as airports, the sample may have been more representative of the average tourist. This problem was overcome in the analysis of results by weighting the data by the length of stay for each tourist to obtain a more accurate depiction of the average tourist in New Zealand. Alternatively, some results are expressed as a rate such as per day or per year.

5.2 Interpretation of Results

The results section shows that there is an over representation of tourists who are from Australia or the United Kingdom, aged between 18-29, are a Free Independent Traveller and are in New Zealand on Holiday. This suggests that even though the sampling method of tourists was random, the surveying sites could potentially have influenced the types of tourists available to be sampled. The surveys that have been completed and returned may not reflect the average tourist population accurately. When comparing the survey results with IVS statistics, the results suggest that the 18-29 year age cohort is over represented in this sample, as well as long stay tourists. However, nationality and travelling style samples from the survey show similar proportions to the IVS as shown in Table 18 and Table 20 respectively, in the results section.

Background information obtained from the survey is further supported by general observations of tourists by the Tourism New Zealand (2003) and is as follows:

- New Zealand's largest market is the Australian tourist, a high proportion of Australian visitors are independent visitors, and the main accommodation types are private homes/friends, hotels and motels.
- Just over half of tourists from the United Kingdom are holiday visitors. Majority of United Kingdom tourists are Independent travellers, and are high users of private and/or rental cars and domestic air. Lastly, their main accommodation types are private homes.
- The majority of United States and Canadian tourists are holiday and independent travellers. Main transport types are domestic air and rental cars or vans.

The size of the sample used in this research, was sufficient to collect a statistically significant sample with a 95% level of confidence. The descriptive results from the surveys were required to convert each respondent's answers into specific measurements required by the EF calculator. Each specific data item obtained from the survey contained important information about tourist

behaviour even before being converted into EF format. Examples include average water usage and which areas within New Zealand tourists travelled to and how far (Km). Results showed that apart from Queenstown the most popular place to visit was Christchurch followed by Auckland. I can assume that the reason for this is because both Auckland and Christchurch are international ports and are the entrance and exit points for many of the tourists (41% of respondents arrived in Auckland airport and 37% departed from Auckland).

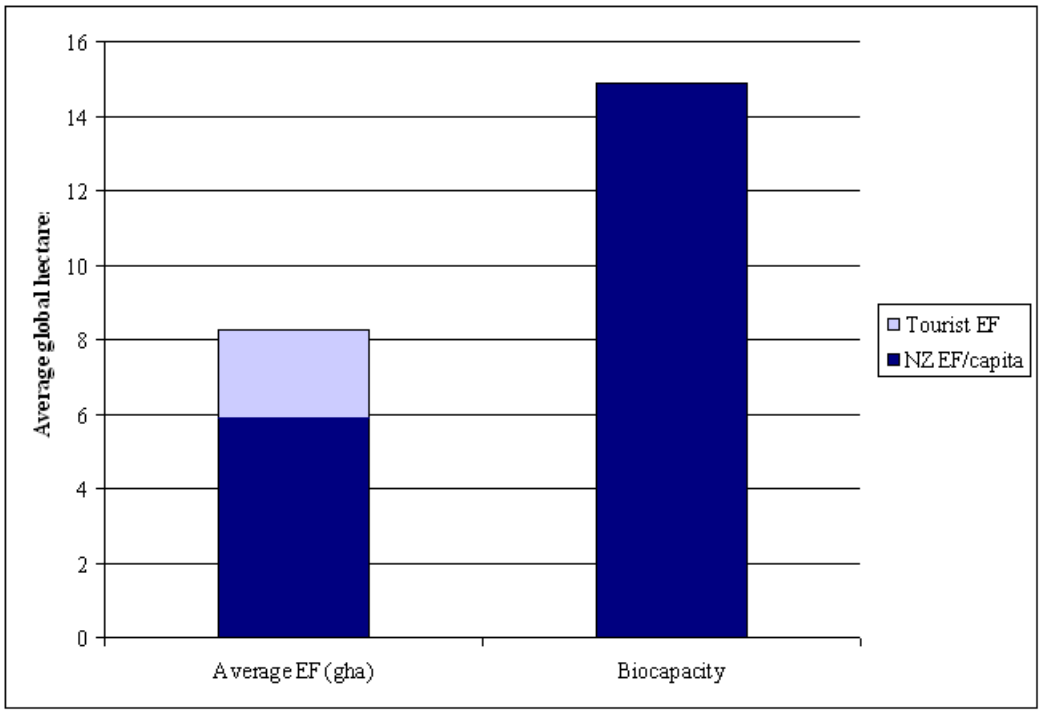
Once the data were converted into EF format, the EF of tourists was calculated. It was then possible to compare each EF against the demographic information of tourists to identify types of tourists who have a greater or lower impact on New Zealand's environment.

5.3 Ecological Sustainability of International Tourism in New Zealand

The relatively larger EF of respondents compared with the average New Zealand resident EF reflects the difference in consumption behaviour as a tourist. Tourist behaviour is in its very nature a major producer of CO_2 emissions through long distance domestic travel in a relatively short space of time and high use of energy intensive activities. Tourism demands energy at various functions ranging from the travel and the management of attractions. A tourist's holiday is composed of a broad range travel choices, so the associated energy use differs significantly (Becken, Simmons & Frampton, 2003). Patterson (2005) also found that the EF of a tourist is higher than the local residents in Val di Merse; the most apparent difference between tourists and local residents is related to local transport. Overall, the local impacts of Val di Merse tourism are within the carrying capacity of the study area. Shimada (2006) found that Japanese tourists in New Zealand were consuming at an unsustainable rate, beyond the biocapacity and have a significantly higher EF than residents. This indicated that the New Zealand tourism industry relied heavily on ecological hinterland or there might have been some damages caused as a result of tourism activities.

A total of 97% of respondents used resources at a sustainable rate, within the biocapacity (14.9 gha) of New Zealand during their stay as shown in Fig. 28. This means that the productive land required to produce the resources (e.g. food, goods, services and energy), land occupied by infrastructure (e.g. roads and buildings), the land to assimilate waste, greenhouse gases (CO_2) emissions produced by activities and the processing/transporting products were able to support the tourists if they continued to stay in New Zealand for an entire year. Common characteristics

amongst the tourists that are living beyond the carrying capacity of New Zealand are tourists staying in New Zealand for up to 30 days (Short stay), predominantly Free – Independent Travellers and that are on holiday. All of these tourists travelled within New Zealand using a private or rented car, and five out of the eight "unsustainable" tourists used domestic air.



Source: WWF, 2006 and 2008 survey

Fig. 28: Comparison between the EF of both the New Zealand resident (5.9 gha/capita) and the tourists surveyed (8.26 gha) with New Zealand's biocapacity (2003 data).

This research suggests that the current tourist population is below the biocapacity of New Zealand, which can be seen in Fig. 28. The EF for tourists sits at 55% of New Zealand's biocapacity. When taking into consideration both the average tourist EF and the EF per capita of residents, the overall status of the EF, with both tourists and residents consuming at the current rate presented in this study, the EF is at capacity (14.2 gha). This means that the tourism population consumes within the country's ability to deliver goods and services sustainably. However, this conservative breakdown of tourist behaviour in New Zealand is not complete due to assumptions made and the dangers of basing management decisions only on local observations of impacts. If this study takes into account the impacts when tourists leave their home countries, this research would consider sustainable tourism analysis for all impacts including those affecting other parts of the globe (Patterson, 2005). Patterson and McDonald (2004) compared the CO_2 emissions from international travel for various overseas origins, where tourists from Europe had the largest CO_2 (t) emissions per visit (2.3-2.5 tonnes), compared with tourists from Australia with 0.42 tonnes per visit. The CO_2 emissions from

international tourists travelling to and from New Zealand were the largest source of tourism-sector CO_2 emissions (71.2%) (Patterson & McDonald, 2004).

A breakdown of tourist behaviour is necessary to understand the sustainability of New Zealand tourism on a more local scale . This allows the researcher to identify the areas with high impact, which can be used as important information when wanting to improve the sustainability of tourism in New Zealand. The following sections describe each component of a tourist's holiday and information on tourist impact obtained from the survey along with comparisons with other studies.

5.3.1 Food

Respondents were asked to report on the size of the meal they generally chose to eat for breakfast, lunch and dinner, plus how often a week they eat each meat type. In this way, the questions were easily understood by the different nationalities. This method made it easier to identify the general eating habits of each tourist instead of underestimating or overestimating the amount of food required for individuals. Gossling, et al (2002) found obtaining official statistical data on tourist food consumption difficult so assumed the quality and quantity of food consumed is similar to the food consumption at home. In this research, this problem was overcome by interviewing owners of restaurants and accommodation while conducting a pilot study in Taupo and speaking to tourists themselves. This allowed the ability to recognise that the main differences in diets between nationalities is meal sizes, and that all meals still contain the same base ingredients such as fibre and starch products. It was found that beef, poultry and fish incur a particularly higher cost to the overall Food EF than non-meat products, so it was necessary to treat meat separately in the survey.

Food was the consumption category with the largest contribution to a tourist's overall EF. This finding is consistent with Patterson (2005) who also found that behind the CO_2 (t) emissions associated with arrival transport, food and fibre consumption was the highest contributer to the tourist's EF. The Food EF is based largely on Fossil Energy land due to the energy required for chilling, preparing and producing food, Cropland, productive sea space and pasture. The direct amount of land required by the tourism industry for food, beverages and tobacco in New Zealand was calculated to be 443 ha, which is the sixth largest amount of land required by the tourism sector sub-sectors (Patterson & McDonald, 2004). Patterson (2005) found that the actual food content is similar between tourists and residents; however, tourists' use of restaurants and bars doubled that of residents'. The amount spent on eating out was therefore a

particularly important component of a tourist's EF since it takes into account the amount the energy required for cooking and preparing the food. On average, it is shown in results that eating out expenditure constituted 15% of the total Food EF, slightly smaller than meat. Fig. 29 are photos of Fergburger, a very popular burger bar in Queenstown and famous amongst the tourists when in New Zealand.

Fig. 29: Fergburger restaurant is very popular with the tourists in Queenstown, even heard about this place when staying at a backpackers in Taupo. K. O'Connor 2008.

5.3.2 Accommodation

Accommodation refers to the energy requirements for each accommodation type, which were found to differ significantly (Becken & Cavanagh, 2003; Becken, Frampton, & Simmons, 2001). The built-up land of all accommodation types is defined by Patterson & McDonald (2004) which for this study is 0.3233m^2 per visitor night. This method for calculating the accommodation EF is consistent with the Shimada (2006) study. The average energy consumption per capita in the New Zealand household is 38.6 MJ per night (EECA, 2000), which is equal to the energy required to stay in a backpackers (39 MJ/visitor night) but is only a quarter of the energy requirements for staying a night in a hotel (155 MJ/visitor night) (Becken, et al., 2001). The energy requirements for each tourist in the survey were based on the direct energy sources for each accommodation type. Electricity was the highest form of energy for all accommodation types, which in New Zealand is predominantly a renewable energy source (55% from hydro) (Ministry of Economic Development, 2008). The energy intensities for each accommodation type were studied by Becken and Cavanagh (2003) as shown in Table 49 below. These energy requirements were directly used in the method to calculate the EF of the different accommodation types for this study.

Table 49: Average energy intensities for various accommodation types.

Accommodation Type	MJ/visitor night
Hotel (Including luxury lodge)	155
B&B	110
Motel	32
Backpacker/YHA	39
Camping Ground	25

Source: Becken et al. 2001

It is shown in the results that the most popular accommodation type is the backpacker hostels and the private or rented homes (which is consistent with the Ministry of tourism CAM database), and these require just a quarter of the energy requirements of hotels and B&B. The least frequent accommodation was B&B accommodation and Luxury Lodges (in terms of visitor nights), which suggests that the accommodation sub-sector within tourism is not a big contributor to an international tourist's overall impact. Furthermore, housing was the smallest contributor to the tourist's EF in this study. Shimada (2006) found that housing was the third highest contributor for a Japanese tourist's overall EF. This is due to Japanese tourists being frequent users of hotels and farm/home-stays which are the two most energy intensive accommodation types. It was also found that tourists who stay in New Zealand for a short period of time (up to 30 days) are far more likely to stay at a hotel or luxury lodge than long stay tourists. In comparison long stay tourists are more likely to stay at a backpackers or rented or private homes when in New Zealand.

5.3.3 Transport

For most other tourism impact studies, transport was the most energy intensive component of a tourist's trip and the highest contributor to the overall EF, mostly due to the CO_2 emissions associated with air travel (Shimada, 2006; Patterson, 2005; Becken & Cavanagh, 2003; Gossling et al., 2002; Becken, Simmons & Frampton., 2003). In contrast, this research suggests that transport is only the third highest contributor to a tourist's overall EF during their stay. This study looked at only the domestic travel costs while in New Zealand, and does not consider the cost of air travel from the home countries. However this study does indicate that transport is the most energy intensive component of a tourist's trip. Patterson (2005) found that domestic transport was second behind food and fibre consumption for a tourist's overall EF. The transport EF consists of both the energy intensity of each transport method as well as the built-up land required for transport infrastructure (roads and railways obtained from the Ministry of Transport).

Mobility is an essential component of a tourist's trip, and all forms of tourists utilise some form of transportation. A private or rented car and domestic air are the most common forms of transport. Shimada (2006) found that for Japanese tourists, the most common method for travelling around New Zealand was domestic air and coaches which is consistent with the Japanese travellers surveyed in this research. Becken et al. (2003) found that the energy use for transport is a result of both the energy intensity of the transport choice and the distance travelled. Becken et al. (2003) found that tourists using camper vans were the highest average energy users out of all the transport modes for international tourists (8303 MJ/person). The findings from Becken et al. (2003) is consistent with this research where tourists travelling in minibus/van had the largest contribution to the overall transport EF due to the long distances travelled. The importance of a transport type with regard to the total energy contribution to the transport sector depends on its popularity, energy intensity, travel distance and the actual vehicle occupancy (Becken, et al., 2003).

The size of the transport EF is largely determined by the number of days spent in New Zealand. Generally if a tourist is only in New Zealand for a short stay, they will travel long distances in a relatively short amount of time, resulting in longer distances on a daily basis. In contrast, a long stay tourist allows more time to travel (Shimada, 2006). From the results it was found that the short stay tourists (in New Zealand for less than or up to 30 days) have a significantly higher transport EF than long stay tourists (more than 30days).

5.3.4 Goods

The Goods component of the EF comprises of two aspects of a tourist's trip. Firstly, Goods looked at the "use" of assets by tourists during their stay at the different accommodation types. Secondly, it is comprised of the purchased products bought by the tourists in New Zealand. Overall the asset use had the biggest contribution to the Goods EF. A drawback for using this methodology of asset use is that it is determined by the accommodation type and its occupancy rate. As a result, the higher the occupancy rate is, the smaller the EF, therefore smaller area per person since it is used more often. This can result in a larger or smaller EF for an accommodation type regardless of its energy consumption. As a result, tourists who stayed at a camp site in Queenstown which has an average occupancy rate of 16% (YE April 08 CAM) will have a greater weighting for the Goods EF than a tourist staying at a Hotel (occupancy rate of 58%). This can give conflicting results when looking at the overall EF for low budget tourists. However, when staying at a camping ground, the use of assets is minimal compared with a hotel, therefore the Goods EF of camp ground tourists remains relatively small. This method to

calculate the Goods (purchased products) component of a tourist's EF has been relatively unexplored by other ecological footprint related studies on tourism. This method must therefore be considered when comparing these results for Goods with other studies

The most common products purchased by respondents are cotton products which include tee-shirts and jeans followed by books, magazines or newspapers (paper products). Goods are large users of Pasture and Cropland for wool and leather products and Forest for wooden and paper products, as well as Fossil Energy and Built-up land. The tourists who are in Zealand for a long period of time (up to a year) have a larger Goods EF than short stay tourists. On a per day basis long stay tourists require more resources than a tourist in New Zealand for a fortnight. For socio-cultural reasons, Japanese travellers buy a large quantity of souvenirs, which ultimately contributed to the large resource consumption for the goods component for Japanese tourists (Shimada, 2006). Results from this survey showed that overall tourists from the United Kingdom were the largest consumers of purchased goods particularly cosmetics, paper and tobacco products.

5.3.5 Activities/Attractions and Services

Services, attractions and activities were particularly important for this research due to the high visitation rates to activities in Queenstown. A total of 77% of all respondents went skiing and snowboarding during their stay, and 59% of tourists visited a nature attraction (such as mud pools). The activities and attractions are considered a sub-sector of tourism; however they constitute the core of the tourism product. The focus of tourism marketing schemes particularly for New Zealand are leaning towards what tourists can both 'do' and 'see' while at the destination (Becken, 2001). Tourist attractions are composed of diverse products and services, and tourist activities are proven to be more energy intensive than tourist attractions. The energy demand of these tourist activities is the result of the large dependence on motorised transport such as air sports, heliskiing, water sports and 4WD (Becken, Simmons, & Frampton, 2003). Results show that Services, activities and attractions are the highest users of the fossil energy land which is the largest out of the six land types. Overall services, attractions and activities were the second largest contributor to the overall EF of the respondents.

Becken & Simmons (2002) compared the results for energy consumption of activities and attractions for tourists with visitor volume to get an overall energy use per tourist. The results were divided into four categories and are listed below:

I: High total energy use – many visitors = moderate energy use per tourist
II: High energy use – few visitors = high energy use per tourist
III: Low energy use – few visitors = moderate energy use per tourist
IV: Low energy use – many tourists = low energy use per visit.

From these results it was found that high energy uses per tourists were for heliskiing, diving, and scenic flights. Moderate energy users were rafting, ski/snowboarding, guided walks and sailing. Lastly low energy users were museums, zoos and experience centres. The results from the survey can be directly associated and compared with the results found by Becken & Simmons (2002); the consistency between the two studies is significant. Only 11% of tourists went heliskiing and 22% went on scenic flights, resulting in high energy use per respondent for these activities. Even though ski and snowboarding, jet boating and boat cruises have a reasonably high energy use, they were also popular activities amongst the respondents (77%, 46% and 50% respectively) resulting in moderate energy use per tourist. Lastly, shopping, bar and casino visitations were high (77%) as well as hiking (56%) and nature attraction (59%) resulting in low energy use per tourist. The frequencies and percentages of the activities can be found in Table 17 in the results section.

The services component of the overall EF comprised of around half of the total services EF, largely due to the amount of money spent by tourists on medical insurance and services while travelling which is important for the safety and security of a traveller.

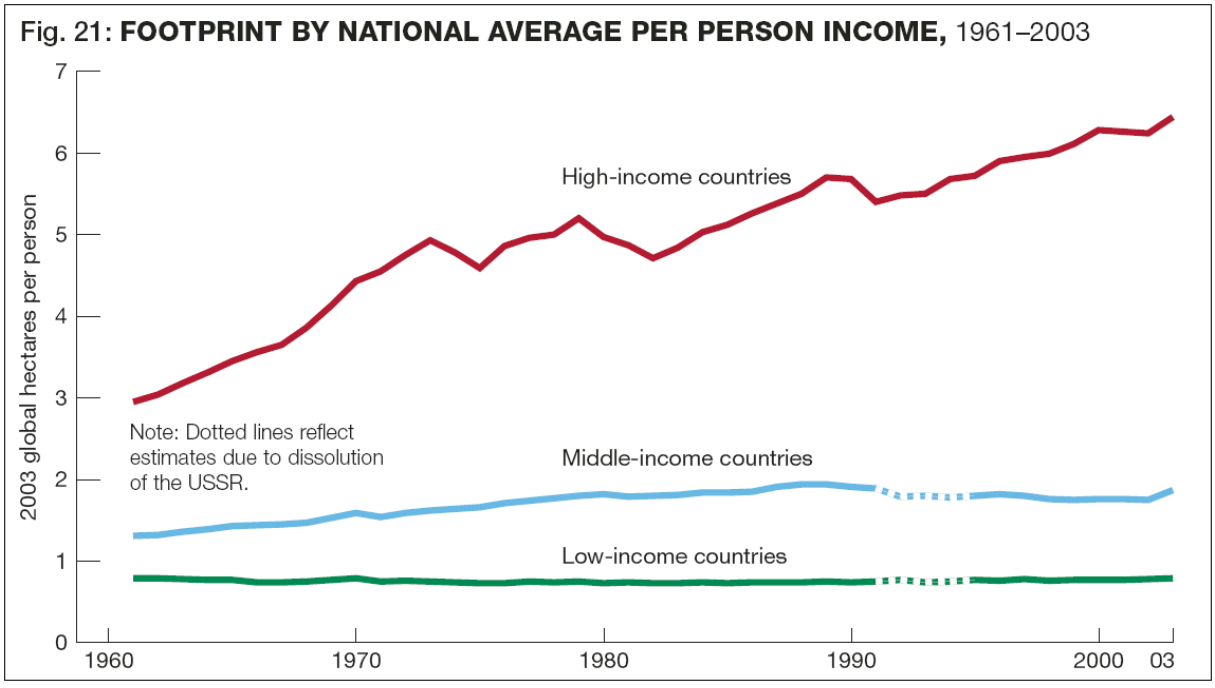
5.4 Ecological Footprints and Tourist Types

A broad range of tools have been used to assess tourism sustainability, most of which are explored in the literature review in Chapter Two. The balance between economic and natural components of tourism in New Zealand is especially important when considering the economic output of the industry relies so heavily on the underlying resource base which gives rise to that output. This dependence on the quality of the environment is obvious when taking into consideration the Tourism New Zealand marketing approach. Identifying a ‘tourist type’ is important to minimise the impacts of the tourist themselves. This research seeks to identify the characteristics of a tourist that have a high impact on New Zealand’s environment and the tourist types that have small impacts. These specific characteristics consist principally on the annual income of the tourist as well as other aspects that might influence consumption behaviour such as travelling style, nationality or age.

There is a large body of research on tourism impacts on the local or national economies and sustainability of tourism as an industry. However it is more difficult to obtain research on the tourist. When tourist types are identified, research commonly incorporates country of origin, travel purpose or travel behaviour (such as travelling style) and as in this case income combined with travel style. Travel behaviour is useful since it relates directly to tourist impacts and provides a well defined target for management, marketing and policy initiatives (Becken & Simmons, 2008).

5.4.1 Tourist Types based on Income

Income is usually a measure of quality of life which is the interaction between human needs and the subjective perception of their fulfilment, as mediated by the opportunities available to meet their needs. The common perception of "more is better", along with the GDP of a country is commonly taken as an accurate measure of the wellbeing of its inhabitants. It is, however, becoming increasingly important to ensure that people live healthy and productive lives without exceeding nature's limits (Costanza et al., 2008). It is shown in Fig. 30 that the global hectares for low and middle-income countries have stayed relatively constant between 1992 and 2003, while the average per person footprint in high-income countries increased by 18% (WWF, 2006). This suggests the more monetary resources available the more people are inclined to consume resources at an increased rate.



Source: World Wildlife Fund, 2006

Fig. 30: Line graph showing the average footprint per capita trends for High, Middle and Low-income nations from years 1960 to 2003

This same concept can be applied to tourists in New Zealand, where it was found that there is a positive trend between the income of tourists and their EF. New Zealand has taken upon itself to not incorporate the "more is better" attitude, since the draw card for tourists to New Zealand are the experiences one can have. Tourism New Zealand's marketing scheme specifically aims to attract a certain tourist "ideal", which doesn't appeal to all tourist types (Tourism New Zealand, 2003). This "ideal" tourist is not based on income or wealth, but certain personality traits that will integrate well with the activities and attractions that New Zealand provides. The EF components that influence the variation amongst high income tourists' trips are the housing and food sectors. In other words a high income tourist will spend more on high energy accommodation types like hotels and food than the mid or low income tourists. Results also show that both the high and low income tourists will spend money on services, activities and attractions and transport. The Goods component explains the variation of low income tourists.

Becken and Simmons (2008) looked at tourist expenditure to identify stereotypical behaviours for tourist types in New Zealand. It was found that coach tourists are the largest spenders due to spending on hotel accommodation while, in contrast, home visitors (staying in private accommodation) spend least, and mostly on retail and recreational activities. The results from the survey identified one specific trend amongst the travellers: low income tourists were generally long stay tourists, have high Goods EF, are aged 18-29 and are in New Zealand on a working holiday. Working holiday tourists generally include tourists who chose the "Other" accommodation category (owned or rented property) since they are working and therefore staying in New Zealand for an extended period of time (average length of stay for a working holiday tourist from survey is 250 days in New Zealand).

5.4.2 Tourist types based on Travelling Style

Travelling style is a common way to identify tourist types, and each has their own specific behavioural characteristics. The travelling styles used in the survey are commonly used by the Ministry of Tourism.

Shimada (2006) found that the size of the travelling style EFs was not clearly grouped in a Principal Component Analysis ordination plot. Therefore, the EF of Japanese tourists is not strongly determined by their travelling style. However, Shimada (2006) found that the travelling styles by their consumption patterns can be grouped into two types; package travellers and independent travellers (both FIT and SIT). The survey results found that the 89% of travellers were independent travellers (FIT and SIT) and the other 10% were package travellers (Guided Package Tour and Package Traveller). The EFA results (as shown in Fig. 19 in results section)

suggests that these two types of travelling styles are also able to be grouped together due to similar consumption patterns amongst the pairs.

It is important to note here that the sample size for 'packer travellers' comprises of only 10% of all respondents, three per cent of those were 'Guided Package tour' travellers. Therefore, the results may not reflect an accurate account of all tourists visiting New Zealand who travel on a 'coach tour'. This means international flights, all domestic transportation, food and activities are predetermined before arriving in the country.

Travel style can influence tourist consumption behaviour; seven out of the eight Guided Package Travellers from this study stayed in hotels and 59% of package travellers stayed at a hotel or motel. Consequently, Guided Package Tours and Package Travellers have a higher Housing and Food EF than the independent travellers. Shimada (2006) states that all package travellers stay in hotels, regardless of their itinerary. Becken (2001) found that 'coach travellers' consumed the most energy per day due to a high use of domestic air and coach travel, as well as the hotel stays. FIT and SIT travellers are free to choose their own transport mode which this research suggests is most commonly a car and tend to eat out a lot; however, accommodation choice is usually low budget (40% of FIT earn ≤$20,000). The IVS results show that 82% of FIT travel in a car or a van, and 92% of travellers on a Tour Group travel in coaches. This research suggests that a more flexible travelling style generally has a higher footprint. These results are the inverse to the Shimada (2006) study on Japanese tourists, since it was found that the package travellers (190 gm^2/day) have an overall smaller EF than the independent travellers (240 gm^2/day).

CHAPTER SIX:

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The previous chapters have presented a study using EFA as a tool to assess the energy and resource requirements of tourist behaviour in New Zealand. EFA is a useful tool since it helps to identify whether the behaviour of international tourists is sustainable in New Zealand. Also, it helps to identify the areas of a traveller's trip that are having the biggest impact on the environment. This method has been used in two other studies: Shimada (2006) to assess the EF of Japanese tourists in New Zealand and Johnson (2003) who studied the EF of tourists in Canada. Both studies used a similar EF calculator; however, Johnson (2003) used 2000 version 2.0 calculator, while in comparison both Shimada (2006) and this study used the 2003 version 3.2 calculator.

One important component of the study is to calculate the EF of tourists with a high, mid and low income to see if there is a relationship between income and the tourist's EF. This helps to identify an optimal tourist type, or specific characteristics of a tourist that will contribute the most economically and have minimal impact. It is intended that this method is a useful tool to help improve the sustainability of tourism in New Zealand so that Tourism New Zealand's promise to tourists of a "clean, green environment" is maintained.

The study area was Queenstown, labelled the "Adventure Capital of the World", and was the optimal place in New Zealand to be able to sample a wide range of international tourists. Queenstown offers tourists a wide range of activities and attractions, which range from bungy jumping, heliskiing to wildlife attractions, skiing and snowboarding, cafes and bars, as well as relaxing spas and golf courses. The survey for this research was conducted in September 2008, from which 236 responses were received, resulting in a 33% response rate.

This chapter summarises the results found in this research and explores ways of reducing the EF of tourists, as well as recommending practical ways to improve the sustainability of tourism in New Zealand based on the results.

6.2 Conclusion

The following conclusions have been drawn from this research:

Results suggest the average EF of international tourists in Queenstown in September 2008 is ecologically sustainable in New Zealand. This is due to the tourism population living and behaving in a way that is within carrying capacity of New Zealand's environment. This study has found that with both the New Zealand's EF per capita and the tourist EF at the current rate of consumption, the capacity of New Zealand is at its maximum. This suggests that even although the tourist population consumes at a sustainable rate, when taking into consideration Zealand's EF per capita, the tourist population can not increase to be able to consume within the resources and services New Zealand can provide on a sustainable level.

The tourist's daily EF is larger than New Zealand's EF per capita, which recognises that tourist behaviour is different to residents. Tourists will travel longer distances on a per day basis, high users of domestic air, therefore high producers of fossil fuels, are more likely to spend more on food and beverages due to high levels of eating out at restaurants and bars. Also tourists are high users of infrastructure by high attendances at cultural or natural attractions and activities. These costs to New Zealand's resources and society are balanced out by the major economic contribution tourism provides to New Zealand's economy as previously discussed in Chapter two.

This EF study is a conservative account of resource consumption by tourists; it does not take into account the flight to and from New Zealand. A draw back of this research was that there were many assumptions made about the consumptive behaviour of individual tourists. However, these assumptions were based on adequate data from several reliable sources (such as Statistics New Zealand, Ministry of Transport, Ministry for the Environment) and the information gathered via survey was sufficient to account for the behavioural differences amongst individual travellers, and subsequently differences in their EF.

The energy footprint is the largest of all six land types in this study, the tourists main energy consumption was transport, goods use and purchases and activities and attractions. Transport, goods and services were also the only users of built-up land. Food was the only consumer of the cropland and fisheries land areas. The cropland was the second largest land area of the EF, which contributed to Food having the largest overall land area of the tourists EF.

The most popular choice for transport amongst the respondents was the private or rented car, which was also the transport mode that collectively travelled the longest distances. The most popular accommodation type amongst the respondents was the Backpackers or hostel; however, the accommodation with the highest number of guest nights was the 'Other' category which consisted of private or rented dwellings. The most popular activity was to visit a bar, casino or shopping. The second most popular activity was skiing or snowboarding. Lastly, just over half of respondents stayed in New Zealand for a 'short stay' (less than or up to 30 days in New Zealand).

6.2.1 Tourist Types

The annual income of tourists was used in this study to identify whether the financial resources of a tourist influences the consumption behaviour during their stay in New Zealand. It was found that there is a positive relationship between income and the EF of tourists. The EF of "high" income tourists can be explained by food and housing, which means "high" income tourists, will spend more on food and housing than "low" income tourists. A tourist will spend time and money on both the transport and activities/attraction aspects of a tourist's trip regardless of the financial resources available to them. The goods category explains most of the variation of EFs in "low" income tourists.

Travel style can influence tourist consumption behaviour and it was found that an independent traveller has a significantly larger EF than package travellers. The travelling styles were able to be grouped into two types, based on their EFA results and consumption behaviour: package travellers and independent travellers. The package travellers have a larger housing and food EF than independent travellers. Those EFs are both aspects of a traveller's trip that are predetermined by the tour or package deal.

There wasn't a strong link statistically which suggested that the EF of nationalities were different. Tourists from South America and Europe with an overall average length of stay of 173 days in New Zealand have the largest transport footprint. The nationality with the highest overall food EF was the 'Other' nationalities since four out of the six 'Other' tourists ate large meals. South America has the highest housing EF, Asian tourists have the highest services footprint, and tourists from America have the highest goods footprint. Therefore this study backs up the observation from other studies that nationality does not determine tourist behaviour, and therefore energy consumption.

6.3 Recommendations

Tourism is a complex industry, and there are many sectors involved which all work together to ensure that all aspects of the industry are successful. The New Zealand Tourism Strategy 2015 states the environmentally based outcomes for tourism. It is stated in one of the recommendations that better information for businesses to encourage visitors to make more environmentally sound choices is required. Another recommendation is for initiatives to develop opportunities for visitors to contribute to the conservation and management of New Zealand's environment. Fig. 33 below is a photo of conservation projects carried out by current and previous tourists at a YHA hostel in central Queenstown. It is this type of environmental action the New Zealand Tourism Board wants to encourage for the smaller to medium sized enterprises.

Fig. 31: YHA Central Hostel in Queenstown, supporting and actively involving the tourists in local conservation projects. K. O'Connor 2008.

Lastly, the 2015 New Zealand Tourism Strategy states one of its objectives is to play a leading role in taking initiatives to areas such as transport, energy use, waste reduction, and management and conservation (New Zealand Tourism Board, 2007).

Tourism operators in New Zealand that are currently contributing to conservation:

- **Kiwi Encounter:** Started out as a conservation programme hatching kiwi eggs and hand raising chicks before being released now has a tourism product based on kiwi recovery.
- **Waimangu Volcanic Valley:** Contributes to spraying weeds and wilding pine seedling removal.
- **Wilderness Lodge Arthur's Pass:** Controls possums and hares and fences areas that contain endangered plants.
- **White Heron Sanctuary Tours:** Maintains 40 stoat traps and contributes to weed control in the area.
- **Black Cat Group:** Contributes annually to conservation and community projects and shares the vision of the Quail Island Restoration Trust.
- **Milford Sound Lodge:** Maintains 10 stoat traps along a local walking track.
- **Real Journeys:** Contributed financially to the reintroduction of Campbell Island Teal Duck to predator free Campbell Island.

(Department of Conservation, 2005)

6.3.1 Practical and achievable ways to reduce a tourist's EF:

Given the findings of this research the following recommendations seem appropriate for the New Zealand Tourism 2015 strategy outcomes to ultimately maintain the sustainability of tourism in New Zealand. Refer to Table 50 below.

Table 50: Policy, management and operational recommendations

Categories	Current Status & Findings	Recommended Solutions to reduce EF
Food	Largest contribution to the international tourist's overall EF. 97% of tourists eat out during trip. Meat consumption contributes significantly to the Food EF. Requires cropland, pasture, sea space and fossil energy for the production and harvest of food products.	Restaurants and cafes can contribute to reduce impact by buying produce from local markets and businesses. Choosing energy-efficient cooking & refrigeration appliances using the Energy Star ratings in both accommodation and restaurants and cafes. Recycling of food containers and bottles encouraged in both accommodation places where cooking facilities are provided and restaurants and cafes. Food wastes sent to a pig for consumption, or composted. Encourage tourists to buy food from local businesses and markets.
Accommodation	Coach tours are high users of Hotel accommodation. Average time spent in shower is 9.9 minutes. Laundry use averages 1.7 times per week. Hotels use just under four times the amount of energy (MJ) required by the average New Zealand household.	Coach tours to use more energy-efficient or 'eco-friendly' accommodation. Increase access to recycling bins. Use solar power for water heating. Use more energy efficient appliances using the Energy Star ratings. Hotels & Motels can encourage visitors to continue to use the same towels and sheets at least more than once to reduce laundry. Improve insulation of buildings. Regular maintenance checks to reduce amount of resources wasted such as power or water from leaks. Contribute to conservation projects which can involve the visitors too.
Transport	High producer of fossil fuels, and consumer of energy land. Average travel time for domestic air is one hour. Private or rented car is the most common transport mode.	Implement more energy efficient travelling schemes such as cycling tours around the South Island. Increase the energy-efficiency of all transport modes. Increase the use of buses and more energy-efficient transport modes through cheaper prices, and package deals for tourists.

Categories	Current Status & Findings	Recommended Solutions to reduce EF
	The mini-bus/van transport mode has the largest footprint out of all transport modes due to long distances travelled, and a popular mode of transport. Domestic air is particularly detrimental to the global atmosphere, since fossil fuels are emitted so high in the atmosphere. The size of the transport EF is largely determined by length of stay. Tourists staying for a 'short stay' tend to travel longer distances per day than 'long stay' tourists.	Transport can play a key role in reducing the CO_2 emissions thereby helping to fight the battle against climate change, particularly through domestic air. Market conceivable incentives for tourists to travel shorter distances. This could be through marketing New Zealand regions rather than the country as whole, incentives to stay in areas longer.
Goods	Contributes to Fossil energy land, high user of forestry, cropland, pasture and built-up land. Uses the most amount of land types due to the wide variety of products that comprises goods. Most popular product purchased by tourists are cotton products which include t-shirts and jeans, most of which are made in other countries. Length of stay influences the number of products purchased and used by tourists, since the longer a tourist stays in the country the more goods are required, particularly hygiene and cosmetic products.	Increase the number of products sold at New Zealand souvenir stores that are made in New Zealand. This reduces the amount of travel miles and ensures the security of local businesses. An essential component of a tourist's trip and plays a vital role in the economic contribution from tourism to New Zealand's economy. Therefore important to keep up the supply to show the international markets the rich culture of New Zealand. New Zealand made products are mostly using natural and/or native resources. Recycle packaging waste where possible.
Attractions/Activities & Services	21% of tourists participated in 'High energy per tourist' activities. Highest consumer of energy land out of all the EF categories. Visitor numbers to sensitive natural environments can cause the appeal of the area to diminish, and have detrimental effects on the environment.	Visitor impacts to particularly sensitive natural areas be minimised. Important to identify the carry capacity for visitor numbers at sites with sensitive environments. This helps to mitigate and control the impacts visitors have on these areas. Encourage the use of 'medium' to 'low' energy use activities. Price of 'High' energy activities which include Heliskiing, scenic flights, sky diving to be associated with energy intensity (MJ).

Categories	Current Status & Findings	Recommended Solutions to reduce EF
Waste	The 100% Pure brand makes managing waste and recycling a critical issue for the tourism industry. Unclear on who should take full responsibility for the wastes produced by visitors. Little information about the costs and detailed data on waste associated with tourists.	Increasing the percentages of recycling, decreases EF for waste. Accommodation and businesses to provide easy access to recycling bins and facilities for the appropriate discarding or waste. Organic waste can be composted. Potential for future research into waste produced by tourists, and how to manage it accordingly.

6.3.2 Sensitivity Analysis

The sensitivity analysis in Table 51 below identifies which areas will make the biggest contribution to minimising a tourist's EF.

Table 51: Scenarios to reduce the EF in different areas, using the tourists average EF of 8.26 gha.

Sensitivity Analysis	% Change	Resulting EF (gha)
10% reduction in car usage.	-0.58	8.21
10% reduction in air travel time.	-1.76	8.12
10% reduction in all travel distances for each mode.	-10.62	7.38
10% increase in energy efficiency of 'High energy per tourist' activities.	-0.35	8.23
Increase consumption of locally grown and harvested food.	-5.58	7.8
10% reduction in money spent on 'Eating out'.	-0.70	8.2
10% decrease in meat consumption.	-1.22	8.16
10% increase in Recycling.	-0.40	8.23
10% reduction in the use and purchases of goods.	-2.36	8.42
10% reduction in energy use by all accommodation.	-0.55	8.58
10% reduction in all services/activities/attractions.	-2.25	8.43
10% reduction in all food.	-3.05	8.36

The sensitivity analysis shows that transport is the area to work with to minimise tourist impact. By minimising travel distances by 10%, the EF of a tourist's trip can be minimised by 11%. Also buying produce from local markets can make a big contribution to reducing a tourist's EF.

6.3.3 Recommendations for future research

This study provided a benchmark of the resource utilisation by international tourists in New Zealand.

It is becoming increasingly important within the tourism industry that the wastes produced by tourists are properly managed. There is a lack of available data about the quality and quantity of waste tourists produce, and about who should take responsibility. A more rigorous study specifically aimed at analysing the disposal behaviour of tourists, as well as the quantity of this by-product and where it is coming from, will allow the industry to be able to manage waste more appropriately.

There is potential for this research to be carried out again using more detailed data on individuals and/or larger sample sizes that will target all tourist types. Furthermore, this study can also be carried out in different areas of the country such as Rotorua and at different times of the year to include tourism's peak season from November through till March.

It would also be interesting to carry out this research after the 2015 New Zealand Tourism Strategy reached its deadline to see how much of the industry has changed, and whether the sustainability of tourism will improve due to an increase of more "energy-efficient" travelling modes. Changes in EF could result from implementing cycling tracks around the South Island, a change of perspective in marketing tourism, or improvements in technology which help to reduce the impact of tourist activities, attractions, accommodation and travelling modes.

GLOSSARY

Biocapacity: Area available to produce resources and assimilate emissions. The biocapacities of nations is not evenly distributed around the world due to differences in the productivity of soil properties and environments.

Biologically productive land and water: The land and water that can produce resources for consumption, as well as assimilating waste. Also supports ecosystem services such as photosynthesis which gives rise to these resources.

Carrying Capacity: A defined limit on the amount of damage and/or change a defined area can withstand without causing permanent damage so the ecosystem or productivity of the area is sustained. If this defined limit of damage is breached, the cause of breaching is going beyond the carrying capacity of the area, therefore is unsustainable (see page 8).

Consumption: The defined amount of uptake or usage of a good or service necessary to sustain an individual or population.

Cropland: Is quantified by the quantity of products consumed (kg) for food, seed, waste, processing, and non-food uses. Takes into account both primary and secondary products (Wackernagel et al., 2005) (see page 48).

Ecological Deficit: There is an ecological deficit when the footprint of a population exceeds the footprint of the area available to that population (Global Footprint Network, 2009).

Ecological Footprint: The total area of productive land (expressed in global hectares) required by an individual or population to sustain their lifestyle and assimilate their waste. It is a measure of how much land and sea is required, and the differences between individuals are because of their rate of consumption of goods and services.

Ecosystem Services: The benefits mankind receives from resources or natural processes. Examples of these are the conversion of carbon dioxide to oxygen through photosynthesis, decomposition of waste and clean water.

Equivalence Factors: The productivity of land for a nation or region, regardless of current management practises, relative to the world average productivity of all bio-productive areas. Used as a scaling factor into a universal unit of biologically productive area (gha).

Fisheries Area: The sea provides fish to consumed for eating, so is an area the represents the production of the sea (see page 49).

Forest Area: Includes both farmed and natural forests which can yield timber for general building, souvenirs and paper products (see page 48).

Fossil Energy: The hypothetical amount of land required to sequester CO_2 emissions from the burning of fossil fuels (see page 48).

Global Hectare: Ecological footprints are expressed as a 'global hectare' (gha) is the hypothetical measure in land area of the amount consumed by individuals or a population. One global hectare is equal to one hectare with productivity equal to the average productivity of the earth's hectares (Wackernagel et al., 2005).

Input-Output Methodology: Consists of a detailed and rigorous mathematical framework that tracks the flow of production and embodied land which gives rise to resources produced to sustain a population (see page 15).

Life-cycle Analysis: Based on the principle that increases in visitation rates by tourists to an area can be followed by a decrease in visitation as the carrying capacity of the destination is reached (Fennell, 2008).

Natural Capital: Natural resources (raw materials and natural cycles) which yield ecological assets. Sometimes described in an economic way in an attempt to place a value on what the natural goods and services provide for consumers.

Overshoot: When the demand of a population for resources exceeds the amount of production an area can produce, diminishing the ability for the area or productive land to be able to regenerate itself once exploited (Global Footprint Network, 2009).

Pasture Land: Land used for grazing stock and farming, quantified in a similar way to cropland. Used primarily for meat, wool, leather and dairy products.

Productivity: The ability of an area of land such as farmland, or cropland to produce. The success of production is dependent on soil properties, local environments and management practises.

Yield Factors: Accounts for the differences in productivities for different regions or nations. It describes the extent to which New Zealand's productivity of land is more or less productive than the world average.

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APPENDICES

Appendix One: English and Japanese Survey Instruments

Student Thesis on Natural Resource Management

Dear Sir / Madam

What is this survey about?
The aim of this survey is to assess the impact tourists have on New Zealand's environment.

Who is the researcher?
Miss Katrina O'Connor's research is part of a Masters degree in Natural Resource Management.

Who should fill in this survey?
Tourists who are visiting New Zealand and are 18 years or over.

Confidentiality
The information you provide will be treated confidentially and anonymously and will only be used for the purpose of this study.

Project contacts
If you have any questions regarding this research please contact either myself or my supervisors.

Katrina O'Connor	Assoc. Prof. John Holland	Assoc Prof. Ed Minot
(06) 356 9099 ext 2944	J.D.Holland@massey.ac.nz	E.Minot@massey.ac.nz
0273486898		
tree_marie86@hotmail.com		

This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Prof. Sylvia Rumball, Assistant to the Vice-Chancellor (Research Ethics), ph. (06) 350 5249, e-mail humanethics@massey.ac.nz

1. What sex are you? (circle letter) a. Male b. Female

2. To what age group do you belong? (circle letter)
   a. 18 – 29 d. 50 – 59
   b. 30 – 39 e. 60 +
   c. 40 – 49

3. Circle your income category ($NZ)
   a. ≤ 20,000 e.100,001 – 140,000
   b. 20,001 – 40,000 g.140,001 – 180,000
   c. 40,001 – 60,000 h. 180,001 – 200,000
   d. 60,001 – 80,000 i. 200,000 +
   e. 80,001 – 100,000

4. In what country do you live in? _____

5. How many days are you staying in New Zealand? _____

6. How many days have you already been in New Zealand for? _____

7. City of arrival in New Zealand _____ city of departure _____

8. What is your <u>main</u> reason for visiting New Zealand? (circle letter)
   a. Holiday d. Education
   b. Business e. Other……..
   c. Visiting friends / family

9. How many nights during your time in New Zealand will you stay at the following accommodation types?
   a. _____ Hotels f. _____ Hosted
   b. _____ Motel/ Motor Inn g._____ Camping Ground/Caravan Park
   c. _____ Bed &Breakfast h. _____ With friends/family
   d. _____ Luxury lodge i. _____ Other (please specify)……..
   e. _____ Backpacker/hostel

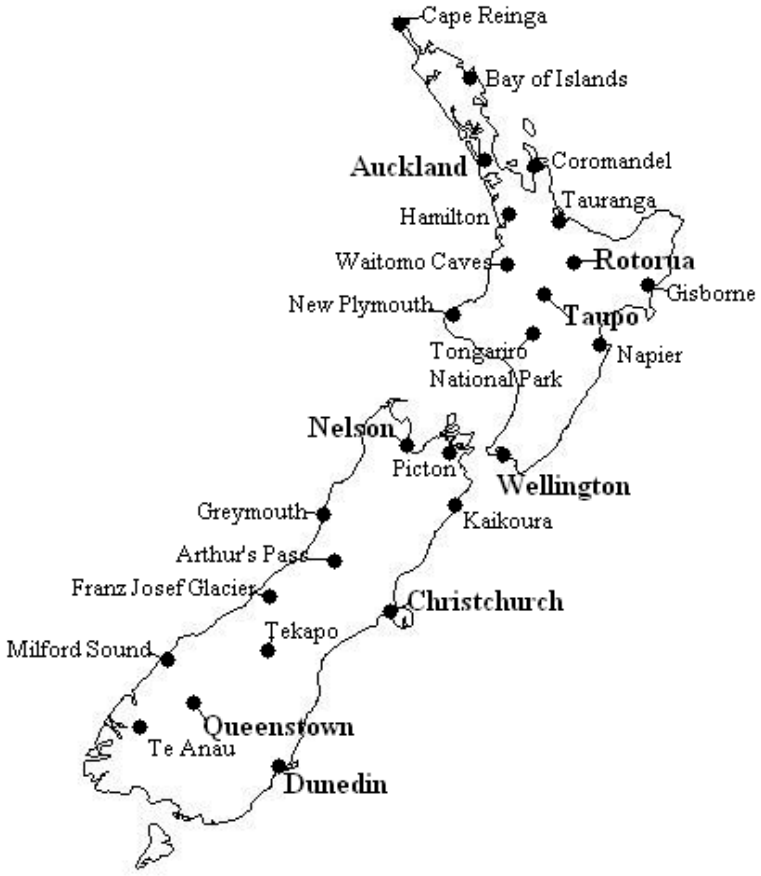
10. How many other people do you usually share a room with during your visit? _____

11. During your trip, approximately how much do you spend <u>per week</u> on the following?
   a. Telephone (public or phone card) $NZ_____
   b. Dry cleaning $NZ_____
   c. Medical insurance and services $NZ_____

12. Indicate the <u>number</u> of the following items you have purchased (or plan to) during your trip?

   a. ____ Jewellery/accessories f. ____ Medicine/health supplements
   b. ____ Cotton products (e.g jeans, tee shirt) g. ____ Wool/sheepskin/leather products
   c. ____ Wooden products (e.g. Maori carving) h. ____ Cigarettes or other tobacco products
   d. ____ Books/magazines/newspapers i. ____ Cosmetics/soap/hand cream
   e. ____ Electronic goods

13. Circle the dots on the map of the places you visited (or will visit) in New Zealand.



14. What are the <u>two main</u> types of transport you have used during your stay and please estimate the portion of your trip using these modes? (circle letter and fill in blank).

a. Domestic Air (_____%)
b. Train (_____%)
c. Car (_____%)
d. Bus (_____%)
e. Mini – bus / van (_____%)
f. Other (please specify) (_____%)…….

15. If you took a domestic flight during you stay in New Zealand, please indicate the place of departure and arrival:

a. Depart from: _____
b. Arrive at: _____

16. Approximately how many times <u>per week</u> do you use the following?

a. _____ Laundry
b. _____ Bath tub

17. Typically, how many <u>minutes</u> do you spend in the shower per day? _____min

18. a. How many times <u>per week</u> do you eat out at a pub / restaurant / cafe while in New Zealand? _____ times
b. On average, how much do <u>you</u> spend on food and drink per outing? $NZ _____

19. Circle the letter that generally corresponds with the size meal you typically eat whilst on holiday.

BREAKFAST

a. Small (e.g. cereal, muesli, toast, juice, fruit, yoghurt)
b. Large (e.g. sausages, bacon, toast, fried tomatoes, eggs, hash browns, pancakes)
c. None.

LUNCH

d. Small (e.g. salad, sandwich, juice, fruit)
e. Large (e.g. pasta, burger, roast, wedges, takeaways)

EVENING MEAL

f. Small (e.g. salad, veggies, rice/couscous/pasta small portion of potatoes and/or small portion of meat)
g. Large (e.g. large portion of all food categories incl. veggies, salad, potato, pasta, rice and meat)

20. Are you a vegetarian? (circle answer) Y / N If yes go to 22.

21. Indicate the number of times per week you would eat each of the following during your trip:

a. _____ Beef
b. _____ New Zealand Lamb
c. _____ Pork
d. _____ Chicken
e _____ Fish

22. Indicate the number of times you have (or intend to) participate/visit the following:

a. ____ Museum
b.____ Zoo/wildlife/marine park
c.____ Nature attraction (e.g. mud pool)
d.____ Hiking
e.____ Bungy jumping/Canyon swing
f.____ Cinema/concert/Maori performance
g.____ Ski/snowboarding
h.____ Historic sites
i.____ Bar/casino/shopping
j.____ Fishing/whale watching
k. ____ Sailing
l. ____ Jet boating
m.____ Heliskiing
n.____ Kayaking
o.____ Scenic flight
p.____ Sky diving
q.____Boat cruises
r.____ Cycling
s.____ Other (specify) ……

23. Indicate which one of the following best describes your travelling style? (circle answer).

a. Guided Package Tour (includes international flights, all/most of domestic transportation, accommodation, food & activities)
b. Package Traveller (includes the international flight and accommodation)
c. Semi-Independent Traveller (part of transportation and accommodation were organised prior to the trip)
d. Free Independent Traveller (Self directed itinerary)
e. Other (please specify)…….

Thank you for taking the time to help me with my studies.

Student Thesis on Natural Resource Management
自然資源のマネージメントに関する学位論文

Dear Sir / Madam
アンケートに参加して下さる皆様へ

What is this survey about?
The aim of this survey is to assess the impact tourists have on New Zealand's environment.
このアンケートは観光客によるニュージーランドの自然環境への影響を調査するためのものです。

Who is the researcher?
Miss Katrina O'Connor's research is part of a Masters degree in Natural Resource Management.
調査員はマセイ大学自然資源マネージメント修士学生、カトリーナ・オコナーです。

Who should fill in this survey?
Tourists who are visiting New Zealand and are 18 years or over.
調査対象は満十八歳以上のニュージーランドへの観光客となってます。

Confidentiality
The information you provide will be treated confidentially and anonymously and will only be used for the purpose of this study.
アンケートに答えていただいた内容は今回の研究についてのみ利用されます。また、参加者も匿名で扱われます。

Project contacts
If you have any questions regarding this research please contact either myself or my supervisors.
この研究に関する質問があれば、調査員のオコナー、もしくは担当教官にお問い合わせください。

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This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Prof. Sylvia Rumball, Assistant to the Vice-Chancellor (Research Ethics), ph. (06) 350 5249, e-mail humanethics@massey.ac.nz

1. What sex are you? (circle letter)　　a. Male　b. Female
   あなたの性別はどちらですか。　　a. 男　b. 女

2. To what age group do you belong? (circle letter)
   あなたの年齢層はどれにあたりますか。

   a. 18 – 29　　d. 50 – 59
   b. 30 – 39　　e. 60 +
   c. 40 – 49

3. Circle your income category ($NZ)
   あなたの年収は以下のうちどれですか。（単位：＄NZ）
   a. ≤ 20,000　　f. 100,001 – 140,000
   b. 20,001 – 40,000　　g. 140,001 – 180,000
   c. 40,001 – 60,000　　h. 180,001 – 200,000
   d. 60,001 – 80,000　　i. 200,000 +
   e. 80,000 – 100,000

4. In what country do you live in? _____
   どこの国に住んでいますか。……

5. How many days are you staying in New Zealand? _____
   ニュージーランドには何日滞在の予定ですか。

6. How many days have you already been in New Zealand for? _____
   ニュージーランドにはすでに何日滞在していますか。

7. City of arrival in New Zealand _____ city of departure _____
   ニュージーランド到着と出発の都市を答えてください。

   到着_____
   出発_____

8. What is your <u>main</u> reason for visiting New Zealand? (circle letter)
   今回のニュージーランドの旅行の<u>主な</u>理由は何ですか（一つだけ選んでください）。

   a. 休暇　　d. 教育
   b. 仕事　　e. その他……
   c. 家族・友人訪問　　……

9. How many nights during your time in New Zealand will you stay at the following accommodation types?
   滞在中、次の宿泊施設に何泊滞在しましたか。
   a. _____ ホテル　　f. _____ ホームステイ
   b. _____ モーテル・モーターイン　　g._____ キャンプ場・キャンピングカー宿泊所
   c. _____ B&B（ベッド&ブレックファスト）　　h. _____ 個人宅（自宅・友人宅）
   d. _____ 豪華ロッジ　　i. _____ その他……
   e. _____ バックパッカーズ・ユースホステル　　……

10. How many other people do you usually share a room with during your visit? _____
    滞在中、何人の人と同じ部屋を共有しましたか。

11. During your trip, approximately how much do you spend per week on the following?
滞在中、次の設備に一週間当たりどのくらい費やしましたか。

a. 電話（公衆・テレホンカード） $NZ_____

b. ドライクリーニング $NZ_____

c. 健康保険とそれに関わるサービス $NZ_____

12. Indicate the number of the following items you have purchased (or plan to) during your trip.
次の製品の中で購入したもの（もしくは購入予定）の製品の個数を記入してください。

a. ____ 宝石・アクセサリー

b. ____ 木綿製品（ジーンズ・Tシャツ等）

c. ____ 木製品（マオリの木彫り製品等）

d. ____ 書籍・雑誌・新聞紙

e. ____ 電化製品

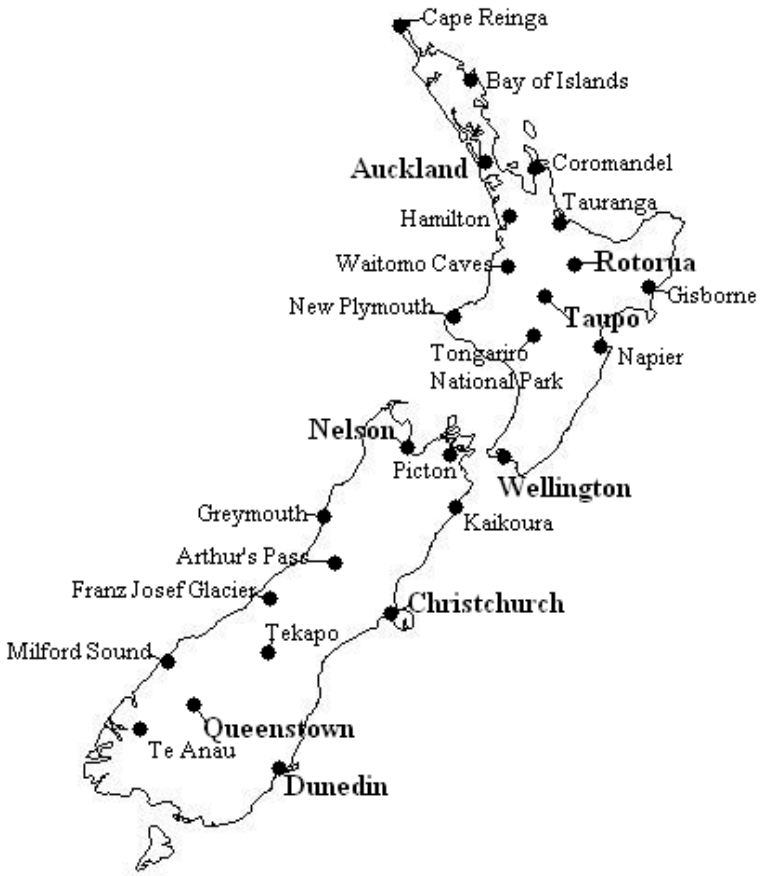
f. ____ 薬・健康サプリメント

g. ____ ウール・ムートン・革製品

h. ____ タバコ類

i. ____ 化粧品・石鹸・ハンドクリーム

13. Circle the dots on the map of the places you visited (or will visit) in New Zealand.
地図上で訪れた（もしくは訪れる予定の）場所の全ての地名に○をつけてください。



14. What are the two main types of transport you have used during your stay and please estimate the portion of your trip using these modes? (circle letter and fill in blank).
滞在中に最も利用した移動手段を二つ選び、またどのくらい利用したか記入してください。

d. 国内線飛行機(_____%)　　d. バス(_____%)

e. 列車(_____%)　　e. ワゴン(_____%)

f. 乗用車(_____%)　　f. その他（記入して下さい）(_____%).....

15. If you took a domestic flight during you stay in New Zealand, please indicate the place of departure and arrival:
国内線の飛行機を利用された方は出発と到着の都市を記入して下さい。

a. 出発: _____

b. 到着: _____

16. Approximately how many times per week do you use the following?

滞在中に次の設備を一週間当たりどのくらい（平均回数）利用しましたか？

a. _____ 洗濯

b. _____ 風呂（湯船）

17. Typically, how many minutes do you spend in the shower per day? _____min
普段の一日あたりのシャワーの利用時間は何分ですか？_____分

18. a. How many times per week do you eat out at a pub / restaurant / cafe while New Zealand?
滞在中、一週間あたり、何回パブ・レストラン・カフェで外食をしましたか。

_____ 回。

b. On average, how much do you spend on food and drink per outing? $NZ _____

一回の外食に、平均でいくら費やしますか。$NZ _____

19. Circle the letter that generally corresponds with the size meal you typically eat whilst on holiday.
滞在中の典型的な食生活について、当てはまるもの全てに○を記入して下さい。

朝食

h. 軽食（シリアル、ミューズリ、トースト、ジュース、果物、ヨーグルト等）
i. 調理された温かい料理（ソーセージ、ベーコン、トースト、ホットケーキ等）
j. 無し

昼食

k. 軽食　（サラダ、サンドイッチ、ジュース、果物等）
l. 調理された温かい料　（パスタ、ハンバーガー等）

夕食

m. 軽食　（例・サラダ、野菜、主食と少なめのメイン等）
n. 調理された温かい料理（全体的に量が多い食事）

20. Are you a vegetarian? (circle answer) Y / N If yes go to 22.
あなたは菜食主義者（ベジタリアン）ですか。 はい・いいえ
「はい」の場合は、質問２２に移動してください。

21. Indicate the number of times per week you would eat each of the following during your trip:
滞在中における、以下の食物の一週間あたりの摂取量を答えてください。

a. _____ 牛肉
b. _____ ニュージーランドラム
c. _____ 豚肉
d. _____ 鶏肉
e _____ 魚

22. Indicate the number of times you have (or intend to) participate/visit the following:

今回の滞在で以下の項目から行った（もしくは行う予定の）アクティビのティ回数を記入して下さい。

a. ____ 博物館・美術館
b.____ 動物園・自然公園・マリンパーク
c.____ 自然景観（マッドプール等）
d.____ ハイキング
e.____ バンジージャンプ・キャニオンスウィング
f.____ 映画・コンサート・マオリショー
g.____ スキー・スノーボード
h.____ 史跡巡り
i.____ バー・カジノ・ショッピング
j.____ 釣り・ホエールウォッチング
k. ____ セーリング（航海）
l. ____ ジェットボート
m.____ ヘリスキー
n.____ カヤック
o.____ 遊覧飛行
p.____ スカイダイビング
q.____クルージング（周遊船旅行）
r.____ サイクリング
s.____その他 ……
（記入して下さい）

23. Indicate which one of the following best describes your travelling style? (circle answer).
今回の旅行スタイルについて、もっとも当てはまるものを次の中から一つ選んでください。

a. 観光つきパッケージツアー （国際航空便とほぼ全ての移動手段、宿泊しう、食事、観光ツアーを含む）
b. パッケージツアー（国際航空便と宿泊施設を含むが、移動手段、食事、観光ツアーを含まない）
c. 一部自由旅行（一部の移動手段と宿泊施設は予約済み）
d. 自由旅行（全ての日程は旅行中に計画）
e. その他（記入して下さい）……

Thank you for taking the time to help me with my studies.
アンケートにご協力いただき、ありがとうございました。
提供していただいた情報は研究に役立たせていただきます。

Appendix Two: Assumptions and Calculations

Food:

- The three main meals in a day were divided up into two main types; small and large. Each tourist was given a set amount of food for each meal size.

- Since meat has a larger footprint than all other food types and is more sensitive to the EF calculator, meat was divided up further into the number of times each meat type was eaten per week.

- Food allergies or special diets that a tourist may have are not incorporated in this research.

- It was assumed that there are two sizes of meat portions (beef, chicken and lamb) for an evening meal:

  Small meal = 130 grams
  Large meal = 200 grams

  Since fish is a lighter meat, the large portion size is smaller:
  Small meal = 130 grams
  Large meal = 150 grams

Food Types		**Breakfast**		**Lunch**		**Dinner**	
	m	**Light**	**Heavy**	**Light**	**Heavy**	**Light**	**Heavy**
Veggies, potatoes & fruit	[kg]	0.1	0.1	0.3	0.3	0.05	0.05
Bread and bakery products	[kg]		0.06	0.06	0.06		
Flour, rice, noodles, cereal products (exc maize)	[kg]	0.045		0.035	0.035	0.05	0.125
Maize	[kg]						
Beans and other dried pulses	[kg]						
Milk, cream, yogurt, sour cream	[kg]	0.25	0.25	0.125	0.125		
Ice cream, other frozen dairy	[kg]						
Cheese, butter	[kg]		0.001	0.002	0.015	0.015	0.015
Eggs [assumed to be 50 g each]	[number]		2				1
Meat (assuming each person eats 250/130g per meal)	[kg]						
Pork	[kg]		0.1	0.05	0.005	0.033	0.05
Chicken, turkey	[kg]				0.005	0.033	0.05
Beef	[kg]				0.005	0.033	0.05
Fish	[kg]				0.005	0.033	0.05
Sugar	[kg]	0.0015	0.0015			0.0015	0.0015
Vegetable oil (seed or olive oil)	[l]		0.005		0.015	0.015	0.015
Margarine	[kg]		0.0015	0.0015	0.0015		
Coffee & tea	[kg]	0.0015	0.0015	0.0015	0.0015		
Juice & wine	[l]	0.25	0.25	0.25	0.25	0.25	0.25
Beer	[l]					0.33	0.33
Garden [area used for food]	[m2]						
Eating out	[$]						

- Cropland and pasture footprint of food away from home is calculated by taking the cropland and pasture footprint of average per capita food consumption without dining out (sum of other cropland and pasture footprints of food) per day (/365), and assuming that each meal eaten out provides one half of the day's nutritional content (×.5). The footprint for eating out also assumes that every $10 spent is roughly equivalent to one meal.

- Each tourist was assigned a number from 1 – 10 depending on the combination of food sizes for each meal type, this makes analysis a lot easier when looking at the total amount of food an individual tourist eats per day. The numbering of food into different sizes is shown in Table… below.

Meal size category	Number	Breakfast	Lunch	Dinner
Small	1	None	Small	None
	2*	Small	Small	None
	3	Small	Small	Small
	4	None	None	Large
Medium	5	Small	Large	None
	6*	None	Small	Large
	7*	Small	Large	Small
	8	None	Large	Large
Large	9*	Small	Large	Large
	10	Large	Large	Large

* This category will have more than one combination.

Accommodation:
Data for energy use per visitor night was obtained from Becken *et. al* (2001). Becken gives the energy use per visitor night (MJ/visitor) which varies for each accommodation type.

Accommodation Type	Mj/visitor night
Hotel (including Luxury Lodge)	155
B&B	110
Motel	32
Backpacker and YHA	39
Camping Ground	25
Home (private or rented)	41

Source: Becken *et. al* (2001)

These energy uses for each accommodation type are broken into the different energy sources; natural gas, electricity, coal, wood and LPG by converting MJ into m^3, KW, kg, and L respectively.

Conversions to MJ:
1MJ = 0.278 KW, 1m^3 of gas = 4.182 MJ, 1 Kg of wood = 15.67MJ, 1 litre of LPG = 25MJ
The resulting conversions were multiplied by the relative contribution (%) of fuel sources to total energy use obtained by Becken & Cavanagh (2003) which are:

Fuel Source	Hotel %	Motel %	Backpacker %
Electricity	70.6	97.8	90.1
LPG	15.8	2.2	6.1
Natural Gas	8.1	0	0.4
Wood	2.3	0	1.2
Diesel	3.2	0	0
Coal	0	0	2.1

The resulting estimations of energy use per visitor night used to estimate the energy requirements for each tourist per night are shown in the table below.

Accommodation Type	Natural Gas m3 per visitor night	Electricity Use KW per visitor night	Coal use per visitor night	Wood use (kg per visitor night)	LPG use (L per visitor night)
Hotel	2.55054825	25.858309	0	0.170629	0.83266
Motel	0	29.90724	0	0	0.0968
Backpacker	0.030592	8.015296	0.186816	0.024505	0.07808
B&B	0.037284	9.768642	0	0.029866	0.09516
Camping Ground	0.0239	6.26195	0	0.019145	0.061
Home (private or rented)	0.039196	11.147244	0	0.031398	0.10004

Firstly, the energy use was multiplied by the number of days in each accommodation type, then if the traveller was staying in New Zealand for more than a month, up to a year, that number was divided by the number of months spent in New Zealand to get an estimation of the monthly average of energy use for each visitor.

The amount of natural gas, electricity, coal, wood and LPG used per visitor night is divided by the number of people sharing the room.

Water:

The direct water use for each tourist was assumed to be the same as the average New Zealander's direct water usage.

It was assumed that the direct water usage for each tourist is:

Water Use per tourist per day	m3 per day
Shower duration	0.0082 per minute
Laundry	0.165
Bathtub	0.15
Kitchen	0.032
Hand/face/teeth	0.005
Toilet	0.011
Drinking water	0.002
dish washing	0.009

This data was obtained from the Waitakere Regional Council website, Carterton Regional Council website and BRANZ (2003).

Goods:

The "Goods" component of the EF is comprised of two parts:

3. Firstly it looks at the number and weight of goods purchased by tourists during their stay in New Zealand.
4. Secondly, it looks at the "use" of an asset during the tourist's stay. For example, beds in a Hotel room were brought and used only by tourists, so therefore each tourist is then allocated a certain weight of the bed according to where the tourist stayed, and the length of stay. This weight was calculated using the following formula:

Average asset weight Use/tourist = (Life span of asset (obtained from Inland Revenue General Depreciation Rates) × Occupancy rate of accommodation type (obtained from Ministry of Tourism) × 365 (number of days in a year) / Average weight of that asset) × length of stay

Assets include anything a tourist may use while at the accommodation type such as; computers, bench tops, beds, desk, drawers, wardrobe, microwave and electronic appliances.

Goods Purchased:
It was assumed that the weight of the goods purchased by tourists during their stay in New Zealand will be the average weight that was estimated by weighing souvenirs and New Zealand made products in a New Zealand souvenir shop. A set weight was established for each type of purchase a tourist buys and each good was weighed with the same scale. The numbers of items purchased by tourists for each good type was obtained via the survey.

The following tables list the items weighed for each good category and how the average weight was obtained. Newspaper and magazines are included in the waste section since it can be recycled.

Wool (sheepskin, merino thermals)	kg
Scarf	0.187
Socks	0.069
Beanie	0.053
Woollen jersey	0.68
Leather belt (inc buckle)	0.067
Merino thermal	0.12
Pair of gloves	0.053
Possum fur/skin	0.081
Average weight	0.16375

cotton (tees, jeans, other textile products)	kg
Kiwi Soft toy	0.046
Tee-shirt (small)	0.141
Tee-shirt (medium)	0.156
Tee-shirt (large)	0.237
polyester/cotton thermal	0.16
polyester/cotton Jumper	0.516
Average weight	0.209333333

Small appliances	kg
Digital camera	0.275
Cellphone	0.084
Average weight	0.1795

Metal items, tools (jewellery)	kg
Cake Slicer	0.095
Metal paua key ring	0.036
Gecko ornament	0.085
fish hook necklace	0.011
Cheese knife	0.053
Silver necklace	0.036
Silver bangle	0.011
Metal earrings	0.013
Metal magnet	0.015
Average weight	0.039444444

Furniture (wooden figurine or carving)	kg
Kiwi puzzle pieces (fixed) (small)	0.047
Kiwi puzzle pieces (fixed) (large)	0.14
Wooden carved box	0.173
NZ Kauri Bowl	0.288
Large rimu bowl	0.405
Wooden bracelet	0.036
NZ timber salt & pepper shakers	0.054
Wooden boat	0.136
Kauri clock	0.41
Sheep puzzle pieces (fixed)	0.186
Wooden Maori carving	0.141
Average weight	0.183272727

Hygiene products, cleaning stuff	kg
Mud soap for men	0.125
Thermal mud soap	0.04
Manuka Honey soap	0.095
Manuka honey nail & hand cream	0.099
Kiwifruit soap (small)	0.04
Kiwifruit soap (large)	0.1
Lip balm	0.0045
Paua facial scrub	0.089
Merino skin lanolin cream (small)	0.1
Merino skin lanolin cream (large)	0.2
Moisturiser (200ml)	0.169
Body wash	0.234
Average weight	0.107958333

Durable paper products (books) and magnetic paper products (toilet/tissue paper)	
Toilet paper (1 roll)	0.198
Book (small)	0.212
Book (large)	0.456
NZ notepad	0.073
NZ magnetic list pad	0.079
Average weight	0.2036

Goods summary:

Purchased Good	Average Weight (kg)
wool (sheepskin, merino thermals)	0.16375
cotton (tees, jeans, other textile products)	0.209333333
Small appliances	0.1795
Metal items, tools (jewellery)	0.039444444
Furniture (wooden figurine or carving)	0.183272727
Hygiene products, cleaning stuff	0.107958333
Durable paper products	0.2036
Health Supplements	0.035

The purchased goods and the total use of an asset during a travellers stay was added together to come up with a total amount of "Goods" use per tourist.

Transport:

- The number of people in a group can only be estimated using the information generated by number of people sharing a room. However it cannot be assumed that a traveller staying at a backpackers or YHA hostel that is sharing a room with 8-10 other people will be travelling with those people.

- The monthly average distance travelled for each mode of transport was estimated by dividing the distance by the number of months each traveller stayed in New Zealand for. This distance was then divided by the number of people travelling together, which was estimated using the number of people sharing a room.

- For hitchhikers travelling by themselves, it was assumed that two people were in the car, since one must be the driver and the other a single hitchhiker, thus the distances for hitchhiking was divided by two.

- For the respondents that did not circle the places visited during their stay in New Zealand, the information of the destination and departure areas given by the respondents were used to give an indication of distances travelled by the tourists.

- It was assumed for tourists who travelled from the North Island to the South Island and vice versa in a bus, car or mini van travelled 96km on the Cook Strait ferry. The energy intensity of the Cook Strait ferry was obtained by Becken (2002) which is 2.4MJ/km. If the tourist was staying longer than a month, the distance travelled by ferry was also divided by the number of months.

- For tourists that recorded only visiting Queenstown during their stay and used only bus or car as a mode of transport, it was assumed that they would travel the distance of the entire breadth of the Queenstown area (to one end and back) twice, which is 84km (distances around Queenstown were obtained using Google Earth). It was estimated that the size of the Queenstown area was 22km. When living in the city area, all of the shops/restaurants and bars are within walking distance. However the adventure activities such as the AJ Hackett Bungy, Shotover Jet, and the ski areas require catching a bus, shuttle or hiring a car since they are further out of town. These distances were taken into account when estimating travel distances for each mode of transport, depending on the activities the tourist participated in.

Activities

The energy requirements for each activity were obtained from Becken & Simmons (2002) and Becken (2000) as shown in the table below.

Activity	Energy Use per visit (MJ)
Building	3.5
Park	8.4
Amusement	22.4
Industry	11.5
Nature Attraction	8.5
Performance	12
Other entertainment	6.9
Air activity	424.3
Sea activity	236.8
Recreation	26.5
Museums	10
Zoos	16
Experience Centres	29
Rafting	36
Adventure activities	57
Guided walks	110
Sailing	140
Heliskiing	1300
Diving	800
Scenic Flights	340

- Some tourists had trouble accounting for the exact number of times they participated in shopping or visiting a bar, especially if the length of stay was longer than one month. It was common for the tourist to estimate the number of times and put round 100 that would sufficiently cover the number of times they participated in an activity they would do countless number of times, or write a comment such as “lots” or “all season” for ski/snowboarding which had to be quantifiable.

- Also a tourist that worked on the boat cruise in Queenstown for a period of time found it difficult to determine the total number of times they travelled on the ferry. Therefore it was essential that the number of times was estimated.

- The monthly average of activities and attractions visited by the tourists was obtained by dividing the activities by the number of months spent in New Zealand.

Waste:

Since there is no data provided on waste produced by tourists it was assumed that the amount of waste produced per tourist is the equivalent of the average amount of waste produced by the average New Zealander.

The information on waste produced by average New Zealander was obtained from the National Data Waste Report (1997) by the Ministry for the Environment, which claims that the annual quantity of waste disposed of through rubbish bags is 152.3kg/capita or 420grams per person per day.

The average composition of residential waste in the rubbish bags and bins in New Zealand are (Ministry for the Environment, 1997):

- 47% organic
- 4% metal
- 5% glass
- 1% potentially hazardous
- 11% plastic
- 2% construction and demolition
- 26% paper
- 4% other

The information on recycling habits of the average New Zealanders was obtained from the National Data Report (1997) and is as follows:

- Paper and Cardboard = 39%
- Aluminium = 12%
- Other Metal = 36%
- Glass = 48%
- Plastic = 18%

Summary of calculations:

- Water: weekly water use (m^3) × 4 = water use per month.
- Food: 16 different food combinations (e.g. Large + large + small or small + small + large), worked out per person (amount of food per day) × 30 = food per month.
- Activities: Number of times participated in each activity/ number of months in New Zealand = monthly average per activity
- Transport: Total distance/ number of months in NZ/ number of people in vehicle = average distance travelled per month
- Goods: (Average weight per purchased product × number of items brought) + asset use per tourist/ number of months in NZ = goods per month
- Accommodation: energy use × number of days in NZ/ number of months in NZ/ number of people sharing a room.

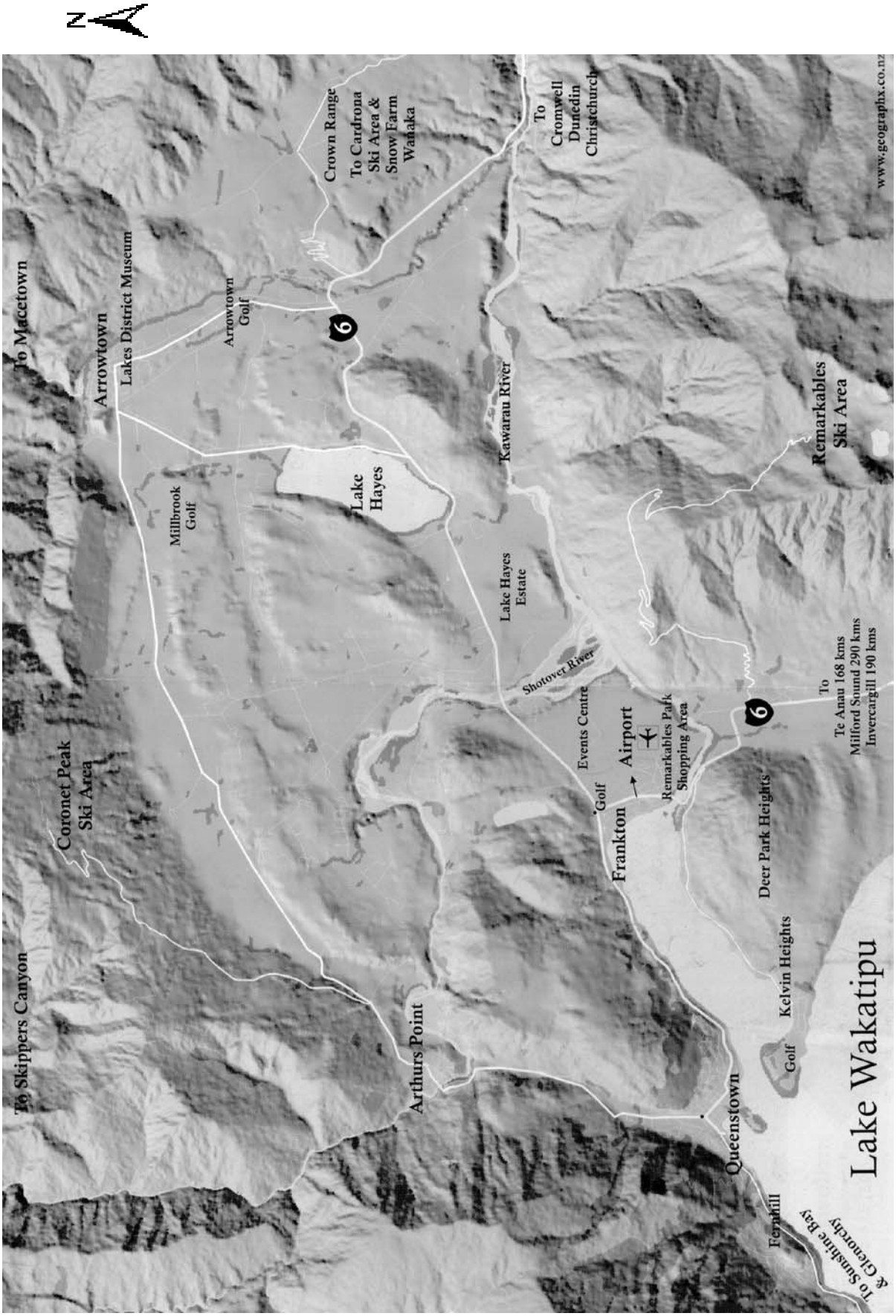
Tourist guest nights:

Queenstown-lakes/Central Otago	Sep-07	Sep-06	Sep-05	Sep-04	Sep-03	Sep-02	Sep-01	Sep-00	Average	Percentage %
Australia	90,820	74,690	85,980	86,050	64,670	53,450	72,050	61,760	73,684	52%
Japan	13,160	9,940	14,120	15,660	15,040	15,770	14,130	15,230	14,131	10%
Korea	4,900	11,550	5,990	5,540	7,800	6,290	3,170	1,390	5,829	4%
Other Asian	8,650	12,330	9,930	8,470	11,710	10,510	14,130	10,830	10,820	7.5%
Total Asian	26,710	33,820	30,040	29,670	34,550	32,570	31,430	27,450	30,780	22%
UK / Ireland	16,770	15,330	18,140	16,210	14,040	12,870	10,070	9,000	14,054	10%
Germany	2,380	2,080	1,910	2,390	1,510	1,140	1,670	1,650	1,841	1%
Other Europe	5,230	4,470	5,710	4,650	3,860	3,160	3,750	2,680	4,189	3%
Total European	24,380	21,880	25,760	23,250	19,410	17,170	15,490	13,330	20,084	14%
North America	8,630	9,730	11,350	9,350	8,530	8,330	8,830	8,970	9,215	6%
Other Country	5,340	6,290	4,570	5,110	6,560	3,930	3,880	2,990	4,834	3%
International Don't Know	8,890	7,210	4,790	3,400	2,320	720	2,030	3,690	4,131	2.8%
Total International	164,770	153,620	162,490	156,830	136,040	116,170	133,710	118,190	142,728	100%

Source: Ministry of Tourism (2008).Commercial Accommodation Monitor.

The raw data from the Ministry of Tourism database to show the proportion of the international tourist markets that will be expected in Queenstown during the September month.

Appendix Three: Map of Wakatipu Basin



Appendix Four: Ecological Footprint Calculator

Ecological Footprint of tourists in New Zealand

I. Calculate how many minutes of life energy it takes to earn one dollar (optional).

Enter your income and hours worked:

0	dollars earned per month (after taxes)
0	work related dollars spent per month
0.0	hours of work per week
0.0	unpaid hours per week for work preparation (commuting, etc.)

It takes 0 minutes of life energy to earn one dollar!

II. Choose whether you want to work with U.S. or metric measurements:

m	**enter "m" for metric, "s" for US standard**

III. Register your monthly consumption in column D (or your yearly consumption in column E). Optional: put the dollar amounts into column F. Goods may be entered as they are purchased to calculate a "one-time footprint", or may be divided by their lifetime (i.e. If you purchase 5 pounds of clothing, and expect the clothing to last 3 years, divide 5 lbs. by 36 months).

IV. Number of people in the household: 1

CATEGORIES	Units	AMOUNT per month	eqv. amount per year	Dollars spent (mth)	FOSSIL ENERGY	CROPLAND	PASTURE	FOREST	BUILT-UP LAND	FISHERIES
1.-FOOD					**(results in uncalibrated global m2)**					
Enter percentage of food purchased that is wasted rather than eaten in your household.				26%	(26 percent is the national average)					
How much of the food that you eat is processed, packaged and not locally grown (from more than 200 miles away)?				d	a. Most of the food I eat is processed, packaged, and from far away b. Three quarters c. Half d. One quarter e. Very little. Most of the food I eat is unprocessed, unpackaged and locally grown.					
Veggies, potatoes & fruit	[kg]	0.0	0	$0.00	0	0				
Bread and bakery products	[kg]	0.0	0	$0.00	0	0				
Flour, rice, noodles, cereal products (exc	[kg]	0.0	0	$0.00	0	0				
Maize	[kg]	0.0	0	$0.00	0	0				
Beans and other dried pulses	[kg]	0.0	0	$0.00	0	0				
Milk, cream, yogurt, sour cream	[l]	0.0	0	$0.00	0	0	0			
Ice cream, other frozen dairy	[l]	0.0	0	$0.00	0	0	0			
Cheese, butter	[kg]	0.0	0	$0.00	0	0	0			
Eggs [assumed to be 50 g each]	[number]	0	0	$0.00	0	0				
Meat										
Pork	[kg]	0.0	0	$0.00	0	0				
Chicken, turkey	[kg]	0.0	0	$0.00	0	0				
Beef	[kg]	0.0	0	$0.00	0	0	0			
Fish	[kg]	0.0	0	$0.00	0					0
Sugar	[kg]	0.0	0	$0.00	0	0				
Vegetable oil (seed or olive oil)	[l]	0.0	0	$0.00	0	0				
Margarine	[kg]	0.0	0	$0.00	0	0				
Coffee & tea	[kg]	0.0	0	$0.00	0	0				
Juice & wine	[l]	0.0	0	$0.00	0	0				
Beer	[l]	0.0	0	$0.00	0	0				
Garden [area used for food]	[m2]	0.0	0	$0.00		0				
Eating out	[$]	0	0	$0.00	0	0	0			0
SUB-TOTAL-1				**$0.00**	**0**	**0**	**0**	**0**	**0**	**0**
2.-HOUSING										
Residence										
House or apartment	[m2]	0	0	$0.00	0			0		
current age of residence	[years]	0								
Construction wood	[kg]	0.0	0	$0.00	0			0		
Yard [or total lot size incl. building]	[m2]	0	0	$0.00					0	
Energy										

Electricity (also check composition–see	[kWh]	0	0	$0.00						
Enter as fraction (eg 25% = 0.25)										
fossil fuels		33%			0					
nuclear energy		0%			0					
large hydroelecric		55%							0	
small or micro hydroelectric		0%					0			
PV solar (on newly built-up area)		0.00%							0	
PV solar (on existing roof area)		1%								
wind		1.3%							0	
geothermal		7.7%								
wood		1%								
waste		1.0%								
Natural gas, city	[m3]	0.0	0	$0.00	0					
Liquid petroleum gas (propane)	[l]	0.0	0	$0.00	0					
Firewood	[kg]	0.0	0	$0.00				0		
Fuel oil, kerosene	[l]	0.0	0	$0.00	0					
Coal	[kg]	0.0	0	$0.00	0					
Water (not included since it depends on	[m3]	0	0	$0.00				0		
SUB-TOTAL-2				**$0.00**	**0**	**0**	**0**	**0**	**0**	**0**

Footprint Calculator for Households

CATEGORIES	Units	AMOUNT per month	eqv. amount per year	Dollars spent (mth)	FOSSIL ENERGY	CROPLAND	PASTURE	FOREST	BUILT-UP LAND	FISHERIES
3.- TRANSPORTATION					**(results in uncalibrated global m2)**					
Bus, transit (around town)	[pers.*km]	0	0	$0.00	0				0.0	
Bus, intercity (Greyhound)	[pers.*km]	0	0	$0.00	0				0.0	
Train, transit (commuter, light rail)	[pers.*km]	0	0	$0.00	0				0	
Train, intercity (Amtrak)	[pers.*km]	0	0	$0.00	0				0	
Car (your own)	[km]	0	0	$0.00	0				0	
average fuel efficiency	[liters]	9								
Taxi / rental/ other's car	[km]	0	0	$0.00	0				0	
average fuel efficiency	[liters]	9								
Motorcycle	[km]	0	0	$0.00	0				0	
average fuel efficiency	[liters]	4								
Airplane	[pers.*hours]	0.0	0.0	$0.00	0					
(e)conomy, (b)usiness or (f)irst class?		e								
Sea Transport (ferry)	[pers.*km]		0		-					
SUB-TOTAL-3				**$0.00**	**0**	**0**	**0**	**0**	**0**	**0**
4.-GOODS										
Clothes and textiles										
cotton	[kg]	0.0	0	$0.00	0	0			0	
wool	[kg]	0.0	0	$0.00	0	0	0		0	
synthetic	[kg]	0.0	0	$0.00	0				0	
Furniture (wooden)	[kg]	0.0	0	$0.00	0			0	0	
Furniture (plastic/metal)	[kg]	0.0	0	$0.00	0				0	
Major appliances	[kg]	0.0	0	$0.00	0				0	
Computers and electronic equipment	[kg]	0	0	$0.00	0				0	
Small appliances	[kg]	0.0	0	$0.00	0				0	
Durable paper products (books) and hyg	[kg]	0	0	$0.00	0			0	0	
Car parts for repair	[kg]	0.00	0.0	$0.00	0				0	
Metal items, tools	[kg]	0	0	$0.00	0				0	
Leather	[kg]	0.0	0	$0.00	0	0	0		0	
Plastic products and photos	[kg]	0	0	$0.00	0				0	
Porcelain, glass	[kg]	0	0	$0.00	0				0	
Medicine	[kg]	0	0	$0.00	0				0	
Hygiene products, cleaning stuff	[kg]	0	0	$0.00	0				0	
Cigarettes, other tobacco products	[kg]	0.0	0	$0.00	0	0			0	
SUB-TOTAL-4				**$0.00**	**0**	**0**	**0**	**0**	**0**	**0**
5.-SERVICES										
Postal services										
international	[kg]	0.0	0	$0.00	0				0	
domestic	[kg]	0	0	$0.00	0				0	
Hotels, Motels	[$]	0	0	$0.00	0			0	0	
Water, sewer, garbage service	[$]	0	0	$0.00	0				0	
Dry cleaning or external laundry service	[$]	0	0	$0.00	0				0	
Telephone	[$]	0	0	$0.00	0				0	
Medical insurance and services	[$]	0	0	$0.00	0				0	
Household insurance	[$]	0	0	$0.00	0			0	0	
Entertainment/Activities/Attractions										
Museum	[No. of visit]	0	0		0				0	
Historic sites, Parliament buildings, mara	[No. of visit]	0	0		0				0	
Botanical Garden	[No. of visit]	0	0		0				0	
Zoo/wildlife/marine park	[No. of visit]	0	0		0				0	
Experience Centre	[No. of visit]	0	0		0				0	
Other Amusements (gondola ride, tram r	[No. of visit]	0	0		0				0	
Farm Show	[No. of visit]	0	0		0				0	
Other Industry (other farm attraction, win	[No. of visit]	0	0		0				0	
Nature Attraction (geothermal attraction,	[No. of visit]	0	0		0				0	
Performance (cinema, concert, Maori pe	[No. of visit]	0	0		0				0	
Other entertainment (bar, casino, shoppi	[No. of visit]	0	0		0				0	
Scenic Flights	[No. of visit]	0	0		0				0	
Other Air activities(air sports, whale watc	[No. of visit]	0	0		0				0	
Sailing	[No. of visit]	0	0		0				0	
Jet boating	[No. of visit]	0	0		0				0	
Boat Cruises	[No. of visit]	0	0		0				0	
Other Motorised water activity (sea fishin	[No. of visit]	0	0		0				0	
Heliskiing	[No. of visit]	0	0		0				0	
Rafting	[No. of visit]	0	0		0				0	
Diving	[No. of visit]	0	0		0				0	
Other Adventure activites (bungy, climbir	[No. of visit]	0	0		0				0	
Guided walk	[No. of visit]	0	0		0				0	
Other nature activities (cycling, dolphins,	[No. of visit]	0	0		0				0	
Education	[$]	0	0	$0.00	0				0	
SUB-TOTAL-5				**$0.00**	**0**	**0**	**0**	**0**	**0**	**0**
6.- WASTE										
waste:					Enter percentage recycled in your household:					
paper and paperboard	[kg]	3	40	$0.00	299	39%		485	154	
aluminum	[kg]	0	0	$0.00	0	12%			0	
other metal	[kg]	1	6	$0.00	90	36%			46	
glass	[kg]	1	8	$0.00	25	48%			13	
plastic	[kg]	1	17	$0.00	192	18%			99	
SUB-TOTAL-6		**5.8**	**70**	**$0.00**	**606**	**0**	**0**	**485**	**312**	**0**

Ecological Footprint Assessment: The Results

Your footprint is 0.5 global hectares.

The Ecological Footprint per household member (calibrated to include indirect commercial and public expenditures)

CATEGORIES	FOSSIL ENERGY [gm2]	CROPLAND [gm2]	PASTURE [gm2]	FOREST [gm2]	BUILT-UP LAND [gm2]	FISHERIES [gm2]	TOTAL [gm2]
FOOD	0	0	0	0	0	0	**0**
HOUSING	0	0	0	0	0	0	**0**
TRANSPORTATION	0	0	0	0	0	0	**0**
GOODS	0	0	0	0	0	0	**0**
SERVICES	0	0	0	0	0	0	**0**
WASTE	3,105	0	0	1,412	102	0	**4,619**
TOTAL	**3,105**	**0**	**0**	**1,412**	**102**	**0**	**4,619**

Ecological Footprint distribution

CATEGORIES	FOSSIL ENERGY	CROPLAND	PASTURE	FOREST	BUILT-UP LAND	FISHERIES	TOTAL
FOOD	0%	0%	0%	0%	0%	0%	**0%**
HOUSING	0%	0%	0%	0%	0%	0%	**0%**
TRANSPORTATION	0%	0%	0%	0%	0%	0%	**0%**
GOODS	0%	0%	0%	0%	0%	0%	**0%**
SERVICES	0%	0%	0%	0%	0%	0%	**0%**
WASTE	67%	0%	0%	31%	2%	0%	**100%**
TOTAL	**67%**	**0%**	**0%**	**31%**	**2%**	**0%**	**100%**

	save cells of this color as values

Footprint Intensity	Cropland [global m2/kg]	Pasture [global m2/kg]	notes
Veggies, potatoes & fruit	1.6		weighted avg:
Bread and bakery products	8.3		same as "flour
Flour, rice, noodles, cereal products (exc	8.3		weighted avg.
Maize	5.0		
Beans and other dried pulses	24.0		weighted avg.
Milk, cream, yogurt, sour cream	2.3	1.2	milk
Ice cream, other frozen dairy	11.6	6.2	milk*5
Cheese, butter	23.2	12.4	milk*10
Eggs	20.8		eggs
Meat			
Pork	27.9		pigmeat
Chicken, turkey	19.0		poultry meat
Beef	54.7	32.3	beef
Mutton, goat	46.9	31.1	mutton & goat
Fish	121.9		weighted avg.
Sugar	3.4		
Vegetable oil	61.8		weighted avg.
Margarine	61.8		based on vege
Coffee & tea	40.1		weighted avg.
Juice & wine	3.8		wine
Beer	2.0		beer
Cotton	39.3		cotton lint
Wool			
Cigarettes, other tobacco products	13.6		tobacco
	Forest [global m2/m3 roundwood]		
Timber	6,469		

Constants and Conversion Factors	
absorption rate [t C/ha/yr]:	0.95
% absorbed by oceans:	31%
Carbon intensity [t C/GJ]:	
coal	0.026
oil (avg. fossil fuel)	0.020
natural gas	0.015
Carbon absorption factor [m^2/MJ]:	
coal	0.19
oil (avg. fossil fuel)	0.15
natural gas	0.11
Pre-purchase food loss	1.1
Structural consumption	1.1
Total built area of goods and waste (m2/cap)	244
Total built area of services (m2/cap)	244
Weight conversion (kg/lb)	0.454
Area conversion (acres/ha)	2.47
Area conversion (m^2/ft^2)	0.093
Volume conversion (l/qt)	0.946

Equivalence and Yield Factors & Footprint [m2]	Equivalence Factors [gm2/m2]	Yield Factors [-]	Unadjusted Footprint [m2]
FOSSIL ENERGY	1.8	0.6	1,725
CROPLAND	3.2	2.1	0
PASTURE	0.4	5.2	0
FOREST	1.8	0.6	785
BUILT-UP LAND	3.2	2.1	32
FISHERIES	0.1	1.0	0
TOTAL	-	-	2,541

Correction Factors for the US	FOSSIL ENERGY	CROPLAND	PASTURE	FOREST	BUILT-UP LAND	FISHERIES
FOOD	1.03	1.35	1.75			2.88
HOUSING	0.98			1.60	0.78	
TRANSPORTATION	0.73				1.19	
GOODS	4.73	4.30	2.16	2.91	0.33	
SERVICES	4.21			3.52	0.33	
WASTE	4.73			2.91	0.33	
U.S. average fossil fuel area of goods:	1903	services:	1652	waste:	1283	

Appendix Five: Raw data, Nationality Averages

	Australia	UK	America	Asia	European	S. America	E. European	Other
Veggies, potatoes & fruit	13.4	13.3	13.4	13.3	13.3	12.0	12.8	13.5
Bread and bakery products	2.2	2.3	2.3	2.9	2.0	2.3	2.7	2.4
Flour, rice, noodles, cereal products (exc maize	5.0	5.1	5.2	4.9	5.1	4.1	4.0	5.3
Milk, cream, yogurt, sour cream	11.0	11.0	10.9	10.6	10.8	8.4	9.4	11.3
Cheese, butter	0.62	0.63	0.65	0.69	0.68	0.65	0.92	0.78
Eggs [assumed to be 50 g each]	34	39	38	60	26	34	45	45
Meat								
Pork	0.342	0.474	0.421	1.202	0.480	0.165	0.500	0.072
Chicken, turkey	1.550	1.744	1.781	1.083	1.275	1.355	1.750	2.367
Beef	2.481	2.165	2.308	2.037	1.822	1.391	1.725	2.293
Fish	0.627	0.662	0.879	0.791	0.314	1.588	0.000	0.706
Sugar	0.119	0.141	0.142	0.176	0.132	0.062	0.259	0.210
Vegetable oil (seed or olive oil)	0.606	0.624	0.645	0.725	0.666	0.656	0.975	0.800
Margarine	0.071	0.072	0.072	0.086	0.065	0.056	0.090	0.083
Coffee & tea	0.089	0.088	0.088	0.086	0.087	0.073	0.079	0.090
Juice & wine	22	22	22	22	22	18	21	23
Beer	9.8	9.9	9.9	9.9	9.9	7.4	9.9	9.9
Garden [area used for food]								
Eating out	226	159	154	146	98	113	130	270
TOTAL - FOOD								
2.-HOUSING								
Residence								
Buildings and land for tourism	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
current age of residence	25	25	25	25	25	25	25	25
Construction wood								
Yard [or total lot size incl. building]								
Energy								
Electricity (also check composition--see note)	226	145	132	236	154	229	237	275
Enter as fraction (eg 25% = 0.25)								
fossil fuels	33%	33%	33%	33%	33%	33%	33%	33%
nuclear energy	0%	0%	0%	0%	0%	0%	0%	0%
large hydroelecric	55%	55%	55%	55%	55%	55%	55%	55%
small or micro hydroelectric	0%	0%	0%	0%	0%	0%	0%	0%
PV solar (on newly built-up area)	0%	0%	0%	0%	0%	0%	0%	0%
PV solar (on existing roof area)	0%	0%	0%	0%	0%	0%	0%	0%
wind	2%	2%	2%	2%	2%	2%	2%	2%
geothermal	8%	8%	8%	8%	8%	8%	8%	8%
wood	1%	1%	1%	1%	1%	1%	1%	1%
waste	1%	1%	1%	1%	1%	1%	1%	1%
Natural gas, city	13.0	2.6	1.9	11.5	0.5	11.4	11.3	3.6
Liquid petroleum gas (propane)	4.8	1.7	1.6	4.4	1.3	4.5	4.7	2.4
Firewood	1.0	0.5	0.4	0.9	0.4	1.0	1.1	0.5
Fuel oil, kerosene								
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water (not included since it depends on local ci	3.4	3.9	3.8	4.0	4.4	4.5	3.8	4.0
SUB-TOTAL-2								
Footprint Calculator for Tourists								
CATEGORIES								
3.- TRANSPORTATION								
Bus, transit (around town)	13.7	3.9	2.9	23.3	8.5	7.9	9.4	29.2
Bus, intercity (Greyhound)	111.1	573.7	7.4	162.5	54.2	144.0	58.8	249.1
Train, transit (commuter, light rail)	0.0	0.0	0.0	0.0	0.0			0.0
Train, intercity (Amtrak)	11.0	0.3	0.9	1.5	1.3	9.7		21.5
Car (your own)	374.1	266.5	185.8	65.9	605.9	183.2	269.2	489.3
average fuel efficiency	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Taxi / rental/ other's car	106.0	144.3	118.3	546.5	219.6	472.2	145.5	
average fuel efficiency	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Motorcycle	0.0	0.0	0.0	0.0	0.0			
average fuel efficiency	0.0	0.0	0.0	0.0	0.0			
Airplane	0.3	1.1	1.1	1.1	1.1	1.2	1.2	1.2
(e)conomy, (b)usiness or (f)irst class?	e							
Sea Transport (ferry)	8.2	17.2	2.3	24.0	21.3	0.0	5.0	8.0
SUB-TOTAL-3								

4.-GOODS								
Clothes and textiles								
cotton	0.43	0.51	0.50	0.34	0.61	0.69	0.59	0.91
wool	0.06	0.09	0.09	0.10	0.08	0.13	0.06	0.43
synthetic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Furniture (wooden)	1.84	4.14	4.75	2.86	4.37	4.50	4.96	3.15
Furniture (plastic/metal)	0.90	2.05	2.37	1.42	2.18	2.24	2.45	1.54
Major appliances	1.58	3.53	4.13	2.15	3.31	3.39	3.71	2.34
Computers and electronic equipment	0.56	1.34	1.54	0.99	1.52	1.57	1.71	1.08
Small appliances	0.27	0.55	0.65	0.35	0.53	0.55	0.58	0.39
Durable paper products (books) and hygenic pa	0.35	0.29	0.27	0.05	0.11	0.27	0.06	0.10
Car parts for repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Metal items, tools	0.05	0.02	0.02	0.01	0.03	0.02	0.02	0.03
Leather	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plastic products and photos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Porcelain, glass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Medicine	0.02	0.02	0.03	0.01	0.01	0.00	0.01	0.00
Hygiene products, cleaning stuff	0.16	0.19	0.07	0.08	0.17	0.06	0.10	0.12
Cigarettes, other tobacco products	0.00	0.11	0.03	0.03	0.07	0.00	0.03	0.02
SUB-TOTAL-4								
5.-SERVICES								
Postal services								
international								
domestic								
Hotels, Motels								
Water, sewer, garbage service								
Dry cleaning or external laundry service	5	10	1	7	7	20	9	22
Telephone	38	44	64	8	28	24	20	93
Medical insurance and services	86	32	14	61	42	9	82	140
Entertainment/Activities/Attractions								
Museum	0.50	0.61	0.31	0.10	1.05	0.73	0.17	0.92
Historic sites, Parliament buildings, marae	1.46	1.07	0.56	0.00	0.61	1.35	0.79	2.50
Botanical Garden		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zoo/wildlife/marine park	0.39	0.38	0.25	0.45	0.39	0.56	0.15	0.33
Experience Centre		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Amusements (gondola ride, tram ride, ca	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Farm Show		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Industry (other farm attraction, wine trail)		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nature Attraction (geothermal attraction, glow w	1.48	0.79	1.32	0.33	2.07	3.45	0.73	2.92
Performance (cinema, concert, Maori performa	0.39	0.78	0.55	0.27	0.58	0.89	0.98	0.33
Other entertainment (bar, casino, shopping, spo	3.51	10.88	6.43	3.39	5.86	4.36	3.15	6.33
Scenic Flights	0.20	0.13	0.01	0.33	0.06	0.13	0.10	0.33
Other Air activities(air sports, whale watching b	0.05	0.27	0.08	0.03	0.16	0.00	0.10	0.17
Sailing	0.03	0.11	0.08	0.00	0.01	0.21	0.10	0.00
Jet boating	0.42	0.31	0.10	0.26	0.09	0.19	0.13	0.33
Boat Cruises	0.70	0.37	0.11	0.21	0.30	0.69	0.25	0.17
Other Motorised water activity (sea fishing, wha	0.22	0.25	0.45	0.79	0.65	0.14	0.15	0.00
Heliskiing	0.04	0.06	0.05	0.42	0.01	0.00	0.02	0.00
Rafting		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diving		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Adventure activites (bungy, climbing, kay	4.05	6.05	5.32	7.00	5.30	1.47	4.60	3.08
Guided walk	1.52	1.64	3.95	0.58	1.60	0.40	0.63	1.50
Other nature activities (cycling, dolphins, horse	0.23	0.36	0.48	0.00	0.32	0.29	0.25	1.33
Education								