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Natural resource consumption of Finnish households and its reduction

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ENVIRONMENTAL PROTECTION

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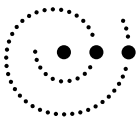

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FOREWORD

Guiding households in a sustainable direction is one of the main prerequisites for an eco-efficient society. Aiming at sustainable consumption stems from the desire to both decrease the environmental impact of consumption and reduce the absolute consumption. Rather than the traditional examination of environmental impact, the MIPS (material input per service unit) method used in this study measures the utilisation of natural resources, thereby focusing on the actual reduction of natural resource consumption.

The study forms part of a more extensive, two-stage FIN-MIPS Household research project for investigating the natural resource consumption of various household activities over their entire life span. During the first stage, completed in 2006–2008, reports on six sub-studies investigating the natural resource consumption of the main components of private consumption were published. The consumption components studied were housing, foodstuffs, tourism, mobility, leisure time activities, and household goods and appliances. This report is associated with the second stage of the project, in which the MIPS data gathered during the first stage were applied to calculations of the natural resource consumption of 27 households.

The scientific director of the FIN-MIPS Household research project was Dr. Heikki Susiluoma and its coordinator until 2008 was Michael Lettenmeier MSc. Satu Lähteenoja MSc was a full-time project researcher and, since the beginning of 2008, was also the project coordinator. The calculations for the study have largely been made by Elli Kotakorpi MA. The methods and research practices used in the study were designed, and the report compiled, by Elli Kotakorpi, Satu Lähteenoja and Michael Lettenmeier.

The steering committee for the FIN-MIPS Household project was mainly composed of the parties who financed it. The main provider of funds was the Ministry of the Environment of Finland. The chairperson of the steering committee was Senior Adviser Merja Saarnilehto, from the Ministry. Other representatives of the funding parties were Ilkka Cantell of the Ministry of Employment and the Economy, Development Manager Ulla Rehell of Kesko Ltd, Sustainable Development Coordinator Mervi Virtanen and Planner Irma Tolonen from the Lahti regional environment services, Camilla von Bonsdorff, Head of Environmental Protection, City of Helsinki Environment Centre, Company Consultant Matti Saarinen and PR Officer Kirsti Vaara from Päijät-Häme Waste Disposal Ltd, Project Leader Harri Helin from Ekokumppanit Ltd, Researcher Annukka Berg from the Sustainable Consumption Network of Finnish NGOs, and Environmental Protection Manager Jouni Nissinen from the Finnish Association for Nature Conservation.

The Finnish Association for Nature Conservation was responsible for implementing and coordinating the research. The study has been carried out as part of the "Eco-efficient Society", the fourth phase of the Ministry of the Environment's Finnish Environmental Cluster Research Programme. In addition to the funding organisations, the steering committee has included Research Professor Eva Heiskanen from the National Consumer Research Centre, Project Coordinator Eija Koski from the Helsinki Reuse Centre and Tiina Sandberg from the Association of Tenants and Home Owners in Finland.

In addition to the steering committee members, we would like to express our thanks to the following persons and parties who have made important contributions

to the progress of the research: Dr Ilmo Mäenpää of the Thule Institute, Holger Rohn, Managing Director of Trifolium, Research Group Director Christa Liedtke and Project Coordinator Michael Ritthoff from the Wuppertal Institute, Deputy Manager Sylvia Lorek from SERI, Director Michael Kuhndt from CSCP, Professor Yrjö Haila from the University of Tampere, Head of Research Jyri Seppälä, Senior Researcher Sirkka Koskela and Special Researcher Ari Nissinen, all from the Finnish Environment Institute, and the team carrying out the sub-studies under the MIPS Household project – Tommi Kauppinen, Karoliina Luoto, Nina Lämsä, Kaisa Merilahti, Tiina Moisio, Riina Pykäri, Marja Salo, Hanna Ruohonen, Petro Tamminen and Sini Veuro, and research assistants Jenni Heikkinen and Samu Piha.

All the above persons have in one way or another helped to promote the study. The views expressed in this publication are, however, those of the authors and do not represent the official line of either the Ministry of the Environment or the other parties involved in the project.

Many thanks to all who participated in carrying out the research. We earnestly hope that the study will assist in promoting sustainable household consumption!

Wuppertal, September 2008

Elli Kotakorpi Satu Lähteenoja Michael Lettenmeier

CONTENTS

1 Introduction

Following the UN sustainable development summit at Johannesburg sustainable consumption and production have become a main issue in international environmental policy (EEA 2005). As a consequence of the 2002 conference Finland, too, decided to prepare a national sustainable consumption and production strategy (Ministry of the Environment 2007). Through sustainable consumption and production programmes a start has been made on paying increasingly more attention to consumption by households. The resolving of environmental problems calls for changes in consumer practices as well. In spite of political warnings the environmental impact of consumption has not decreased. For instance, the greenhouse gases caused by traffic and tourism are growing, despite technology having become more energy efficient (EEA 2005). Only massive increases in oil and fuel prices could, to some extent, slow down this trend.

An eco-efficient society calls for improvement in all actors and their activities. To monitor progress in eco-efficiency, efficient and broad-ranging measurement tools are necessary. The MIPS indicator (material input per service unit) shows how much natural resources an activity or product has consumed during its life cycle. Trends in the natural resource consumption of an activity or product roughly reveal progress towards sustainability (see Schmidt-Bleek 2000; Ritthoff et al. 2004).

This study report forms part of the "FIN-MIPS Household: promoting sustainable consumption" project, whereby the natural resource consumption of Finnish households is being investigated using the MIPS method and the opportunities for increasing the eco-efficiency of households are being documented. Material flow estimations have been used previously, to some extent, for measuring household consumption, but, in general, the calculations have either been confined to individual products or carried out at a very general level. In Finland extensive material flow studies have only been made on transport (Lähteenoja et al. 2006a). The MIPS method has not previously been used for demonstrating consumption choices to consumers on as large a scale as in this study, neither has its applicability to making households aware of sustainable consumption choices been previously tested to a similar extent.

1.1 FIN-MIPS Household research project

This report is based on the results of the second phase of the FIN-MIPS Household research project; at the same time, it represents the project's summary report. The subject of the project coordinated by the Finnish Association for Nature Conservation is the incorporation of sustainable development in the activities of households with the aid of the MIPS concept. The aim of the FIN-MIPS Household project is to assist efforts towards sustainable consumption and production:

- by strengthening the material flow calculation database with relevance to household activities,
- by testing the use of MIPS in households' consumption monitoring, assessment and trends,
- by making proposals regarding through what methods households' consumption choices and lifestyles could be made more sustainable, and
- by bringing to public attention by various means the results and the advisory material prepared on the basis of these.

The subject of this study is extremely topical. One aim of the consumer policy programme prepared by the Government in 2004–2007 is the recognition of the environmental impact of consumption and production and the promotion of responsible consumption. In this study an endeavour is made to respond to both objectives with the aid of material flow studies.

The study was divided into two parts. During the first phase, the existing material input (MI) database, which is relevant from the standpoint of households, was documented and supplemented. Additonally, six new sub-studies were carried out on material flows in relation to household activities in Finland. At the time this report went to press, a total of five reports had been published separately in the series of publications by the National Consumer Research Centre (Luoto et al. 2008; Moisio et al. 2008; Veuro et al. 2008), MTT Agrifood Research Finland (Kauppinen et al. 2008) and the Ministry of Employment and the Economy (Salo et al. 2008).

During the second phase of the project, the data from the first stage were applied in practice by calculating, with the aid of consumption monitoring, the natural resource consumption of 27 Finnish households and by assessing, on the basis of the MIPS results obtained and through the focus groups that were arranged, the entrenchment of consumption choices and lifestyle. The consumption monitoring succeeded well because none of the households gave up monitoring, despite its laboriousness.

This report sets out how and with what data the households' natural resource consumption was calculated, the nature of the consumption, and what opportunities there are for reducing consumption.

Framework set for the study

As a basis for defining the extent of the studies, the consumption definition of the Organisation for Economic Co-operation and Development (OECD) has been adopted. Household consumption was divided into seven components – housing, mobility, tourism, leisure time activities, food, packaging and wastes, and household goods and appliances (Figure 1). These components were chosen because, based on previous studies, these aspects of consumption are most important from the environmental perspective (Michaelis & Lorek 2004; EIPRO 2006; Lähteenoja et al. 2006b).

The system boundaries used for the study are not exactly the same in the different consumption components. The limits set are based on what has been assessed as being important in the various components, as well as on the availability of data. More details about the boundaries set for the various consumption components are given in Section 2. The components included in the study are those that households can directly influence through their own choices. Thus, public services like health care and education were excluded from the study, even though they are services targeted at households and account for an appreciable amount of consumption by Finns.

The Thule Institute, University of Oulu, has calculated the private and public material flows at the level of Finland's national economy. The Thule Institute is also calculating the total material requirement (TMR). However, the results of the Thule Institute and of this study are not fully comparable owing to the partially

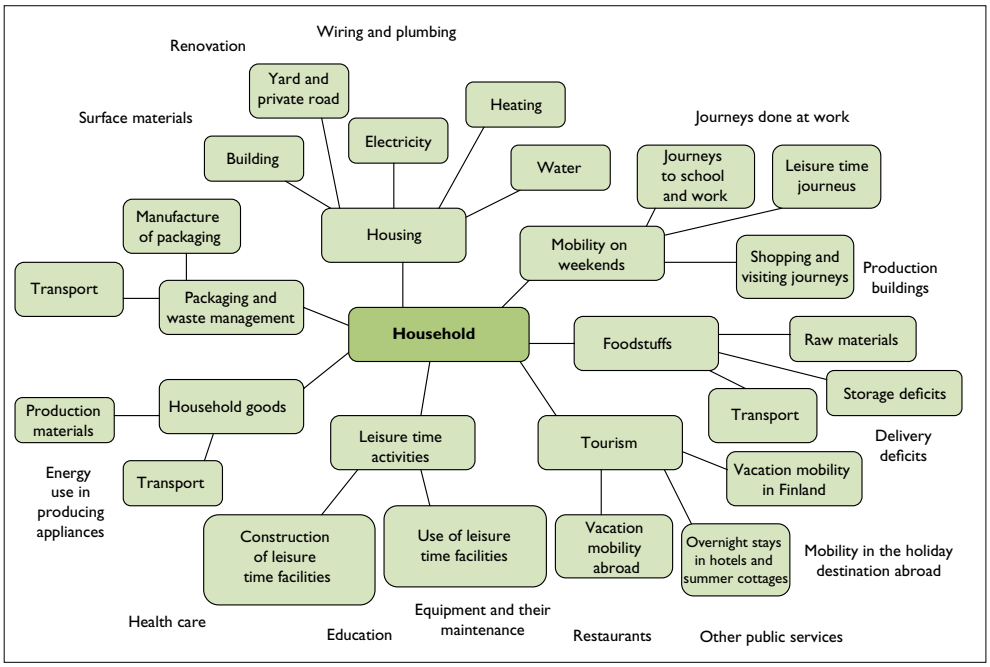

Figure 1. The sub-sectors and their specifications in the study. Topics in the boxes are included in the study, while those outside the boxes are excluded from the study.

different boundaries to the system sectors used. In the national economy material flow accounting (Mäenpää 2000 and 2005) the final use of products is divided into three main categories – (private and public) consumption, capital formation, and exportation. Material inputs to the infrastructure of the national economy accounting, that is, road and building material inputs, are calculated by the Thule Institute as capital formation, whereas in this study they are considered as belonging to the users. Thus, residential buildings are calculated for households, and roads, according to their users, for passenger and goods transport. Another important question appertaining to the system's sector boundaries is associated with agriculture and whether the crop plant harvest is to be considered an output of nature or of the human economy. On the basis of the MIPS concept (for more about this see Section 1.4), the material input to crop plants is wholly calculated as natural resource consumption.

1.2

Households and sustainable consumption

According to Statistics Finland's definition (2007) a household comprises all those persons who live and eat together or who otherwise use their income together. Frequently, the household concept is used as a synonym for the consumer concept. The difference between these concepts, however, is that the consumer is generally taken to be an individual, whereas in the case of households there is a group of consumers involved, even though a household can be composed of a single person. The consumer is often seen as the individual making decisions on the markets, while a household is viewed as a productive unit (Heinonen et al. 2005). According to Hultman's (1994) definition, a household is a social-organisational unit, which does not have to be limited to the physical frames such as wall, floors and roof. The most significant physical manifestation of a household is housing, that is, the home.

According to the OECD's definition, household consumption means products and services consumed by households. This includes the choosing, purchasing, maintenance, and disposal of products or services. Household consumption does not include public sector consumption or the indirect consumption of products and services taking place in the production sector (OECD 2002).

The widely used definition of the concept of sustainable consumption is as follows: "the use of goods and services that respond to basic needs and bring a better quality of life, while minimising the use of natural resources, toxic materials and the emission of waste and pollutants over the life cycle, so as not to jeopardise the needs of future generations" (Norwegian Ministry of the Environment at the Sustainable Consumption Symposium, 1994). The "basic needs" mentioned in this definition are, however, a problematical concept. Necessary and unnecessary consumption are difficult to define because people's concepts of these vary enormously. Defining "necessary and "unnecessary" calls for broad public discussion into which this study does not, however, go.

Sustainable consumption is a dynamic concept indicating the direction of a desired or hoped for change. The definition of sustainable consumption can be developed when fresh data are gathered and political objectives change. Holden (2001) has recognised three strategies for achieving sustainable consumption, namely, efficiency, replacement and reduction. According to the efficiency strategy, a prerequisite of sustainable consumption improvement is the development of new, more effective technologies. In the replacement strategy the change in consumer habits is seen as a precondition for sustainable consumption. The reduction strategy aims at reducing consumption of all kinds.

The Finnish Sustainable Consumption and Production National Action Plan, the KULTU Committee's proposal for a national programme for sustainable consumption and production (Getting more and better from less) lays down a vision for the year 2025: People will have the motivation, opportunity, and access to knowledge to allow them to make choices that support sustainable consumption and production patterns, as well as opportunities to participate in planning processes and in making decisions affecting their surroundings. In addition, it states that the needs and behaviour of the different consumption clusters should be identified better in order to use education and awareness raising efficiently and offer sustainable choices to the consumers. This vision has also formed one of the starting points for this study.

In the analysis of the interview data from this study (see Section 6) consumption is considered to be a wide-ranging concept, which is influenced by people's lifestyles and social and cultural structures. To make it possible to steer consumption in a more sustainable direction, the consumption choice situation context must also be taken into account. The consumption choice situation and the consumption concept underlying the analysis of the interview material are discussed in greater detail in Section 1.5.

1.3

Trends in household consumption

People's consumption habits are constantly changing. The main changes at the moment are associated with, for example, nutrition, the amount of goods, and housing (Heinonen 2004). According to Perrels et al. (2004), the most significant change in direction in Finnish households in regard to the environment and natural resources consumption has been the growth in consumption expenditure and the general increase in the size of homes, together with a rise in the amount of small

households. Growth in the actual number of households, and the decrease in the size of individual households have been predicted as continuing with changes in the population structure and large population classes taking retirement. Trends of this kind are followed by privatisation, meaning that activities are becoming more household-oriented. As a consequence of privatisation, among other things, the amount of equipment and accessories owned by individual households will increase (Perrels et al. 2004).

According to Statistics Finland (2003), on average 2.15 persons belonged to a Finnish household in 2001, whereas the equivalent complement in 1966 had been 3.34 persons. The number of households has grown over the period 1966–2001 by around one million, while over the same period the growth in the population has amounted to some 500,000 persons. Around two-thirds (1.6 million) of households are one- or two-person households. The proportion of childless couples and pensioners among households has been predicted to rise dramatically in the future (Perrels et al. 2004). In relation to the form of housing, the changes have been particularly obvious in the increase in the abundance of row houses (terraced houses) and detached (single-family) houses. One of the most significant changes occurring in housing as a whole during the last few decades has been families with children moving to detached houses. Housing has become sharply differentiated according to the type of household. Young people typically live in apartment buildings, families with children in detached houses, and older people either in detached houses or row houses (Ahlqvist & Berg 2003).

According to Perrels et al. (2004), in addition to the total number of households, a factor which has a major effect on eco-efficiency is the surface area of a dwelling. This directly affects energy consumption through, for example, heating, lighting and other use of electricity. Additionally, the amount of living space has a direct effect on the consumption of materials and energy per person connected with the entire complement of buildings (Perrels et al. 2004). According to Statistics Finland, in 2006 floor space amounted to 38 m2/person (Statistics Finland 2007). Floor space is predicted to rise by as much as 25% by 2020 compared to the 2000 level (Lahti & Halonen 2006).

Trends in household consumption over the last few decades reflect the modernisation of consumption, through which consumption growth has been vigorous and the focal point of consumption has shifted. Growth in consumption expenditure accelerated during the late 1980s and 1990s. At the same time, the proportion of foodstuffs in terms of consumption expenditure fell, while correspondingly the proportion of mobility, leisure time activities and data communications grew (Ahlqvist & Berg 2003). Private household consumption accounts for around a half of Finland's GNP (Perrels et al. 2004).

In the transport sector the trends are rising all over Europe. People are travelling farther and farther afield and are making short trips within Europe increasingly more often. The growth in air traffic is faster than economic growth. Again, the number of passenger cars grew between 1995 and 2002 in the European Union member states by 10% (EEA 2005).

An important trend in food consumption over recent decades has been the increased consumption of meat. According to the FAO's (2008) statistics, between 1980 and 2003 in Finland the annual meat consumption per capita rose from 58 kg to 68 kg. The demand for products of animal origin grew rapidly, especially in countries like China and India (Rosengrant et al. 1999).

1.4

MIPS as a calculation method for eco-efficiency

The idea behind eco-efficiency is that we ought to derive more benefit while loading the environment less than we do at present. The definition of eco-efficiency varies slightly and some researchers refer generally to less environmental loading than at present (see Heiskanen et al. 2001), while others speak specifically of less consumption of materials (Rissa 2001). In this study, eco-efficiency means a reduction in the consumption of materials, with the benefit received from a product or service either remaining the same or improving.

To facilitate monitoring a possible increase in eco-efficiency, tools are required for measuring it. MIPS is one measure of eco-efficiency. The term "MIPS" is an acronym for "material input per service unit". With the aid of the MIPS measure one calculates how much natural resources have been consumed during the life cycle of a product or service (Hinterberger & Schmidt-Bleek 1999). MIPS takes into account all the materials that have been transferred from their original place during the life cycle of a product (Ritthoff et al. 2002).

In eco-efficiency thinking products are approached from the perspective of the services they produce for people. Products are not needed for themselves, but for the services they offer or provide (Schmidt-Bleek 2000). In a MIPS calculation the materials used for manufacturing, using and disposing of a product are divided by the 'service units', i.e. the benefit achieved. For example, in the case of a washing machine this would be the materials consumed by the washing machine and its use per kilogram of clothes washed (Schmidt-Bleek 2000). A service unit is required to make it possible to compare different products and services (Ritthoff et al. 2002). For instance, it is more sensible to compare the consumption of materials during the life cycle of a coach and a passenger car when they are divided by the number of passenger kilometres produced.

Material efficiency can be improved by either lowering the material input or raising the service performance. Eco-efficiency is often called a technical development perspective. The MIPS figure for a product or service is appreciably lowered also by the consumer's own choices. For example, the decision to arrange car pooling increases the efficiency of a car more than any technical improvement does (Schmidt-Bleek 2000).

MIPS figures are calculated for five or six categories. These categories are abiotic natural resources, biotic natural resources, water and air, together with erosion and/or earth moved in agriculture and forestry. 'Abiotic natural resources' stands for non-renewable materials, 'biotic natural resources' for renewable materials. Erosion caused by agriculture is calculated in its own category. In addition, earth masses moved in agriculture and forestry can be calculated separately. Water is included in the calculation when it is exploited by technical means. 'Air consumption' means the amount of air constituents that are chemically changed by mankind, that is, basically the amount of oxygen combusted (Schmidt-Bleek 2000). The quantity of oxygen burnt also reflects the amount of carbon dioxide formed because air consumption causes carbon and hydrogen to be oxidised to carbon dioxide and water. Thus, the MIPS air consumption category roughly estimates the amount of carbon dioxide emissions.

MIPS does not directly measure the environmental impact of a product or service, but it is assumed to reveal this at a rough level. The idea is that the input to some process changes at some stage to yield only part of which is desired. MIPS provides a preliminary estimate of a product's environmental impact potential (Ritthof et al. 2002). MIPS has also been classed as the preventive environmental policy standpoint (Ritthoff et al. 2002). Instead of concentrating on reducing the effects of, for instance,

emissions and pollution, an effort is made to reduce the consumption of materials in the background.

In this report we talk a lot about the total material requirement (TMR). TMR means abiotic and biotic natural resources, plus erosion, combined. For the sake of simplicity at times the report speaks only of natural resources while actually meaning TMR figures.

In public debate the term ecological rucksack or ecological backpack is used a great deal. Ecological backpack means the sum of the abiotic and biotic natural resources required by a product, together with erosion, minus the product's own mass. Ecological backpack means the 'hidden flows', that is, invisible material flows, for the finished product (Schmidt-Bleek 2000). The ecological backpack is inseparably linked to MIPS methodology, since backpack means almost the same thing as TMR. The only difference is that with TMR the product's own weight is also included in the calculation on the product level.

Another well-used indicator of eco-efficiency is ecological footprint. Ecological footprint has been used for measuring the environmental impact of consumption. Ecological footprint measures the amount of natural resources consumed by people in comparison to the natural capacity for renewal. For this concept, the consumption of food, materials and energy has been calculated in relation to the amount of earth and water area used in production, as well as the area required to assimilate the emissions, principally carbon dioxide (Global Footprint Network 2007). Calculated per inhabitant, the ecological footprint reflects the amount of productive land area required to satisfy one person's consumption requirements (Rissa 2001). With the present size of the global population, it has been calculated that each person has 1.8 hectares of productive land area, but already in 2001 the world's average footprint was 2.2 hectares per person, exceeding by 20% the biocapacity available per person. A Finn's average ecological footprint is almost four times greater than the Earth's carrying capacity would permit at the moment (Global Footprint Network 2007).

Ecological backpack and ecological footprint both indicate natural resource consumption in a particular unit. Ecological footprint measures the surface area used, ecological backpack the mass used. In addition to the surface area used, ecological footprint measures in reality the surface area that would be required to assimilate the carbon dioxide from fossil fuels. Thus, measured in terms of the ecological footprint it is possible to use more surface area than is actually available in the world. Ecological backpack tells us the natural resource consumption actually consumed in kilos or tonnes. Their correlation with the natural resources available is more difficult because there is no unambiguous way of defining the sustainable level.

So-called factor targets are closely connected with the eco-efficiency discussion. Our society ought to dematerialise, that is, reduce the amount of materials it uses, in order to put our activities on a more sustainable level. According to the Factor 4 target, material consumption should be decreased globally by one half over the next 50 years, and, at the same time, our prosperity should double. Achieving this target would require a reduction in material consumption by the western countries by one-tenth of the present level (Factor 10), because nowadays the industrial countries use considerably more natural resources per person than the developing countries (Schmidt-Bleek 2000). If the factor targets are adopted as policy targets, MIPS-type indicators are needed to monitor the achievement. Factor targets and their monitoring do not, however, make any statement regarding reduction prioritisation in environmental problems. For determining priorities, other methods are also needed.

1.5

Action space as a theoretical concept

The question underlying the entire study is how consumption habits could be turned in a more sustainable direction. To make it possible to answer this question, we need to understand in what context consumers act. What matters restrict their actions and what make them possible? What is the action space like where consumers make their choices?

To assist in analysing the focus group data in this study the concept of 'action space' is employed. 'Action space' means those factors that restrict and determine the individual's consumption choice situation. The analysis replies to the question as to what factors determine people's action space and what individuals can do to enlarge their action space. What options are available? The "obstacle" does not necessarily have to be something concrete like price, but it could be, for example, the social environment not approving the making of certain choices.

The action space idea differs greatly from the traditional atomic consumer concept. The consumer does not make separate choices in a vacuum, rather the choices constitute part of social practices as a whole. Neither do consumers have a ready-made set of values separate from the rest of the world which they could apply without discord in all situations (see e.g. Moisander 2001; Spaargaren 2003; Hobson 2001 and 2002; Halkier 1999; Gronow & Ward 2001; Blake 1999). When examining action space, the consumer choice context is a major target of analysis.

Timonen (2002) has criticised the one-sided viewpoint of consumers as rational choosers. She considers that authorities responsible for consumer policy continue to believe that solutions connected with consumption problems will be resolved once the consumers are supplied with sufficient information about the impact of their choices (Timonen 2002). However, criticism of the one-sided consumer viewpoint does not mean that the consumers act senselessly. Timonen endeavours to distance herself from the rationality versus irrationality scenario by analysing consumers' decision-making as mundane reasoning. She examines how daily activity practices that are considered right and sensible are formulated (Timonen 2002).

Based on Giddens' philosophy ("The constitution of society" and "Modernity and self-identity"), Spaargaren's (2003) social practice model is closely allied to the action space concept. The hub of the model is not the individual's norms or values but patterns of social practice defined in time and space which are common and shared with other individuals. The model examines the actions of aware and goal-directed individuals in certain social practices where the individuals can benefit from existing systems of provision (Spaargaren 2003). The arranging of provisions means the alternatives available to the individual in the different sub-sectors of consumption.

One important aspect of action space is that the choice situations of different people are different because, for example, the systems of provision vary according to the circumstances. The choice situation respecting the use of a passenger car may for a certain individual be "will I go by car or bus today?", whereas for another it may be "will I go by car today, or will I go at all?". The latter case simply indicates that public transport is not a realistic option everywhere for work trips. On the other hand, there is no absolute definition of a realistic alternative. Different people consider different things convenient and comfortable and these convenience standards change the whole time (Shove 2003).

The actors are not, however, victims of structures constricting their action space, neither do structures directly determine people's actions. The idea of interaction between the structure and the individual is based on the theory of structuration

formulated in Giddens' book "The constitution of society". Giddens' idea is that structure and the individual are not opposites or distinct from each other, but, at the same time, as structures constrict the activities of the individuals, the individuals also retain them by their own actions (see Hay 1995; Spaargaren & van Vlien 2000).

According to Hay, an action leads to all kinds of effects; as a consequence of the action certain direct effects occur which alter the activity environment, but, at the same time, the performer also learns something new about the structures applying to the action which either restrict it or permit it. The activity situations consequent to the changes differ slightly from previously (Hay 1995). For example, when people begin to travel to the shop by bus instead of using their own cars, they alter their action space a little by reducing the number of passenger cars while, at the same time, showing their friends that the use of a private car is not strictly necessary. If the bus proves to be a practical form of transport, the individual may be encouraged to make use of public transport to a greater extent than previously. The activity environment alters and learning takes place.

In Spaargaren's social practice model the dynamism of this activity environment does not explicitly come out. The action space examination brings to the consumer choice concept historical modification and changes in the possible choices based on previous ones.

Hay points out the significance of structures both as factors restricting action and as factors making the action possible. As an example he uses the Alsatian, which makes the security of an area possible but, at the same time, restricts the actions of an intruder (Hay 1995).

From the standpoint of the formation of action space the choices of one person are not insignificant, even if their actual effect from the environmental standpoint is miniscule. Even minor options extend the individual's action space and, at the same time, reveal the possibilities of resolving options to others. A change in the culture to a more sustainable direction can have its origins in modest beginnings (Massa & Ahonen 2006).

Action space is also associated with the 'lifestyle concept'. The lifestyle concept means the sum of social practices and the individual's story told about these practices. This definition comes from Giddens' book "Modernity and self identity". (see Spaargaren & Van Vliet 2000). The lifestyle concept combines different social practices into a relatively coherent whole. Lifestyle forms part of the formation of an individual's identity. The story of the individual's life indicates what kind of person the individual wants to be. The aim of the practices is not merely to satisfy needs, they also reveal the individual's identity. To retain the 'self identity' of an individual, there has to be some kind of uniformity and coherence between the practices (Spaargaren 2003).

Part of the story told about lifestyle could, for instance, be the justification for a family that otherwise rigorously takes the environment into account in its actions, but drives to the shop by car. The story is action substantiation above all to oneself, but also to others. If it is impossible to justify an action and it is not suitable for the way of life, the action mode will probably change.

The lifestyle concept helps us understand how individuals attempt to distinguish themselves from others and construct their own identity, while, at the same time, adapting to common standards. When investigating sustainable consumption we have to take into consideration how practices reveal people's lifestyle. For instance, when preparing food, people may attain a green way of life by purchasing organic milk. On the other hand, the same person may consider eating vegetarian food too radical.

2 Study material and methods

This section first reports on what data the MI factors used for the natural resource consumption calculations of this study are based. Following that, the households taking part in the study are described, together with the practical arrangements of the consumption monitoring. Additionally, the section describes how the natural resource consumption of households was calculated and how the focus group interviews were conducted.

2.1 MIPS data used for calculations

The calculation of the natural resource consumption of the households taking part in the study is based to a large extent on the database created during the first phase of the study, which comprised six sub-studies (Kauppinen et al. 2008; Luoto et al. 2008; Moisio et al. 2008; Tamminen et al. 2008; Salo et al. 2008; Veuro et al. 2008), and on a literature review of previously made material flow calculations suitable for household consumption (Lähteenoja et al. 2008). The database is fairly heterogeneous and in some consumption components it was necessary to manage with less data than in others (tables 1 and 2). The MIPS data for each sub-sector is briefly described below.

Table 1. Material used in the different sub-categories of consumption.

Consumption sector	Categories used
Transport	7 modes of transport (Lähteenoja et al. 2006a)
Buildings	Individual calculations for each household based on data provided by Tamminen et al. (2008) for different building types, materials, yards, etc.
Energy consumption	2 categories of electricity 6 categories of heat
Foodstuffs	47 groups of food or drinks based on data provided by Kauppinen et al. (2008) and Bringezu (2000)
Household goods and appliances	192 products, materials or product groups based mainly on data provided by Moisio et al. (2008)
Tourism	1 type ("simple") of free time residences provided by Salo et al. (2008) 1 hotel (Salo et al. 2008) 3 flight distances 8 other modes of transport (Lähteenoja et al. 2006a)

Table 2. Comprehensiveness of the MIPS material in each sub-category.

Sub-category	The comprehensiveness of the MIPS material
Buildings	Only the most essential factors for most common building types in Finland
Energy	Comprehensive data on electricity produced in Finland and on different modes of heating
Foodstuffs	Most of the data is about Finnish foodstuffs. The MI data is not entirely comprehensive
Goods and appliances	Only the most essential factors included, the calculations are mostly estimates
Mobility	Comprehensive data on the MI figures of the Finnish transport system
Hotels	Based on case studies that have been conducted comprehensively
Free time residences	Based on case studies that have been conducted comprehensively
Leisure time activities	Based on case studies that have been conducted comprehensively

2.1.1

Study material

At the start of the FIN-MIPS Household project an extensive survey was made of the existing material flow data relevant to household consumption. This was carried out because it was recognised that the subject was an exceedingly broad one and the authors wished to avoid repeating what had already been done somewhere else. A large number of MIPS calculations have been carried out by, for instance, students in Central European universities as part of their degree studies but these are not available in one compilation, especially in electronic format. Data were gathered by contacting researchers and obtaining material directly from them. Some of the material is unpublished. The data obtained was transformed into a literature review. The review covers studies from Finland, Germany, Russia, Austria, Italy, Spain, Japan, China and South Korea (Lähteenoja et al. 2008).

The applicability of the results from the studies mentioned in the literature review to Finland was assessed and based on the assessment those areas in which additional studies were required were identified. Six new sub-studies on material flows within the following sub-sectors were created for the project – Finnish housing, Finnish foodstuffs, Finnish travel, leisure time physical exercise, other leisure time activities, and household goods and appliances. Data from the literature review were used in all the sub-studies and this is dealt with in greater detail in the study reports (Kauppinen et al. 2008; Luoto et al. 2008; Moisio et al. 2008; Tamminen et al. 2008; Salo et al. 2008; Veuro et al. 2008). For each sub-study, the following sections give a condensed account of the assumptions, the system boundaries, and the results.

2.1.2

Housing

The natural resource consumption of the most common types of Finnish dwellings was examined in the sub-study carried out by Tamminen et al. (2008). A calculation tool was used in which the natural resource consumption of different construction materials and construction components made from different materials was calculated in such a way that by combining these a value could be obtained for the material flows of different buildings.

In the Building MIPS sub-study report, MI figures are given for construction technology components, which are divided into three parts – groundwork (excavation) and foundation work, load-bearing structures, and additional elements and non-load-bearing structures. Groundwork and foundation work refer to the removal of soil for underground drainage and frost protection in a yard area, and surfacing and foundation laying in conjunction with green and traffic areas. Load-bearing structures are the structural elements that support the building. They consist of the foundation, load-bearing vertical structures, and horizontal structures, which transfer loads to vertical ones for their support. Additional elements and non-load-bearing structures include non-load-bearing external and internal walls, windows, doors, balconies and stairways. All the interior decorative elements, like paints, wallpaper and flooring, are omitted from the study. In regard to the whole building, the significance of these was considered to be minor. HEPAC (heating, plumbing and air conditioning) technology was also omitted from the study by Tamminen et al. (2008) due to a lack of source data. However, HEPAC technology, with its copper wiring, has been shown to be significant, for instance, in Sinivuori's and Saari's (2006) MI calculation study on university buildings. It can thus be stated that the available MI figures for buildings are minimum estimates, and in actual fact the figures are probably higher. The MI factors used by this study for apartment buildings vary between 49 kg/m^2 and 94 kg/m^2 and those for detached houses between 53 kg/m^2 and 115 kg/m^2. The MI figures for buildings can be found in Appendix 2.

Housing also includes the use of the buildings, that is, the consumption of electricity, heating and water. A great deal of information is available in Finland on the natural resource consumption of forms of energy. For the purpose of this study we used the calculation factors of Nieminen et al. (2005) for electricity consumption, together with the Wuppertal Institute's (2003) MI factors for water. The factors for the energy and water consumed are given in Appendix 2.

2.1.3 Mobility and tourism

Comprehensive information is available in Finland on material flows relating to transport in the form of the results of the FIN-MIPS Transport research project (Lähteenoja et al. 2006a). In the study the MIPS figures for passenger transport, buses/coaches, local and long-distance trains, the metro, trams, aircraft and bicycles were calculated. The natural resource consumption of driving was calculated separately for different road classes like motorways, category 1 main roads, and roads going to properties by allocating the material input required by the infrastructure between the users. The study provides MIPS figures for air transport separately for domestic flights, flights to Central Europe, and inter-continental flights. The MIPS figures used for transport are given in Appendix 3.

Aside from mobility, one significant factor correlated with travel is staying overnight elsewhere than at home. In the Tourism MIPS sub-study by Salo et al. (2008), the natural resource consumption of travel in conjunction with leisure homes (summer cottages) and three hotels was calculated. All the locations in the case examples are located in Finland. One of the leisure homes, the smaller and more traditional one, is based on actual examples. The second summer cottage represents the modern consumption trend in being larger and fully equipped. The luxury leisure home has been calculated using the same defined boundaries as the modest one, giving a valid comparison between the two. Additionally, the natural resource consumption of rental holiday cottages has been calculated in the study. The MIPS figures for leisure homes have been calculated in extreme detail. The main building, the toilet and a possible wood shed, as well as the wastewater treatment system, have all been taken into account.

In addition to leisure homes, Salo et al. (2008) calculated the natural resource consumption of three example hotels. For these calculations, actual data on energy and water consumption, surface areas, parking places and the number of users, the amount of waste and laundry washed, and equipment in the rooms, were used. No information has been obtained about the material inputs of hotel buildings, so for these assessments the MI calculations by Sinivuori and Saari (2006) for university buildings were used. The MIPS figures used for this work are presented in Appendix 3.

In the Tourism MIPS study some sample journeys have been calculated based on mobility and overnight accommodation. Activities taking place while on a trip, such as fishing or gardening, or sightseeing, have been left outside the boundary of the study.

2.1.4 Foodstuffs

In the Foodstuff MIPS study by Kauppinen et al. (2008), MIPS figures were calculated for 22 Finnish foodstuff categories and for Brazilian soya. In that study, foodstuff groups were formed, so that comparisons at the product level were not made for any foodstuff. This also defined to a large extent the level of scrutiny for the MIPS estimate of households' food consumption.

The system boundaries in the study by Kauppinen et al. (2008) differ somewhat from those in the other sub-studies. Owing to the poor availability of source data, material inputs are not included for either production buildings or retail establishments. Distribution losses are not included in the figures because the data available on these are insufficient. Risku-Norja's (2002) general assessment according to which distribution losses amount to around 16% of the total quantity of foodstuffs was considered too rough for the study. Consequently, with foods one can also say that the source data are minimum assessments, which are not as comprehensive as, for example, the figures used for mobility.

In addition to using the Foodstuff MIPS study as material for this work, figures by Bringezu (2000) for foreign foodstuffs were used. Bringezu's figures are also rough ones, providing a picture of magnitude in natural resource consumption. Bringezu gives factors only for biotic natural resource consumption and erosion. From the order of magnitude of biotic factors one can see that these have a narrower scope than those calculated by Kauppinen et al. (2008). However, the figures were used in the absence of more comprehensive data. All the MI factors used in this study, as well as the MI figures calculated on the basis of them for ready-made meals, are given in Appendix 4.

2.1.5 Packaging and waste management

The consumption of natural resources used for packaging was assessed on the basis of the materials contained in them. MI factors were obtained from the list published by the Wuppertal Institute (2003). The weight of returnable bottles was divided by the assumed number of cycles of reuse. The washing of bottles has not been taken into account in the MI calculations for returnable bottles because no information was available on this.

Data on natural resource consumption associated with waste management were mainly based on Salo (2004), taking into consideration either municipal landfill disposal, or in the case of recycling, transportation to the first place of treatment (e.g. a waste sorting centre). For disposal, the same assumptions were made as in Salo's

study and for transport, the published MI factors of Lähteenoja et al. (2006a). No data was available for the air consumption during the construction and maintenance of landfills.

2.1.6 Household goods and appliances

Tthe Goods MIPS sub-study by Moisio et al. (2008) was used as the main material for the MIPS calculation in regard to household goods and appliances. 'Goods' is a very loose concept and can encompass just about anything. 'Goods' in the context of the Goods MIPS study means the moveable property owned by households, with the exception of vehicles used for transport. Fixed furnishings, such as toilet and washroom, kitchen, and clothes cupboards which are permanently attached, have been omitted from the study. The goods concept includes, among other things, furniture, electrical and electronic appliances, textiles, paper and printed materials, and jewellery. The focus of the study is on durable goods. A significant group among these in regard to natural resource consumption is electrical and electronic goods. Non-food daily goods such as tissue paper and detergent were not calculated in the study by Moisio et al. (2008). In this study, these non-food items were taken into account on the basis of their material composition when calculating the natural resource consumption of households.

In their report, Moisio et al. (2008) presented MIPS figures for a total of almost 200 materials, products and product groups. The calculations are relatively rough and are mainly based on product-level studies previously carried out. The calculations include the manufacturing materials, transportation and use of the product, according to what was considered relevant in each product group. For instance, in the case of furniture, transport has been calculated separately for the Far East, Central Europe and Finland. In some goods groups the availability of source material even severely restricted the calculation of the assessed life cycle stages. The energy consumed in manufacturing electrical and electronic appliance had to be left outside the scope of the study because there were no data available on this at all. The energy consumption of appliances throughout their life cycle has been calculated separately for the time of active use and standby use. One can also assume that the MIPS data for goods represent minimum values and in calculations on individual products the figures would most likely be higher.

The average lifespan of goods and appliances from different sources have been used for the Goods MIPS study. Additionally, the study gives MI figures without any division over the years of the lifespan of the items, making it possible to use the actual lifespan when data become available. There is a list of the MI figures used in this study in Appendix 5.

2.1.7 Leisure time activities

The natural resource consumption of leisure time activities was assessed in two sub-studies. Luoto et al. (2008) studied the natural resource consumption of physical exercise activities during leisure time. The Exercise MIPS study focused on the natural resource consumption of the most common physical exercise activities of Finns in different places, that is, cycle paths, jogging tracks, gymnasia and sports halls, ice halls, fitness centres, and artificial grass courts. The calculations took into account travelling to the physical exercise venue, the construction of the physical exercise locale, and the maintenance and use of the latter. Such considerations as the equipment and gear at the physical exercise locations and those belonging to the practitioners, as well as the

maintenance of the equipment and gear, were omitted from the study. For the service performance unit, one activity hour per person was adopted.

The Hobby MIPS study by Veuro et al. (2008) examined the natural resource consumption of boating, the playing of musical instruments as a hobby, and theatre visits. The service performance is the same as in the Exercise MIPS study. The study looked at boating with a fibreglass rowing boat, a fibreglass and an aluminium motor boat, and a small sailing boat. Attending musical instrument lessons can be compared to the calculation of MIPS figures of Luoto et al. (2008) for sports pastimes, while visits to the theatre are representative of cultural pastimes.

The boating calculations of Veuro et al. (2008) are limited to the boat itself and the transport of the boat to the point of sale, the outboard motor, fuel consumption by the outboard motor, the boat harbour, and travelling to the harbour. The MIPS calculation for the playing of a musical instrument as a hobby covers the instrument itself, that is, either a guitar or a piano, the music academy and its maintenance and administration, and travelling to the music academy. In the theatre study both the theatre and the activities of the theatre-going public are examined. The functioning of the theatre includes the theatre building and its maintenance, costumery and sets, and the transportation of props. The public's journeys to the theatre are included in the calculations.

The calculations for both studies have been made based partially on case studies, so that the results cannot be generalised to apply to an average case. However, the calculations bring out the order of magnitude of the natural resource consumption of various physical exercise pastimes. In addition to these studies, assessments of the natural resource consumption of motorcycle sports and visits to the cinema were made based on Merilahti's (2008) research for a Bachelor's thesis. The MI factors used for the MIPS calculations in this study are shown in Appendix 6.

2.2 Households participating in the study

The households involved voluntarily agreed to participate in the project. 'Household recruiting adverts' were placed in the Finnish magazines Luonnonsuojelija (Nature Conservationist) and Nuorten Luonto (Youth Nature), placed on the websites of the environmental administration, the Finish Association for Nature Conservation and the Martha Organisation for home economics, and distributed on the mailing list of the Sustainable Consumption Network of Finnish NGOs. In view of the character of the publication channels it can be assumed that the advert has reached people who are more than averagely interested in environmental affairs. With regard to the success of the study, this may well be a good thing. Carrying out consumption monitoring calls for a certain amount of time and effort, so that motivation was required right up to the study's end.

Approximately 90 households registered for the study. Of these, 27 households were selected for participation. An attempt was made to obtain as broad a range of different households as possible, despite statistical representativeness not being the aim of the study. The 27 households had a total of 78 members. The size of each household varied between one and nine persons. In terms of their location, 7 were in Pirkanmaa (Tampere with its surrounding area), 16 in Uusimaa (Helsinki with its surrounding area), and 4 in Päijät-Häme (Lahti with its surrounding area). There were 6 single-person households, 10 comprised families with two parents and children under 18 years old, and 10 had only adults; there were also one household containing three adults and one with a single parent. Regarding the type of home, 16 families are

living in detached (single-family) houses, 9 are living in flats, and 2 are living in row houses (terraced houses). Of the households, 5 are located in areas of low population density and 22 in urban areas. The lowest gross incomes per person were less than 5000 euros per annum and the highest was 80,000 euros per annum.

Even though producing statistically viable material was not an aim of the study, it was interesting nevertheless to compare how these households fall in relation to other Finns in regard to their attitudes, values and social grouping. In connection with the study project, two Master's theses were produced. For her Master's thesis, Riina Pykäri (2008) examined the environmental attitudes of the households in the study and their possible changes while participating in the project. Dorothée Dutter (2008) analysed the social background of the study households.

Pykäri (2008) gathered research data at the same time as the consumption monitoring was taking place (see next section). The persons participating filled in a questionnaire connected with their attitudes and environmental knowledge before, and again six weeks after, the consumption monitoring. Some of the questions were the same as the ones asked in a broader-ranging questionnaire aimed at gauging the environmental attitudes of Helsinki residents (Lankinen 2005). Additionally, data were obtained from focus group interviews conducted after the consumption monitoring.

Based on Pykäri's (2008) investigation, the study households used for this project, on average, have more favourable attitudes towards the environment than Helsinki residents. When comparing the households' natural resource consumption to environmental attitudes, however, it was observed that attitudes are not correlated with deeds, that is, the overall consumption of natural resources. Thus, it can be assumed that the more environmentally friendlier attitudes of the study households do not have a significant effect on the MIPS results of this study.

For her diploma project at the Wuppertal Institute, Dutter (2008) studied the households participating in the Household FIN-MIPS study using 'social milieu segmentation' (www.sociovision.com). The Sinus Milieus classification used is of German origin and originally featured 10 classes, which Dutter proceeded to divide into four classes. These are leading milieu, traditional milieu, mainstream milieu and sensation-oriented milieus. The premise is that the consumption requirements of people belonging to different social milieus (environments) are extremely different, so that environmental communications should also be different for different groups of people.

2.3 Implementation of consumption monitoring in practice

The consumption monitoring lasted for six weeks in September–October 2007. Before the monitoring period commenced, the research team met all the households at group events, of which there were four, two in Helsinki, one in Lahti and one in Tampere. At the initial meeting a general account was given of the study, together with instructions on carrying out the consumption monitoring. The purpose was also to motivate and commit the households to staying with the project during the whole autumn. In this the team was very successful, as not a single household abandoned its consumption monitoring.

The consumption components monitored were housing, mobility and leisure time activities, tourism, food (nutrition), packaging and wastes, and household goods and appliances. Each week the households received in the mail a questionnaire on the sub-sectors for the week, and the questionnaires were returned immediately

after the week's monitoring period. In contrast to the other sub-sectors, two weeks were allowed for the inventorying of household goods and appliances. In addition to these sub-sectors, summer cottage owners filled in a separate questionnaire about their leisure home. The instructions received by the households for filling in the forms, and the household monitoring data, are available on the net at <www.sll.fi/luontojaymparisto/kestava/mips/kotimips/kulutusseuranta>. This section gives a condensed version of the contents of the questionnaires. In the next section the feedback obtained from the households is given, as well as feedback on the practicality of the questionnaires based on personal experience. The questionnaires are not appended to this report because their total length runs to several dozen pages.

In the background questionnaire households were requested to list the names, ages, education levels and professions or tasks of all members of the household. Additionally, they were asked for the household's total annual gross income and requested to assess the use of money for various things over the month.

For the housing week, questions were asked about the size of the dwelling, its age, and the wall materials. In addition, the households mentioned possible cellars and yard buildings. Aside from the size of the house yards, the questionnaire also asked over how large a part of the yard a lawn, tarmac, gravel or stone slabs had been constructed. The households also provided information on major renovations made to their homes. However, in the final MIPS calculations all these details were not used. The households also gave details of the length of a possible private road to the house and the number of households using the road.

Residents indicated their annual electricity and heat consumption, heating mode, and whether they used eco-power or wind power. Those families using wood for heating indicated whether a tree had been felled for use as firewood, or whether the fuel was waste wood. Additionally, they indicated from how far and by what kind of vehicle the wood had been brought to their home. The households monitored water consumption for one week by keeping a water diary. For the diary the families calculated how many litres of water were consumed for one shower, one visit to the toilet, washing up, and washing clothes. They then calculated how many times each operation was carried out in one week.

In the mobility part the number of journey performances was determined. For a week the households kept a mobility diary in which the kilometres travelled in each vehicle and the purpose of the visit were recorded. The questionnaire also asked for information about the make of a possible car, its year of manufacture, and fuel consumption. A request was also made for information on the number of persons in the car in conjunction with passenger-car kilometres. Although each member of a household kept a separate mobility diary, for the MIPS calculation all the household's kilometres were added together.

In connection with the mobility part of the questionnaire, questions were also asked concerning household members' leisure time activities. Questions were asked separately about summer and winter pastimes, as well as leisure time activities taking place once a week on a regular basis.

Tourism was described on a form on which trips made abroad and in Finland during the previous year were marked. The households were asked to mark down on the tourism form all those trips which did not come under the title of daily journeys. For each trip, the length of the journey, vehicle, and possible overnight stays at hotels, in rental cottages, or cottages belonging to acquaintances had to be indicated. People owning their own leisure home filled in a separate form. On this 'cottage form' the surface area of the summer cottage, the construction materials, water and electricity consumption, the amount of any dredging carried out, and the length of any private road and the number of people using it, could be entered. A rough inventory of goods in the summer cottage was also requested.

During the food week the households kept a food diary in which the food bought during that week, together with food from the larder that was taken out and eaten, were entered. At the end of the week, food which had been purchased during the week but not eaten was deducted from the total amount of food. Also, different members of the family listed all the food they had eaten outside the home. During the food week, the consumption of non-food daily goods like toilet paper and toothpaste was also followed. In the same week the accumulation of waste was monitored. The households weighed the waste accumulating during the week. Packaging and waste sorted by the households (e.g. paper, metal, biowaste) were all weighed separately.

In the goods inventory, goods and appliances in the home and in storage were calculated separately. In the end, stored goods and goods in use were combined in the MIPS calculation. The households listed all their furniture, household appliances and electrical appliances, fabrics, books and newspapers, tools and garden equipment, and jewellery. Households were asked to indicate the main material in the goods together with the estimated service life. Goods obtained second-hand were marked down separately, because the materials consumed by them are no longer calculated as part of the next user's ecological backpack.

The monitoring period for mobility and food was one week. To ensure that the results were as close as possible to reality, households were requested on the sub-sector forms to estimate by how much, and how, the study week differed from a routine week.

The households filled in the forms diligently and on time. Only one household failed to return one form (the food diary). The goods and appliances inventory form sent in by another household was mislaid at the results processing stage. The tourism form from one household was not included in the final review because it appeared that it had not been filled in right to the end.

More details are given in Section 4 regarding the processing of the household consumption monitoring forms and the calculation of natural resource consumption. The preliminary MIPS figures for a household were sent to that household by post in November 2007. A comparison showing the lowest and highest results, together with the figures for an average Finn, for each sub-sector accompanied these. Soon after the results had been received focus group interviews were arranged with the households in which the results and their personal opinions were discussed.

Feedback from the questionnaire forms

Preparing questionnaires is a challenging task, a fact which was also recognised during this study. The results obtained depend to a great extent on how effective the forms are in practice. In this study it was not possible to make use of existing questionnaires; the forms had to be prepared by the authors. The forms were first tested before being finalised based on the feedback results obtained. They were then sent out to the study households. However, there was insufficient time for the testing phase; the forms could have been even more effective, if it had been possible to arrange a second test. The households gave feedback on the effectiveness of the forms, in addition to which the researchers noticed deficiencies when making the MIPS calculations. Below, the deficiencies observed from the standpoint of how they affect the results are succinctly described. Their effectiveness is also regarded from the perspective of what should be taken into account, if an equivalent study were to be made again, or if the households' replies were to be used as data for another study.

Large families in particular felt that there should always be a free week between monitoring weeks to give time for the previous week's forms to be returned before the new ones arrived. This would also have been a good arrangement from the researchers' point of view. The households wished for more background information on the study.

However, the authors did not want to give out this information beforehand for fear that the information would influence the monitoring results. Generally, the questions were considered easily comprehensible and a week set aside for the work was felt to be reasonable. The questions were not, in the households' opinion, surprising.

Since the material consumption of households has not been comprehensively studied previously, it was not clear at the outset what things are fundamental regarding the level of accuracy and what are not. Especially on the housing form, households were asked about many things which were not, however, used in the MIPS calculation owing to a lack of background material or the level of precision. Such information includes, for instance, the number of electrical sockets, the surface area of common areas in apartment buildings, renovations and excavation, which were not in the final instance taken into account because they overlapped with road and yard construction. On the other hand, when asking about the yard, it was not very clear whether the question applied to the yard or to the entire plot, nor was it clear whether a lawn had been planted or not. These aspects in relation to households were later examined separately. Households also gave negative feedback regarding the ambiguity of the yard and plot concepts. Again, where the surface area of the house was requested, it was unclear whether this meant the size of the apartment, the storey, or the total surface area.

To make it easier to enter notes in the food diary, a distinction was made between purchased food and food from the store. Some households, however, found this difficult and confusing due to the large number of options. Again, a separate column for "self-grown food" would have been appreciated. The keeping of the food diary and weighing of foodstuffs was considered laborious. Also, a week was felt to be too short a time for average consumption habits to reveal themselves, as weeks varied a lot in some of the households. There was ambiguity in the food diary instructions. For example, should milk be recorded in grams or litres, and tea as the amount of tea leaves or as a drink? Despite this, the households clearly explained their diary entries. In conjunction with the waste monitoring chart some households experienced difficulty with filling in the form due to the concept. Not all, for instance, understood the term "packaging".

The household goods and appliances inventory was considered extremely laborious, as was anticipated at the outset. Several households mentioned that the amount of household goods and appliances mentioned in the form were minimum estimates. An effort was made to make the task easier by dividing household goods and appliances into groups. The groups were not, however, in everyone's opinion logical and a lot of items fell outside the groups. Some people wondered why, for instance, more details were not requested about the manufacturing materials for clothing. However, a sound concept was acquired as to the level of accuracy required in this study. For the 'estimated service life' column we should have explained more clearly that this applied to the entire service life of an item, not to its age at present. In association with the household goods and appliances inventory we also requested households to weigh their junk mail, but this would have been easier to do in conjunction with the waste monitoring.

The mobility and leisure time activities forms were generally found to be effective from both the households' and the researchers' perspective. Some people wondered why the metro had been excluded from the mode of transport options in the mobility diary. Kilometres travelled by metro were entered in the column intended for other means of transport. A certain amount of puzzlement was caused by whether the distance travelled should apply to single or return journeys. However, it was possible to discern from the forms which was required and in the case of unclear responses the information was checked afterwards. Repeated, daily trips to school or work, for example, could have been put down just once, with the number of trips per week

entered afterwards. Recording nature-based hobbies was considered to be difficult, as birds, for instance, can be observed wherever and whenever one wishes.

In the leisure time activities monitoring the households estimated the actual amount of their leisure time activities over a one-year period. Hence, the leisure time activities data, which spans an entire year, are more reliable than the other monitoring data where the households assessed their consumption over a one-week period, the result than being extrapolated to one year. However, an error became apparent in the questionnaire monitoring form, which influenced the calculations. The monitoring form asked for households' weekly leisure time activities in hours, but not for the number of times these took place. From the standpoint of travelling to leisure time activities it is of significance, however, how many times a week a person visits the activity venue. Most leisure time activity sessions occupy an hour at a time but the time spent on geographically more distant hobbies, like hunting and golf, had to be estimated on an ad hoc basis.

The research team wished to make a distinction between daily mobility and leisure time mobility. This was to some extent difficult when trips were asked about in different weeks and when filling in the tourism form the households no longer had the completed mobility forms which they could, if necessary, have corrected. But annual trips were found easy to enter so long as the information was available from a calendar. Every household should have been asked to record the number of work and holiday weeks per year. Defining the purpose of a journey caused some puzzlement; for example, describing the difference between a summer cottage trip and a journey to see a friend at a summer cottage. Cottage owners criticised the leisure home form on the grounds that it did not take into account the fact that a summer cottage may actually be used by several families.

2.4

Calculating the natural resource consumption of households

Based on the consumption monitoring, the natural resource consumption of households was calculated. This was done by multiplying the data provided by the households (e.g. 50 km travelled by bus per week) by the most appropriate MI factor (0.32 kg/person-km), giving the household's natural resource consumption per week for travelling by bus (i.e. 50 km x 0.32 kg/km = 16 kg). The service performance chosen for the MIPS calculation was kilograms per person per year, which enabled households of different sizes to compare the figures with each other. For this purpose, the data for the sub-sectors (food, mobility, water), which were monitored over a one-week period, were extrapolated to one year. The material consumption of household goods and appliances was converted to an annual basis by utilizing service life estimates.

2.4.1

Housing

The calculation of the material consumption of housing by households is mainly based on the sub-study of Tamminen et al. (2008). The natural resource consumption of housing comprises the building, yard, and a possible private road, plus heating, electricity and water consumption.

The building

The MI figure for a building consists of the external and partition walls of the building, the roof, and the foundation. Different construction materials have been taken into account in regard to the walls. The various materials include concrete, brick, breeze block and wood, as well as board and brick for wall surfacing. An individual MI factor, based on the calculations of Tamminen et al., has been calculated for each of the houses participating in the study. The number of storeys in the building has also been taken into account, because higher buildings use slightly less materials per square metre than lower ones (Tamminen et al. 2008). In the calculations by Tamminen et al. the surface area of windows has been assumed to be 0.14 times the living space in square metres. If the window area provided by a household differed from this assumption by 10 square metres or more, the assumed window surface area was altered to bring it in line with reality. With an increase in window surface area of 10 m2 in a small house the assumption reduced the MI factors calculated per gross square metre by around one and a half kilos.

Renovations to a house have not been taken into account. The material input of components of buildings above ground have been divided over 50 years because after such a period of time major renovations are already most likely necessary. There were some buildings in the study which were over 50 years old. The material input of the foundations of such buildings has been divided over 100 years.

In the calculations of the material consumption of buildings, material inputs to a possible yard have also been included. Old structures, like hay barns and cow sheds, already present in the yard have been left out of the calculations since they have already provided the service for which they were originally intended. Thus, today they can be regarded as used buildings. The material input of a cellar has been roughly assessed by basing it on the amount of earth excavated from the space occupied by the cellar.

Water, heating and electricity

Water consumption encompasses only the water used in the home, so that the amount of water used by people spending a great deal of time at home exceeds that consumed by those who are away a lot. This lessens the comparability of the figures for water. Energy used for heating water has been included in the material consumption for water use. For heating cold water, the use of various forms of energy was added to the MI factors published by the Wuppertal Institute (2003), with the assumption that 0.058 kWh energy (Motiva 2007) is needed to heat one litre of water to 50 degrees Celsius.

The households reported their annual electricity consumption based on their electricity bills. If the home had electric heating, it was impossible to separate the electricity and heating figures. Other possible forms of heating were wood, oil and pellets, in addition to district heating. Some of the people living in an apartment building were unable to estimate their district heating consumption. For the calculations applying to these households, Motiva's (2007) value for average district heating consumption per square metre (210 kwh/m^2, personal communication) was used.

Schmidt-Bleek et al. (1998) have published an MI factor for wind power. All eco-electricity used by the households has been multiplied by the wind power factor. Nieminen et al. (2005) have calculated factors for district heating and conventional electricity. The calculations of Salo et al. (2008, Appendix 11) were used for the pellet heating factors. With solar heating, in the consumption of materials the material input of the solar energy collector has been taken into account (Klemisch et al. 1999). The

Wuppertal Institute (2003) has calculated MI factors for heating oil production and combustion. In the case of wood heating, the amount of wood has been included in biotic resource consumption if trees are felled for heating purposes, rather than, for example, waste wood being used for the heating. In addition, wood haulage has been taken into account.

Yard and road

The yard figures take account of various kinds of surfacing, that is, lawn (grass), gravel and tarmac. The MI factors for these surfacings have been calculated by Tamminen et al. (2008). Any possible terraces and patios have also been included in the yard figures. The material input of a lawn depends on whether the lawn has been artificially established or converted from nature. The material input of natural yards or gardens is zero. In the case of a planted lawn, the surface soil has been removed and replaced by gravel and sand. This kind of lawn also has sub-surface drainage (Tamminen et al. 2008). In some households with planted lawns, the surface soil had been replaced by gravel and sand but there was no sub-surface drainage. In such cases, the input for the lawn was confined to the gravel and sand. In apartment buildings the material input was divided by the number of households in the building.

Some families living in detached houses had their own private road. Private roads are included in the material consumption of housing. An MI factor for a private road has been calculated by Talja et al. (2006). The material input for a private road was divided by the number of households using the road. Material inputs for other categories of roads, that is, public roads, are included in the figures for mobility, in which the infrastructure contributes to the MI factors for different modes of transport (see Lähteenoja et al. 2006a).

2.4.2

Mobility

The calculations for mobility are based on the results of the Transport MIPS research (Lähteenoja et al. 2006a). Seven different modes of transport were included – passenger car, metro, tram, train, coach, bicycle and walking. The MI factor used for distances driven by passenger car was expressed as average kilograms per vehicle-kilometre, and for distances covered by public transport as average kilogram per passenger-kilometre (Lähteenoja et al. 2006a). This means that the kind of road or track section on which a journey has taken place is not taken into account. Calculating the route travelled by each of the study households separately would have vastly increased the amount of time spent on the calculations. For the kilometres covered by passenger car, the capacity used was taken into account. If half of the people in the car belonged to another household, only half of the material consumption by a household on that particular journey was used for the calculation.

Journeys taking place during work time have been left out of the calculations because they are considered to belong to the employer's material consumption. In the case of walking and cycling, only journeys made in the transportation sense and not trips undertaken for the sake of physical exercise were of interest here. The latter category formed part of the material consumption of leisure time activities. Journeys entered in the mobility diary were multiplied by 45 instead of 52 because in the consumption monitoring the team wished to separate daily mobility from tourism. It was assumed here that daily mobility applies to only 45 weeks of the year. The mobility diary asked whether the study week differed from a normal week. Figures entered in the mobility diary were corrected, if the households had clearly indicated how that particular week differed from a routine week.

2.4.3 Tourism

The consumption sub-components of tourism are free time residences, overnight stays at hotels or elsewhere than in the owned leisure home, journeys by passenger car, journeys by public transport, flights, journeys by ship, and journeys by bicycle. Work trips are not included in the calculations. Journeys by public transport comprise those made by train, coach, tram and the metro.

The hotel and summer cottage calculations are based on the sub-study of Salo et al. (2008) on the material input for three different hotels and two different summer cottages. Overnight stays at hotels were multiplied by the overnight stay factors for Sokos Hotel Arina calculated by Salo et al. (2008), and stays at participants' own summer cottages were multiplied by the MI factor calculated by Salo et al. (2008) for a basic cottage. For the natural resource consumption of households' own summer cottages, the electricity consumption of the cottage, any possible private road, dredging of shores, and goods and appliances in the cottage were also included in the calculations. Water consumption was excluded because many cottages used lake or rain water, or brought water with them from home. Thus, water consumption can be assumed to be low.

If a holiday cottage was being shared among several households, the material input of the cottage was divided by the number of households involved. If it was reported on the forms that members of other households made regular use of a cottage, despite not having any ownership in it, the amount of use they put it to was subtracted from the material input of a study household's cottage. Similarly, if a study household indicated that it stayed overnight at acquaintances' cottages, these were included in the tourism material input of the study household. Nights spent in cottages belonging to acquaintances were multiplied by the MI factor for basic cottages expressed as kilogram per overnight stay, calculated by Salo et al. (2008), and the use of such a cottage was divided evenly among the users. Accommodation in a yacht was entered as an overnight stay. Active sailing was assumed to be six hours per boating session. The MI factor for using a sailing boat has been calculated by Veuro et al. (2008).

For journeys by passenger car and public transport, we used MI factors expressed as average kilograms per person-kilometre and kilograms per vehicle-kilometre, just as in the mobility section of the study. On the other hand, for journeys made by air the length of the journey has been taken into account and the different factors for domestic, European, and long haul flights were used (Lähteenoja et al. 2006a).

2.4.4 Foodstuffs

In the calculations for natural resource consumption of eating and drinking, we first determined how much a household ate in terms of the different foodstuff categories in the course of one week. The reported amounts of food were converted to kilograms on the basis of Sääksjärvi and Reinivuo (2004). The kilogram figure thus arrived at was then multiplied by 52 to give an estimate of the amount of food consumed by a household in a year.

Estimating the natural resource consumption of eating and drinking outside the home proved a challenging proposition. We did not request the size of helpings served in restaurants or at work places, neither did we ask for the precise ingredients. Thus, the size of helpings and nutritious content of foods had to be estimated, and for this we used Sääksjärvi and Reinivuo (2004) food measurements as our source.

Next, the food data, which had been changed to kilograms, were multiplied by appropriate MI factors. Since only 50 MI factors were available, it was necessary to

make a large number of generalisations and to use the MI factors with the best fit for each type of food. Owing to the limitations of the source material, we had to assume that almost all the foodstuffs eaten were of domestic origin. Data were available on transportation from abroad but haulage is not the only consideration with foreign foodstuffs. On the other hand, one can assume that the MI factors calculated by Kauppinen et al. (2008) for Finnish foodstuffs cannot be generalised to cover countries with different climatic conditions. MI factors for foreign food on the basis of Bringezu (2000) were only used for citrus fruits, coffee, tea, cocoa and rice. Nor was it possible to consider organic foods separately, as these do not have their own MI factors. All the MI factors used for the individual foodstuffs, and the MI factors calculated on the basis of these for the different foodstuffs, can be found in Appendix 4. Finally, the annual consumption of food by a household was divided evenly among its members.

The MI factors for food were presented to households as two food pies, in the first of which there was the food eaten, without ecological backpacks, and in the other including their ecological backpacks. For this purpose the food eaten outside the home and 'ready-meal' food had to be separated into different foodstuff groups because we needed to know how much meat, vegetables and cereals were contained in them. Sample results can be found in Appendix 1 and in the MI calculations for the average Finnish consumer (Section 3).

Foodstuff MI figures include only food manufacturing and transport as far as the shop. Trips by households to purchase food have been calculated as part of the MIPS figures for mobility, while the natural resource consumption of food manufacturing comes under electricity consumption, which was obtained as a single figure from the electricity bill. Hence, based on this study it is only possible to compare one foodstuff group with another and not, for instance, adopt a standpoint on food preparation practices. For produce grown by households themselves only the biotic natural resources were calculated. In regard to food grown themselves the households were not asked how much fertiliser they apply. Fertilisers significantly affect the natural resource consumption of foods (Kauppinen et al. 2008).

Horticultural equipment and tools are included in household goods and appliances and irrigation in the water consumption for a whole year.

2.4.5 Packaging and waste management

During the food week, the households weighed the waste accumulating over the week in different waste categories according to how they normally sorted it. Packaging materials were weighed separately from other waste. Additionally, returnable and disposable bottles accumulating over the week were weighed. The amount of packaging and waste accumulated in one week was multiplied by 52 to give the amount for the whole year. Some households indicated how much the study week differed from a normal week, in which case the amounts were calculated on that basis.

An MI figure for packaging was also calculated for the packaging materials themselves, because the packaging for food and non-food daily goods were not taken into account anywhere else in the study. On the other hand, here only the natural resource consumption due to waste management was taken into account in relation to wastes, not the products becoming waste as they have already been taken into consideration previously in other consumption components. Consequently, the natural resource consumption of waste management indicated in this study upholds only to a small extent the notion of waste prevention as a means of reducing natural resource consumption.

For calculating the MI of waste management there were 15 different MI factors for haulage distances based on Salo's (2004) study. The waste management factors include the transportation of packaging. In the MI calculation for packaging materials the MI data for 10 different materials were used. Wastewater treatment is not included in the study due to the lack of available data. All the packaging and waste management MI factors used in the study, and also the households' MIPS results, are given in Appendix 5.

If, during the study week, a household has thrown away the packaging for durable non-food goods, there may be double calculations for packaging and household goods and appliances because Moisio et al. (2008) have also taken packaging into account at a rough level in their MI calculations. However, the packaging contribution was considered marginal, for which reason no instructions were included in the questionnaire to avoid double calculations of this kind. On the other hand, there is a lot of discussion about packaging and waste management nowadays, so we wished to include these in the study in their own consumption component.

2.4.6 Household goods and appliances

The inventory week for household goods and appliances for many households proved to be the most laborious monitoring week of all. The households were able to compile their inventory with varying degrees of accuracy. Household goods and appliances were itemised in categories. These included clothes and footwear, household fabrics, furniture, bulky household appliances, electrical and electronic appliances, books, magazines and newspapers, jewellery, kitchenware, tools, toys and equipment for leisure time activities, and other items. The consumption of non-food daily goods had already been monitored during the food week. However, the MI calculation relating to these was made in conjunction with that of other household goods and appliances.

The households listed all the items they owned, as well as ones which had been obtained second-hand. The number of items was not precisely recorded but was inventoried at a general level. For instance, in the case of colour slides these were entered on the form as boxes of slides, not as single transparencies. Books could be entered as shelf-metres. However, the number of items in each case were added together to give an idea of the total quantity. The overall number of items was up in the thousands. The natural resource consumption was not calculated for goods and appliances which had been purchased or otherwise obtained second-hand. According to the MIPS calculation principle, natural resource consumption is allocated to the first user of a product (Ritthoff et al. 2002). The households were requested to list items in use and in storage separately. However, in the final instance these were added together.

For the MI calculation for the manufacturing of goods and appliances we mainly used the calculation factors of Moisio et al. (2008), which we altered slightly to suit our application. Since the idea was to calculate consumption per year of use, we asked households to assess the probable service life of their goods and appliances. Not everyone understood this request, however, and consequently some households provided the present age of the household goods and appliances. In such cases we used the service life evaluation of Moisio et al. For calculating the MI of furniture, transportation in the country of origin was taken into account but the country of origin was not specifically requested. We asked households to weigh newspapers, magazines and jewellery; otherwise we used existing data on the weight of the items.

The authors wanted to produce an estimate of the use of electricity-consuming household goods and appliances in relation to manufacturing, despite electricity consumption being included under 'housing'. In regard to the use of an appliance the

questionnaire asked how many minutes, hours or times each household appliance is used within a particular time span. Additionally, the form asked whether the appliance is kept on standby when not in use. For consumption data relating to appliances, the calculations of Moisio et al. (2008) were used, as households were not specifically requested to measure the consumption of their appliances.

The households also reported on the form their weekly or annual use of tissues, detergents and other hygiene products, light bulbs, candles, and aluminium foil. Non-food daily goods included, for instance, cat litter, barbecue charcoal, and grit for applying to roads or yards in winter. Since an MI figure has not been calculated for all the products, we had to make use of what was available. As with other goods, the estimated annual consumption in kilograms was multiplied by the MI factor before being divided among the members of a household. The MI factors used for these goods can be found in Appendix 6.

2.4.7 Leisure time activities

When calculating the MIPS for leisure time, only the natural resource consumption of the pastime itself was taken into account, owing to the fact that travelling to the venue for a leisure time activity has been included in the daily mobility figures. However, mobility to a leisure time activity is included in the interpretation of the results. In the monitoring forms, family members were asked to write down their leisure time activity, the amount of time spent on this weekly, and the months during which the particular activity was engaged in. Additionally, households recorded the venue for the activity and the journey to it, the mode of transport used, and the number of other enthusiasts in the same vehicle and at the venue. Using the time and place of the leisure time activity, the MIPS figures were calculated for each pastime making use of factors based in the main on the results of the leisure time activities sub-studies in the FIN-MIPS Household project (Luoto et al. 2008; Veuro et al. 2008).

The natural resource consumption of households' leisure time activities was calculated by multiplying the number of hours spent on an activity by the kilogram per hour factors for the different kinds of pastimes. The yearly natural resource consumption of family members' leisure time activities was added up, before being divided by the number of people in the family. The authors made the same decision in other components of consumption, despite the risk of this distorting the result calculated per person, especially in families with small children. In the MI factors used for the calculations the construction and maintenance of the venue for a leisure time activity, the service life of the venue, and the number of enthusiasts have all been taken into consideration. In the leisure time activity calculations the number of other enthusiasts at the venue was not taken into account. Instead, the average figures of Luoto et al. (2008) and Veuro et al. (2008) were used.

For calculating the natural resource consumption of leisure time activities, the infrastructure required, together with travelling to the venue, were taken into account. The material input to leisure time activity equipment was ignored because gear of this kind owned by the households was already calculated as part of the natural resource consumption of the households' goods and appliances. In addition, the contribution of equipment to the natural resource consumption of leisure time activities has been shown to be small. In the case of guitar or piano lessons, the equipment for the hobby accounts for less than one percent of its natural resource consumption per hour spent on it (Veuro et al. 2008). There are exceptions to the disregard of the material input of equipment for leisure time activities in motor sports and cycling. In motor sports, in addition to the natural resource consumption of the infrastructure, that of the vehicle itself plus the fuel consumed were taken into account (Merilahti 2008). With

cycling taking place alongside a main road, the infrastructure consumption was not calculated, leaving only the material input of the bicycle.

Hobby transportation calculations are based on the Transport MIPS project results (Lähteenoja et al. 2006a). The natural resource consumption of hobby transportation for all the family members was totalled for the whole year, then divided among the family members. Just as with calculations of a leisure time activity venue, the vehicle MI factors were not affected by the number of passangers reported by the people in the vehicle, rather the average vehicle ridership was used for the calculations.

For the calculations, assumptions were made in the case of certain leisure time activities. The consumption of walking to a leisure time activity venue was assumed to be zero. The consumption of walking as a hobby was also assumed to be zero, if the walker had indicated that he or she indulged in the activity at the side of a road. In contrast, walking along a cycle track was calculated according to the average factor for walking along a cycle track (Luoto et al. 2008). No surface-area data were available regarding the homeowner associations' clubrooms, parish halls, or other gathering places, neither were there any estimates of the number of users. The natural resource consumption of these areas was not taken into account. The natural resource consumption of building renovations, gardening, hiking, berry picking, swimming in a lake, and reading were also left out. Holidaying at a summer cottage or staying with friends was included under 'tourism' and thus left out of the leisure time activity calculations. The natural resource consumption of musical instrument lessons held in school classrooms after school hours was calculated according to music academy factors since the occupancy rate of a music academy is high, as is also the occupancy rate of a music classroom. The natural resource consumption of an outdoor swimming pool was estimated by dividing the natural resource consumption of a municipal swimming hall by three. The MI figures and their sources are given in Appendix 7.

2.5 Focus group interviews

2.5.1 Focus group interviews as a means to obtaining data

Interview material for the study was gathered by means of focus group interviews. The focus group interview is a technique which has traditionally been used for market surveys, but the popularity of this method in the social sciences has increased over the last few years. In the focus group interviews, people participating in the study discuss the matter which is the target of the study (Barbour & Kitzinger 1999; Valtonen 2005). A focus group interview resembles a discussion more than an interview, as the participants discuss subjects chosen by the researcher in a rather free manner (Morgan 1988).

In the focus group interviews interaction between participants is of the utmost importance and interaction within the group forms a tool for information formation (Barbour & Kitzinger 1999). Interaction can assist in the development of ideas among the interviewees to a greater extent than individual interviews is able to. The interviewees comment in the discussion on each other's ideas and develop them further (Valtonen 2005; Timonen 2002).

The themes for the focus group interviews can be brought into the discussion through, for example, questions posed by the group's moderator, or through the use of stimulative material of various kinds. Examples of stimulative material are adverts, newspaper or magazine articles, and photographs (Valtonen 2005). In this study the

themes were decided in advance based on a preformed question framework. The printed results revealing the participants' own ecological backpack also served partly as stimulative material.

The focus group interview technique is considered particularly applicable when the intention is to study peoples' attitudes and experiences. Participants can themselves decide in what context a matter is approached and how it is framed (Barbour & Kitzinger 1999). In conventional interviewing the interviewer plays a greater role in guiding the discussion.

A typical number of participants in a focus group interview varies around ten (Valtonen 2005). Eskola and Suoranta (1998) consider a suitable group size to be 4–8 persons. In this study the group sizes were determined according to how many people were participating in the study at the same location. In Lahti six persons constituted the group, in Helsinki on one day, five, and on the next occasion, four. In Tampere nine people arrived for the meeting, as a consequence of which the gathering was split into a four- and a five-person group.

Alasuutari feels that the beauty of the focus group interview lies in the fact that it encourages people to talk about things that are obvious (Alasuutari 1999). In the focus group interviews, participants talked about daily life and habits which can be considered this type of self-evident fact. Comparing customary behaviour and consumption habits with other people makes the material more interesting than merely holding dialogue with an interviewer.

2.5.2 Implementation of focus group interviews in practice

The interviews were arranged around three weeks after the consumption monitoring was completed and soon after the results of the monitoring were announced to the households. A few days before the focus group interviews the households received a summary of their own ecological backpack by post. At the start of the proceedings the results of the consumption monitoring were gone through together once more and participants were permitted to ask questions where the results were unclear to them. They were requested to save other comments and thoughts for the actual focus group interview, however. The purpose of the interview material was to gather consumers' views on the MIPS measurement and on reducing the ecological backpack. They were asked in which consumption components did the greatest opportunities for reducing consumption lie and how well does MIPS depict the environmental impact of consumption. The interviewees were not asked to talk about eco-efficiency as such, rather they themselves were allowed to define what they regarded as an environmentally friendly act. In this study the focus group interview had a potentially fertile foundation because the people participating in the study were motivated and interested in thinking about their consumption choices. Besides, they shared a common experience of consumption monitoring.

At the start of an interview the moderator spoke briefly about the purpose of the focus group interviews being to garner the participants' views regarding MIPS, the project and sustainable consumption. The interviewers told the interviewees that the event was aimed at encouraging participants to speak their mind, that is, the questions did not need to be answered in turn, rather they could talk freely. The interviewees were encouraged to voice opinions that were both similar to, and that differed from, those of the other participants. After this, the participants introduced themselves one by one, mentioning not only their name, but also their main feelings about the success of the study. The purpose of this introduction was to enable participants to relax and to talk freely from the very outset. If a participant is asked right at the start

to reply to a simple question, he or she will most likely participate in the discussion later on (Krueger & Casey 2000).

The different components of the consumption monitoring were not separately mentioned in the interview framework for the focus group interviews. Instead, the participants were permitted to bring up the consumption components that they wanted to discuss. There was at least some discussion about every component of the consumption monitoring. When the questions in the interview framework had been gone through, we showed the groups a leaflet on which possible means of reducing the ecological backpack were listed. The groups discussed for a while longer these methods, their logic and the chances of accomplishing them.

The focus group interviews were very successful. Naturally, each group had its share of quieter and more vociferous members, but all members participated to some extent at least. Each of the interviews lasted for around an hour and a half and in every case there was time to deal thoroughly with all the themes in the interview framework. The same focus group interviews were used as material for Pykäri's (2008) sub-study (see Sections 2.2 and 2.5.3).

2.5.3 Analysis of interview data

The approach to the interview data analysis was to consider the material in its pure form, without any patent interpretation theory being applied to it (Saarela-Kinnunen & Eskola 2001). However, this material-based approach does not mean that in the data analysis, previous studies and hypothetical concepts were not made use of. Here it is a question of theory-bound analysis, where the analysis has theoretical connections, but it is not directly based on a certain theory (Eskola 2001).

The interviews were taped and then transcribed. First, the material was organized using thematics (Eskola & Suoranta 1998). The consumption components monitoring used as the basis of the thematics were mobility, housing, foodstuffs, tourism, household goods and appliances, waste management and packaging. The interviewees' comments were collected in which they discussed how good opportunities in the various sub-sectors of consumption there are for environmentally friendly behaviour.

After the thematics, the interviewees' views on what factors prevent environmentally friendly options and what promotes them were sought. Based on these, an image was formed of the consumers' space of action in environmentally friendly choices. Additionally, the interviewer would ask for the consumers' interpretations of how well MIPS works as a tool for guiding consumption choices.

The interview material was approached from the fact perspective (Alasuutari 1999). In other words, an attempt was made to obtain information about how people act in reality. According to Alasuutari (1999), the fundamental question in the fact perspective is whether the interviewees are speaking the truth or not. Our interviewees spoke freely and came up with so much criticism that it can be assumed that a real picture of the interviewees' concepts and experiences was obtained.

3 Natural resource consumption of the average Finn

Before the calculation of the natural resource consumption of the study households was undertaken, the natural resource consumption of the so-called average Finn was calculated based on statistics and average data. The purpose of this exercise was not to produce statistically fully proved figures, but to test the use of MIPS data for the calculation and to produce some sort of average estimate with which the results from the households could be compared. In this study, the results of this exercise, which was done for comparison purposes, are presented as 'the average Finn'. This section describes the assumptions made in the calculations and the results obtained. The calculation and results are also given in the conference article by Lähteenoja et al. (2007), as well as in the popular poster series, which can be borrowed from the Finnish Association for Nature Conservation (SLL 2007). It is not possible to compare the average Finn in this study with, for example, Mäenpää's (2000, 2005) TMR figures calculated per capita because of different system boundaries. In this study only the TMR (sum of abiotic and biotic natural resource consumption and erosion) is presented, and water and air consumption are omitted.

The average Finn of this study is a person living in a household of two adults (the average size of a household in Finland is 2.1 persons, Statistics Finland 2007). He or she lives in an urban area in an apartment building erected in the post-1960s period, which has 38 m2 of living space per person. The natural resource consumption of the building, the energy and electricity use, and the goods and appliances in it has been divided by two to give the natural resource consumption per person per year. In the assessment of the consumption of the average Finn we wished to use the same division into consumption components as in the study households, but this was not possible with mobility and tourism. The National Travel Survey (Henkilöliikennetutkimus 2006), which we used as our source, does not separate journeys into daily mobility and leisure travel. Thus, tourism and daily mobility are grouped together here and only overnight stays during leisure time are relegated to their own group.

Housing

Natural resource consumption of the component housing was calculated not only on the basis of the residential building, but also the yard of an apartment block, district heating used for heating, Finland's average electricity consumption, and a person's average water consumption. Electricity consumption is on average 2000 kWh energy per year and, according to Motiva (2007), the heating of one square metre by district heating consumes approximately 210 kWh a year. For water, a Finn consumes, according to Motiva, an average of 155 litres a day, this being apportioned as follows:

- 39 % (60 l) personal hygiene
- 26 % (40 l) toilet flushing
- 13 % (20 l) washing clothes
- 22 % (35 l) kitchen

Around 45 % of the water used is heated. Again based on Motiva's (2007) data, it was calculated that the heating of one litre of water consumes 0.058 kWh of energy, that is, in one day on average 4 kWh and in one year 1500 kWh is used for heating water. In Figure 2 water heating is included in the TMR of water.

Figure 2 shows the TMR of the average Finn for housing.

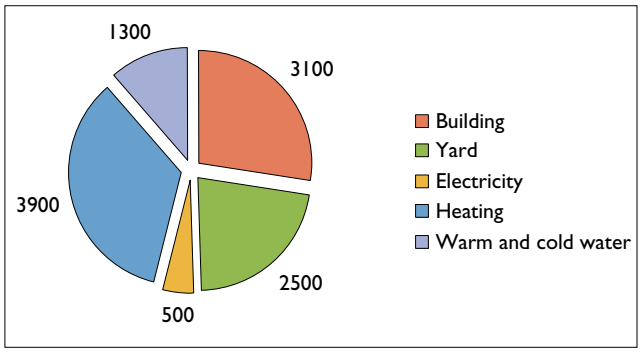

Figure 2. Average natural resource consumption of housing in Finland, kg/person per year (in total 11,000 kg/person).

Mobility and tourism

According to the National Travel Survey (Henkilöliikennetutkimus 2006), a Finn travels an average of 42 km a day. Of this, 4 km constitutes work trips and other journeys paid for by an employer which do not come under a household's private consumption. The remaining 38 km includes trips to work, school and leisure time activities, visiting other people, and leisure travel in Finland. The average length of a journey is 15 km and by far the largest proportion of trips are made by passenger car. The coach is the most common mode of public transport.

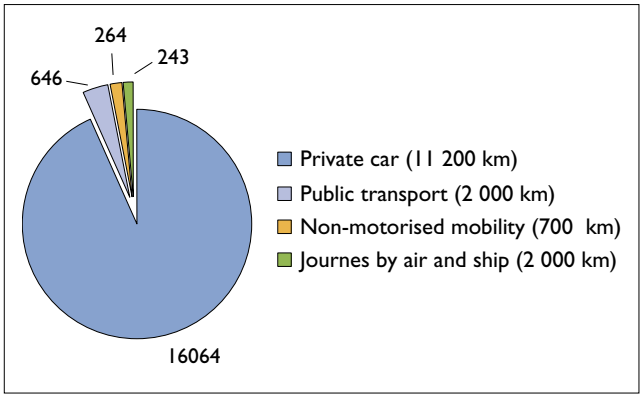

Figure 3. Natural resource consumption of mobility, kg/person per year.

Trips to destinations abroad are not included in the travel survey data. Based on Statistics Finland's (2007) data, it was calculated that a Finn travels abroad on average 2000 km a year, or 5.5 km per day. This was added before the natural resource consumption of mobility was calculated.

By aplying the Finnish MI factors for the different modes of transport (Lähteenoja et al. 2006a) on the average journey performance, it was found that the average Finn's mobility accounts for 17 tonnes of natural resource consumption a year. A car journey consumes five times as much as a coach on an equivalent journey. Since most journeys are made by passenger car, motoring is responsible for most of the natural resource consumption of mobility (Figure 3).

Overnight stays in leisure travel

In 2006 Finns made 30.2 million holiday trips. Of these, 25 million were taken in Finland. Of the trips taken in Finland, 20.2 million consisted of journeys to summer cottages and to private accommodation, and 4.8 million trips were made to commercial accommodation locations like hotels and rental cottages. Of the 5.2 million trips to places abroad, 0.6 million lasted at most one day, 1.5 million trips contained an overnight stay on a ferryboat and 3.1 million trips contained at least one overnight stay abroad. The Finns' most popular holiday destinations in 2006 were Estonia, Spain (including the Canary Isles), Sweden, Russia and Greece. Thailand was the most popular Far Eastern holiday destination: in 2006, 90,000 trips were made by Finns to Thailand, which was 70% more than in the previous year (Statistics Finland 2006).

Over half of Finns spend their leisure time in summer cottages. According to Nieminen (2004), on average 72 days a year are spent at summer cottages. The average summer cottage is unpretentious, but has electricity. The cottage is made of wood and its surface area is 47 m^2. This kind of traditional summer cottage is still common, but fully equipped leisure homes are increasing in accordance with the modern trend.

Because of the limits of the National Travel Survey (Henkilöliikennetutkimus 2006), daily and leisure time mobility could not be differentiated. All the journeys of the average Finn have thus been added together under the heading of mobility and, based on the statistics, only overnight stays in commercial accommodation and summer cottages have been relegated to tourism. With the use of the MI figures of Salo et al. (2008) for overnight accommodation, we arrived at around 1,000 kg/person per year as the natural resource consumption for tourism. Of this, around a half comes under leisure homes and half under hotels.

Foodstuffs

Finns consume far more meat and dairy products than average within the European Union. According to the Finnish Food and Drink Industries' Federation (2007), the average Finn in 2005 consumed a total of 73.5 kg of meat and 18.6 kg of cheese, and drank 184 litres of milk. Figure 4 shows the food consumed by Finns in kilograms.

For the calculation of the natural resource consumption of foodstuffs eaten by the average Finn the same sources and boundaries were used as have been used elsewhere in the study (see Section 2.1.4 and 2.4.4). It was necessary to assume in almost all cases that the food was of domestic origin and the level of investigation was foodstuff categories. The ecological backpack of food consumption in Finland is shown in Figure 5. Neither food preparation in the home, nor shopping trips by households are included in the percentages given.

When comparing Figures 4 and 5, one can see that the proportion of foodstuffs of animal origin, notably meat, is significant in terms of natural resource consumption. Even though the amount of meat we eat amounts to only 10% of all food, it accounts for almost one-third of the natural resource consumption due to food. Together, meat and dairy products contribute 62% to the natural resource consumption.

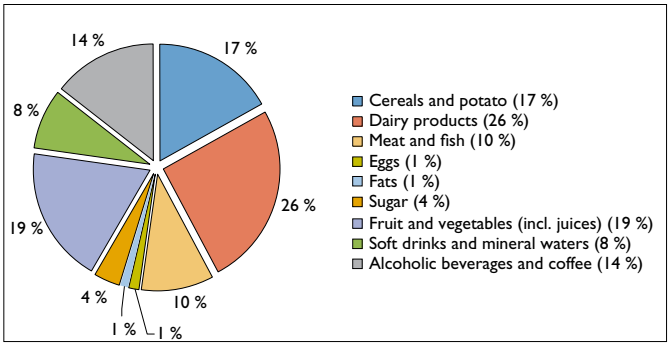

Figure 4. Food consumption in Finland, excluding tap water (in total 840 kg/person per year).

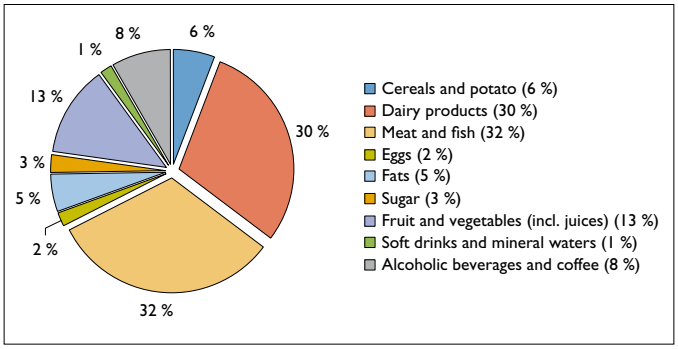

Figure 5. Natural resource consumption of food consumed in Finland, (in total 6,000 kg/person per year).

Household goods and appliances

Although households own thousands and thousands of goods, there have been very few holistic studies on the quantity and quality of these. For example, Statistics Finland records only the ownership of various electrical and electronic appliances, and not how many units of a particular item are owned by households as a whole. Thus, we needed to estimate the goods and appliances owned by the average Finn ourselves. The figures represent the minimum quantity of pieces of furniture and goods to be found in most apartments in a high-rise building.

For this study, the natural resource consumption of the goods and appliances in an average household was calculated from approximately 1,700 items. This

includes furniture, electrical and electronic devices, clothing and other textiles, books and magazines, and jewellery. Kitchenware and tools were not included because these were considered to have a long life, thereby consuming little natural resources per year of use.

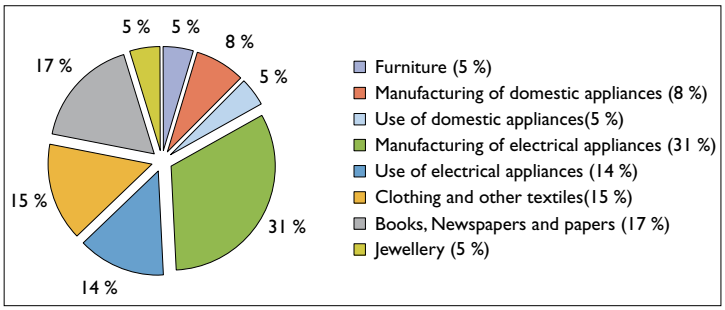

Figure 6. Natural resource consumption of household goods and appliances in Finland

The production of the goods and appliances in an average household requires some 3,000 kg of natural resources per year. Not only that, but over a one-year period the use of electrical and electronic goods accounts for a significant amount of electricity in the home which is not included in this figure. Figure 6 shows how the TMR of household goods and appliances is apportioned among the different groups. The figure includes the use of electrical and electronic devices. The manufacturing of these devices consumes even more natural resources than their use.

Hobbies and leisure time

A Finn has on average 6.5 hours of leisure time a day. Both the actual amount of free time and how this time is spent vary tremendously. According to Liikanen et al. (2005), on average three hours a day is spent watching television. Reading and listening to the radio are also popular leisure time activities. The leisure time of an average Finn may be divided up, for example, as follows:

- 3 hours a day watching TV
- 2.5 hours a day attending to daily routines, reading and listening to the radio
- 0.5 hours a day of physical exercise or other leisure time activities outside the home

Table 3. Abiotic consumption of various leisure time activities and travel to the venues where these take place per activity hour (Sources: Luoto et al. 2008; Veuro et al. 2008).

Leisure time activity	kg/hour
Jogging on a track	1
Rollerblading	1
Swimming in a swimming hall	11
Ice hockey in an indoor ice rink	7
Going to the gym	6
Football on a non-heated artificial lawn	6
Playing piano in a music school	4
Going to a large theater	13
Rowing a boat	0,7
Boating in a large motor boat that is stored in a harbour	52
Watching TV	1
Average mobility to leisure time activities	**kg/trip**
15 km by a private car	22
15 km by a bus	5

The natural resource consumption of leisure time activities has been calculated per activity hour to make it possible to compare various sorts of activities. As can be appreciated from the table 3, marked differences exist in the natural resource consumption of different hobbies and pastimes. Yet, transportation connected with leisure time activities is often of more significance than the activity itself, particularly when a car is used.

If the above assumptions are made in relation to leisure time activities applying to the average Finn, the natural resource consumption of such pastimes amounts to around two tonnes per person per year. This does not include either mobility or holiday travel (tourism).

Summary of the natural resource consumption of the average Finn

Based on the system boundaries used for this study and on the assumptions made, the average Finn consumes approximately 40 tonnes of natural resources a year. This is equivalent to the load on a lorry with a trailer. The figure 7 summarises the distribution of the natural resource consumption. Of these results, all the other categories apart from mobility and tourism are specified such that they are comparable to the results for the households given in the next section. On the other hand, the results cannot be directly compared to Mäenpää's (2000, 2005) TMR figures for households, for example.

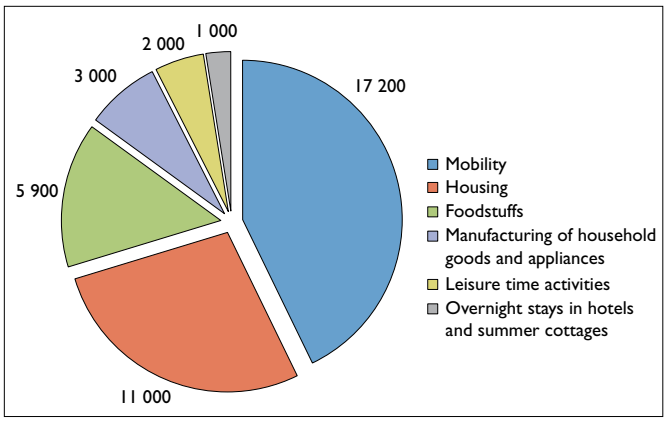

Figure 7. Natural resource consumption of the average Finn (40,000 kg/person per year).

4 Natural resource consumption of the households in the study

Based on this study, the ranking of the natural resource consumption of the different consumption components from the highest to the lowest is mobility, tourism, housing, food, leisure time activities, household goods and appliances, packaging and waste management (Figure 8).

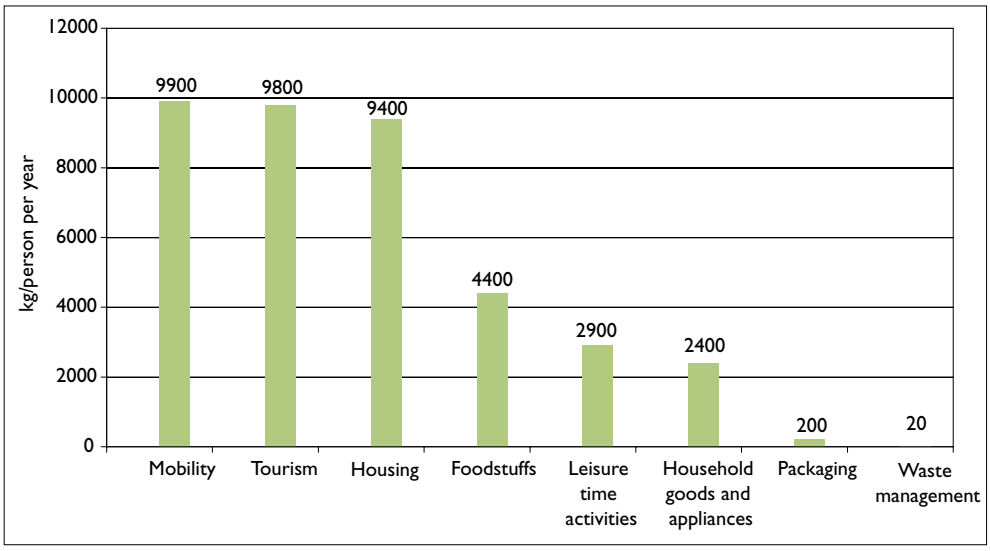

Figure 8. Average TMR of households by consumption component.

Since the three largest consumption components are so close to each other, their ranking is not the main point in the study results. What is more interesting is what each component consists of and what is the reason for the differences in the natural resource consumption of households. The differences in the natural resource consumption are shown in Figure 9. The difference between the most and the least consuming household is over tenfold. In the diagram the last column reflects the natural resource consumption of the average Finnish consumer calculated on the basis of the statistics (see Section 3). Each household has been given its own letter (A to Å), which remains the same throughout the entire report.

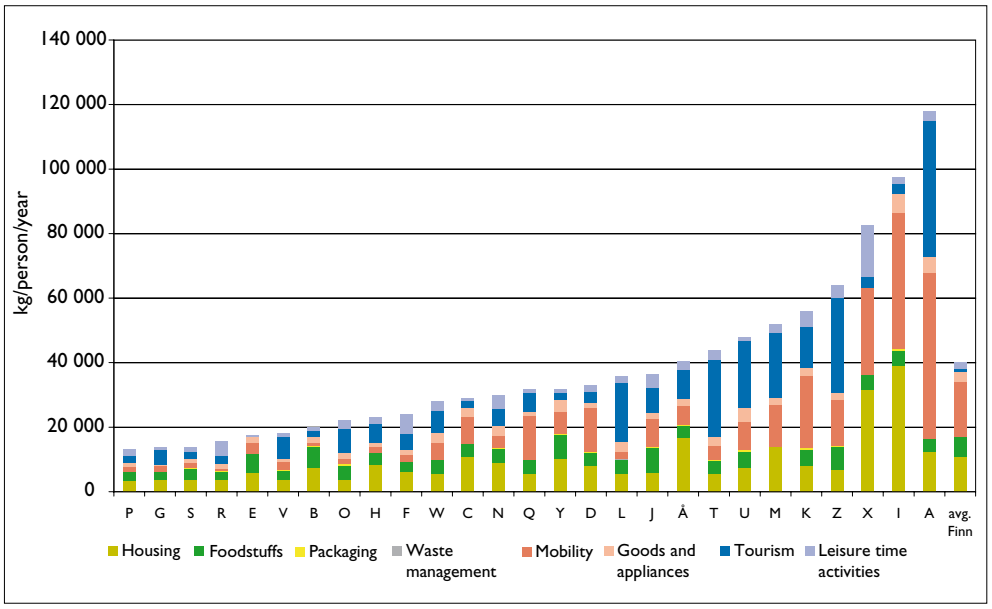

Figure 9. Contribution of the consumption components to the households' TMR.

Households with low TMR figures are rather similar to one another, whereas at the other end of the TMR scale the differences between households are more pronounced. For households with high consumption, the figures are high in particular because of housing and mobility: the members have plenty of living space and they use a car a lot. In household A the contribution of tourism is also great. The natural resource consumption of households P, G, S and R is explored in more detail in Section 5.9.

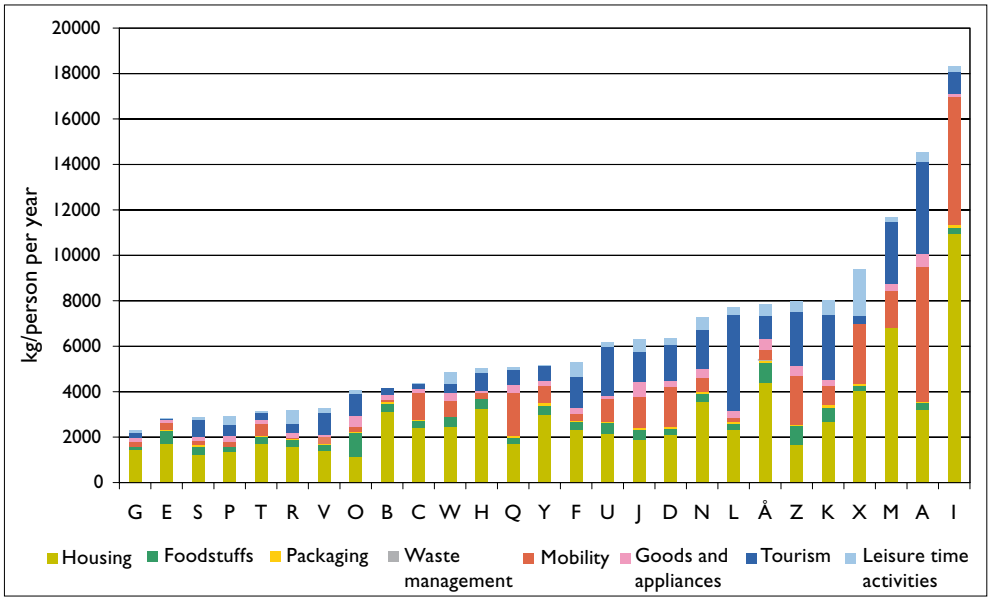

Figure 10. Contribution of the consumption components to the households' air consumption.

In regard to air consumption (Figure 10) the contribution of housing is more significant than in terms of the TMR. Heating is the factor that contributes the most to the high air consumption of housing. In the two comparisons, the ranking of households is practically the same. Household T is an exception, consuming relatively little air compared to its abiotic and biotic resource consumption. In terms of the

TMR, household T's consumption is increased by tourism, where once again the consumption from possessing a summer cottage is high. In this section we explore the natural resource consumption of each component, while explaining the reasons for the differences between households. The relationship between air consumption and the TMR is discussed in Section 5.8.

4.1

MIPS results for housing

In relation to the natural resource consumption of the various components, housing came second only to mobility and tourism. The ranking of the average TMR figures for the different sub-components of housing from the highest to the lowest is as follows: road, building, yard, heating, water, and electricity. Six households had electric heating, making it impossible to separate electricity and heating figures in

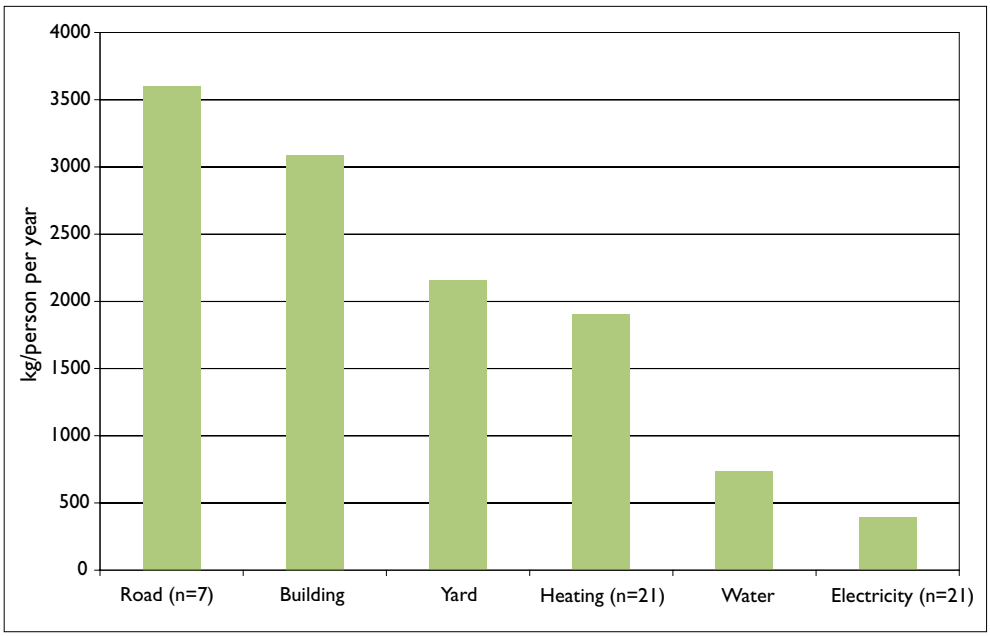

Figure 11. Average TMR of the sub-components of housing.

their case. The electricity and heating levels for these households are not included in Figure 11, which shows the average figures. Seven households had private roads.
In housing the difference between the three highest and the three lowest natural resource consumption levels was eight-fold. The yard contribution in particular raised the natural resource consumption of four households to a higher level than that of the others. In a few families a private road also raised the figures appreciably (Figure 12). The lowest natural resource consumption is that of a family living in an apartment building and occupying 21 residential square metres per person. The most natural resources are consumed by a person living alone in a 215 m^2 detached house.

The significance of the different sub-components changes when, instead of abiotic and biotic natural resources, air consumption is considered. In terms of air consumption, heating has the most significance (Figure 13). In both comparisons the same household consumes the most natural resources.

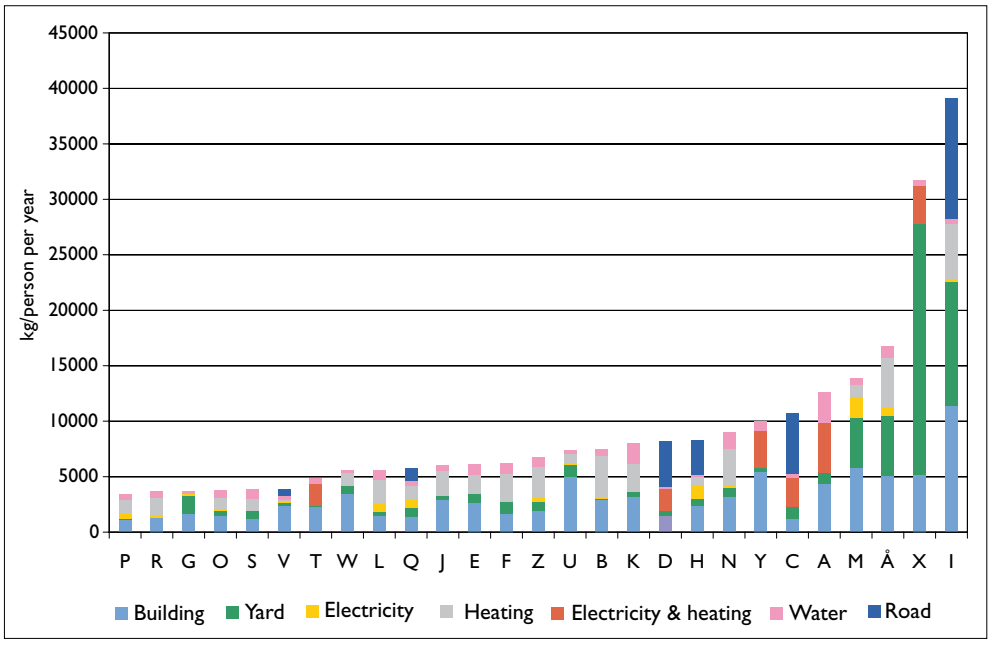

Figure 12. Contribution of the sub-components to the TMR of housing (electricity and heating combined in households with electric heating).

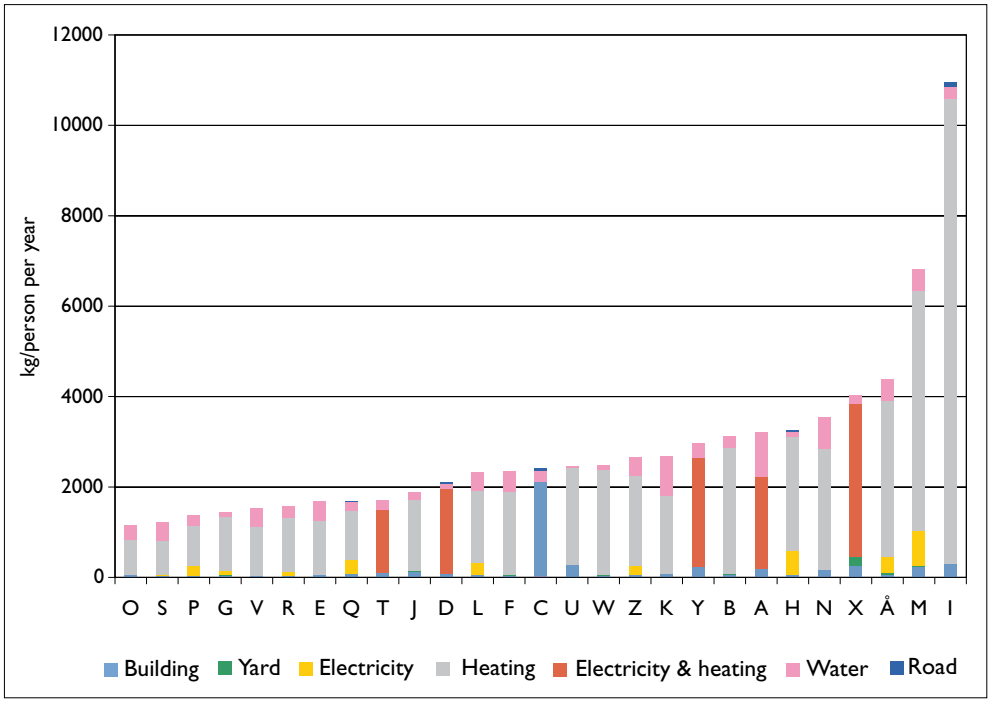

Figure 13. Contribution of the sub-components to the air consumption of housing.

The natural resource consumption of a building was affected the most by the total square metres of the dwelling. Wooden houses are slightly more favourable compared to those constructed from other materials, and the same goes for apartment buildings compared to detached (single-family) houses (Tamminen et al. 2008). However, the floor space has a far greater influence as regards the natural resource consumption (Figure 14).

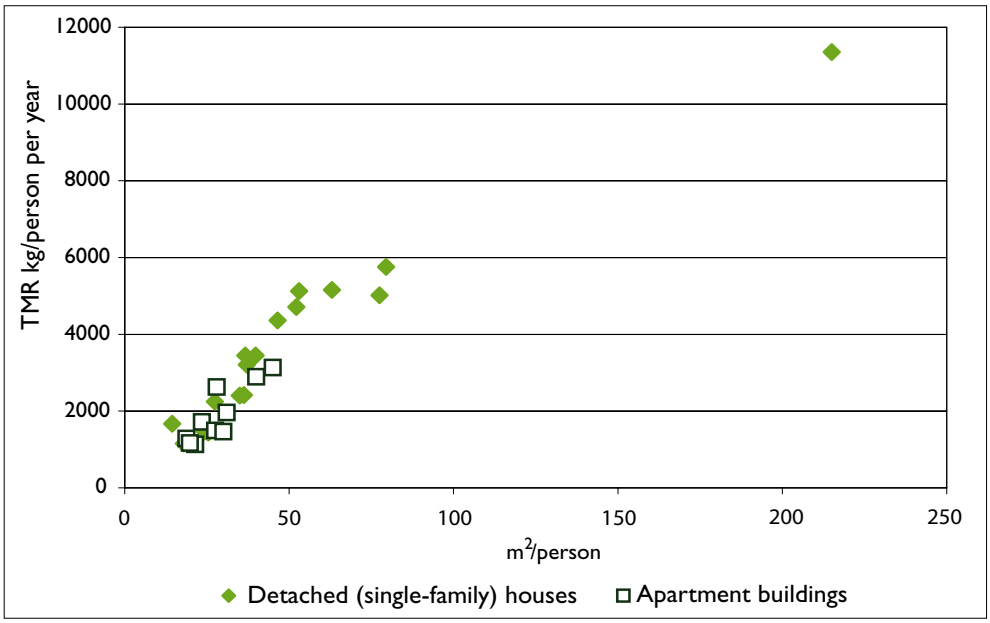

Figure 14. Relationship between floor space and the TMR of a building: Large dwellings consume more natural resources.

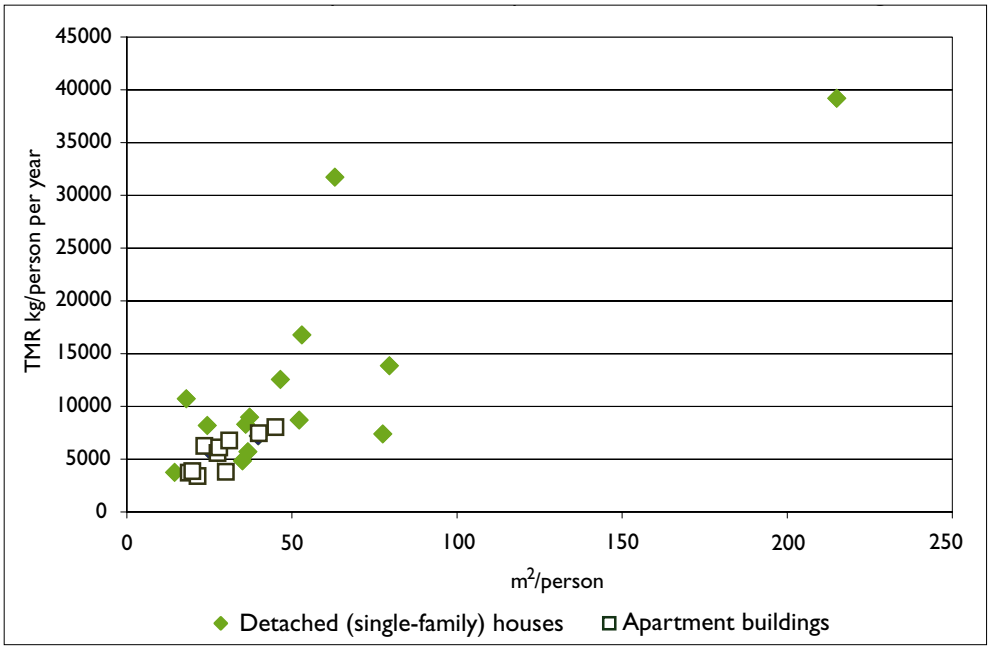

Figure 15. Relationship between floor space and the overall TMR of housing.

Again, as regards the overall natural resource consumption of housing, the floor space of the dwelling is a significant factor, although the relationship is not always so clear (Figure 15). Relative to its surface area, the housing aspect that consumes more natural resources compared to other households (63 m^2, 32,000 kg/person per year) is a large artificially laid lawn, which raises the figures for housing.

The natural resource consumption of yards varies a great deal according to how natural the yard is. A yard that is in a completely natural state would have a MIPS value of zero, but no yards of this kind were included in the study. In almost all instances, apartment building yards were completely constructed but with the apportioning of the natural resource consumption of apartment building yards among several households their figures remain as low as for a detached house when expressed on a

per person basis. The average TMR for a yard per person per year for people living in a flat came to approximately 540 kg and for those in detached houses it was about 3,470 kg. Among all the yards, the lowest natural resource consumption was 40 kg and the highest was 23,000 kg. The least natural resource-consuming yard belongs to a 120 m^2 flat in an apartment building, where the yard is, to a large extent, tarmacked. The highest TMR is that of a yard with a 3,000 m^2 artificially created lawn and 210 m^2 of gravel surfacing.

Seven households had a private road. The natural resource consumption of private roads varied tremendously depending on the length of the road and the number of users. The lowest TMR for private roads was 3 kg per person per year and the highest was 10,900 kg. The length of the latter road is 100 m and it has a single user.

The contribution of electricity to the TMR is the lowest among the sub-components in this study. The low electricity input can be explained by the fact that 12 households among those studied had an eco-electricity agreement. If all the households had had a conventional electricity agreement, the average TMR for electricity would have been 840 kg per person per year, which is higher than the water contribution. Air consumption due to heating is highly affected by the number of square metres to be heated (Figure 16). Households using electricity for heating are excluded from the comparison of consumption in relation to living space and air consumption due to heating because it was impossible to separate the figures for electricity and heating.

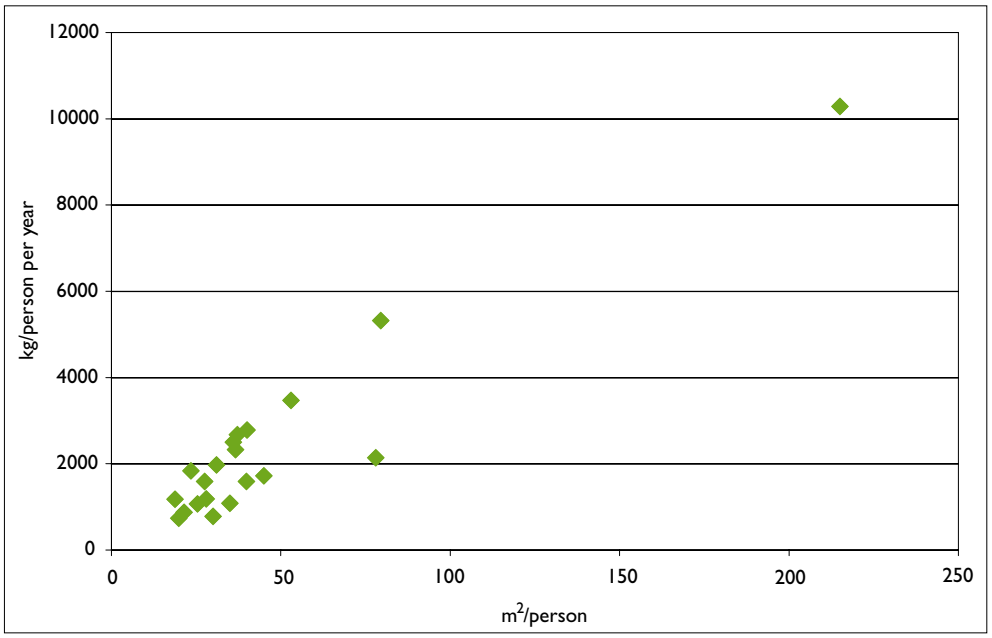

Figure 16. Relationship between floor space and air consumption of heating.

The following table gives the lowest and highest values for housing in all natural resource categories, the average for each sub-component, and the Factor 4 value. The figure "0" means that the natural resource consumption of a particular household did not exist in this category, so the smallest possible figure for the category is shown in addition.

'Factor 4' means the natural resource consumption attained by reducing the natural resource consumption to one-quarter of its current level: this is an intermediate stage towards a more eco-efficient society. Here the Factor 4 level has been calculated by dividing the average for each sub-component by four. As there is scant study material, Factor 4 can only be used for putting the results of this study into perspective. The Factor 4 level provides some sort of indication of the sub-components where it would

Table 4. Differences in the natural resource consumption of housing.

Building kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	780	20	5,700	30	1,100
Highest	8,800	2,500	234,000	300	11,000
Mean	2,800	310	36 000	110	3,100
Factor 4	700	78	9 000	28	775
Yard kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	40	2	0/20	0/1	40
Highest	23,000	5	9,200	200	23,000
Mean	2,200	<1	660	10	2,200
Factor 4	550	<1	165	3	550
Electricity kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	40	-	80	0/90	40
Highest	1,900	-	662,000	770	1,900
Mean	390	-	117,000	140	390
Factor 4	98	-	29,250	35	98
Heating kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	560	0/150	1,600	740	850
Highest	4,300	1,600	426,000	10,000	5,100
Mean	1,800	110	61,000	2,500	2,000
Factor 4	450	28	15,250	625	500
Water kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	220	-	13,000	30	220
Highest	2,700	-	210,000	980	2,700
Mean	740	-	52,000	340	740
Factor 4	185	-	13,000	85	185
Road kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	0/3	-	0/60	0/40	0/3
Highest	10,900	-	240,000	100	10,900
Mean	3,600	-	79,000	30	3,600
Factor 4	900	-	20,000	8	900
Housing altogether kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	3,400	20	49 000	310	3,400
Highest	35,000	4,100	1,784,000	8,800	40,000
Mean	8,900	480	452,000	2,500	9,400
Factor 4	2,225	120	113,000	625	2,350

be easiest at the present time to reduce the natural resource consumption. A household utilising conventional electricity could easily achieve the Factor 4 level in terms of eletricity by switching over to eco-electricity. Among the households in the study, some buildings close to Factor 4 were also found. Reducing the natural resource consumption of yards can be accomplished by leaving the yard in as natural a state as possible.

4.2

MIPS results for mobility

In regard to mobility the natural resource consumption of the different households varied enormously. The lowest TMR due to mobility was 600 kg/person per year and the highest was 51,000 kg (Figure 17). The lowest TMR figure was that of a household comprising two people living in the centre of town and owning no car. The most natural resources were consumed by a couple in which one of the pair travels to another town several times a week. The difference between the three highest and the three lowest households in their natural resource consumption due to mobility is 35-fold. The three highest mobility TMR figures are caused solely by passenger car travel. By contrast, the fourth highest is solely due to public transport. The fourth highest column applies to a household in which one person travels an exceptionally great extent by train – approximately 400 km per week.

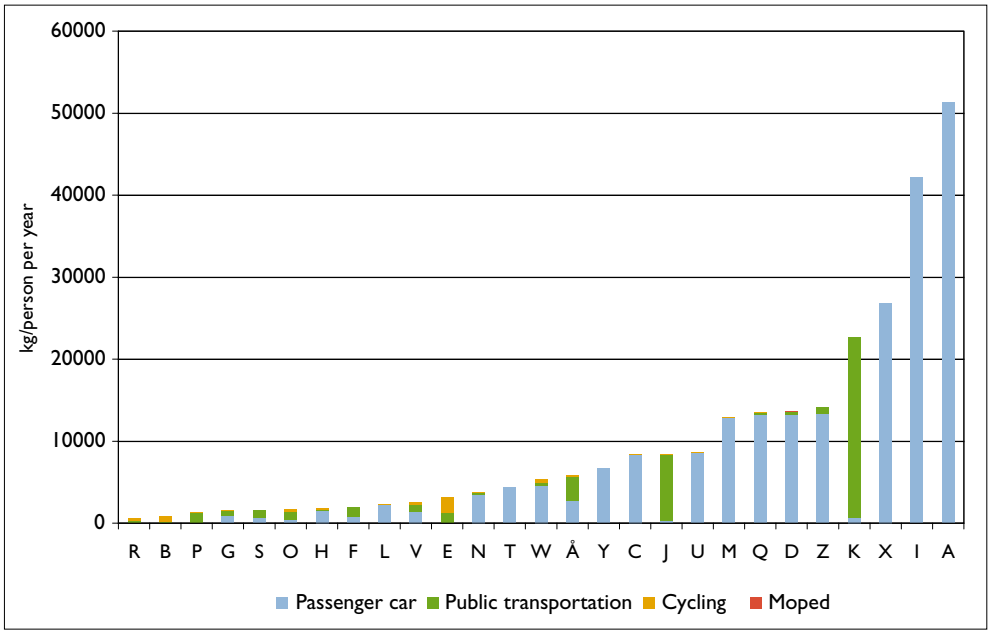

Figure 17. Contribution of different means of transport to the households' TMR of mobility.

Table 5 shows the lowest and the highest natural resource consumption in each natural resource category, the average figure for the households, and the Factor 4 level calculated from the average. In relation to mobility, Factor 4 households appeared in every natural resource category.

Table 5. Differences in the natural resource consumption of mobility.

	Abiotic	Biotic	Water	Air	TMR
Lowest	600	-	18,600	80	600
Highest	51,000	-	537,000	5,900	51,000
Mean	9,900	-	123,000	1,100	9,900
Factor 4	2,475	-	30,750	275	24,750

A comparison of the different means of transport produces no surprises. The passenger car's negative effect compared to public transport and cycling was an established fact at the outset. A passenger car consumes more air in comparison to other modes of transport. A road infrastructure is required for cycling, so that the latter consumes a certain amount of abiotic natural resources. On the other hand, air consumption due to cycling is very low (Figure 18).

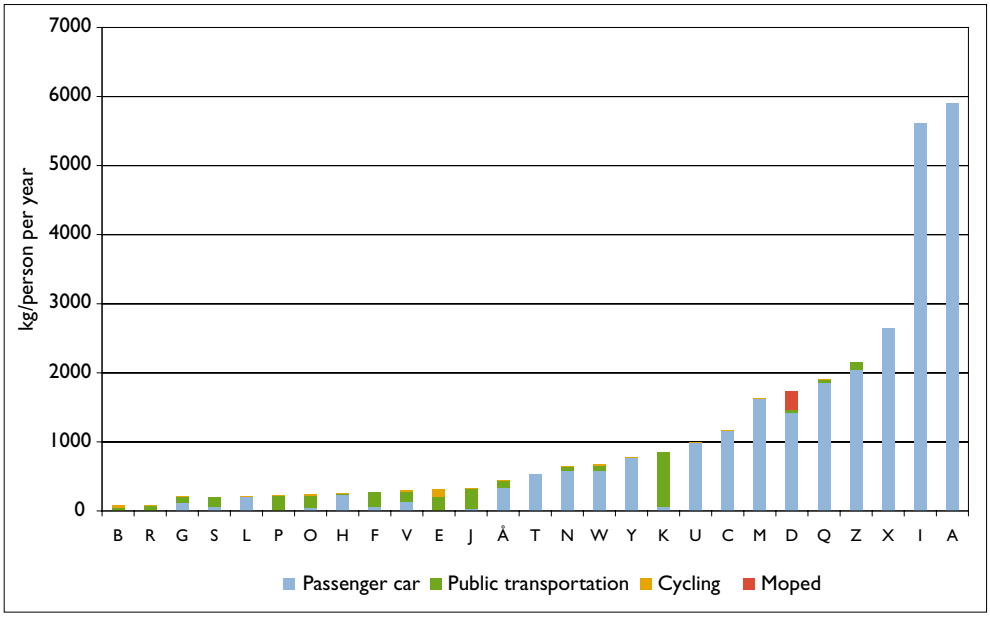

Figure 18. Contribution of different means of transport to the air consumption of mobility.

When the TMR figures are calculated for mobility, the contribution of the infrastructure to road traffic predominates: around 90 % of the consumption of abiotic natural resources by motoring in Finland comes from the road infrastructure. The use of a car is most significant as regards air consumption[1].

4.3

MIPS results for tourism

In terms of the abiotic and biotic natural resource consumption of tourism, summer cottages and travelling by passenger car were the most significant sub-components (Figure 19). In each sub-component of tourism there was at least one household which did not have that particular mode of travel at all. Seven households had their own summer cottage.

1 More information about the proportion and the allocation of infrastructure in the MIPS figures of mobility can be found in the Transport MIPS report (Lähteenoja et al. 2006a).

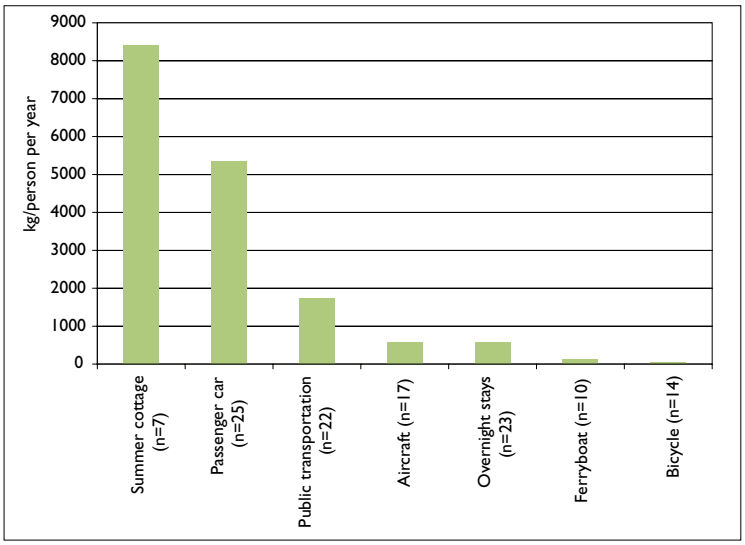

Figure 19. Average TMR of the sub-components of tourism.

There were large differences among the households in respect of the natural resource consumption of tourism. The lowest total natural resource consumption was 1,900 kg/person per year and the highest was 42,000 kg. The composition of the TMR also varied (Figure 20). Among the households studied, the one with the highest natural resource consumption mainly travels by passenger car (approx. 40,000 km a year). For the second and third highest consuming households, a summer cottage contributes the major portion of the TMR. The household consuming the most abiotic and biotic natural resources ranks second in terms of air consumption. In air consumption the leader is the household which frequently uses aircraft as a means of transport (slightly over 40,000 km of air travel per year) (Figure 21).

The small contribution made by air travel to the TMR figures can be explained: aircraft require less infrastructure than public transport and private motoring. In terms of air consumption the CO2 emissions by air travel becomes obvious. The effect of a summer cottage in air consumption comparisons is appreciably smaller than when measuring TMR.

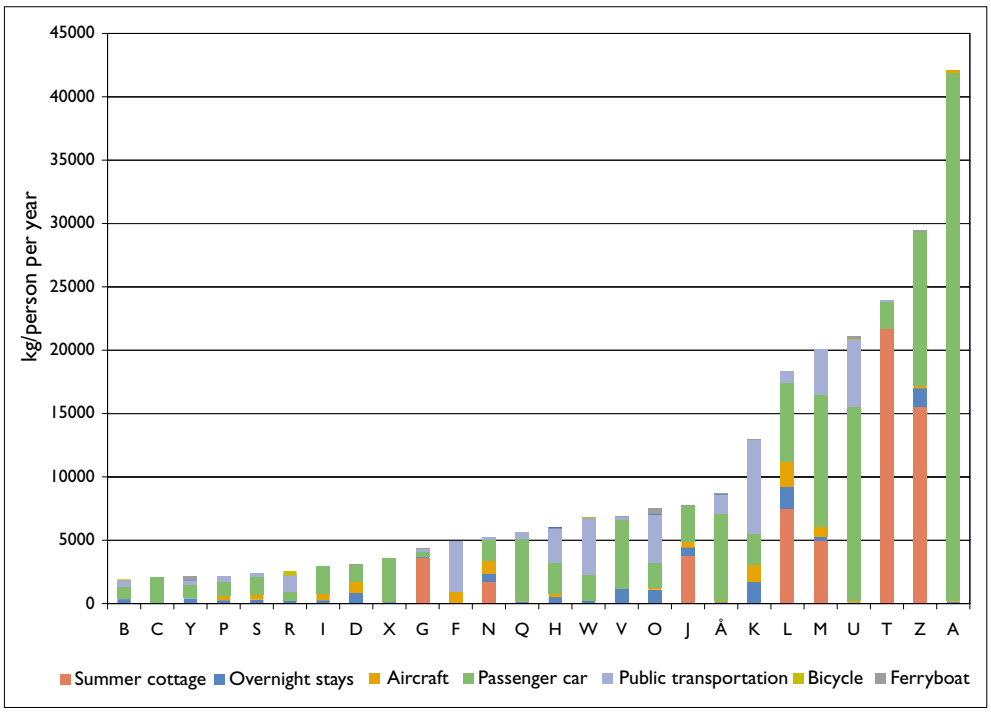

Figure 20. Contribution of the sub-components to the TMR of tourism (information is missing on the results of one household).

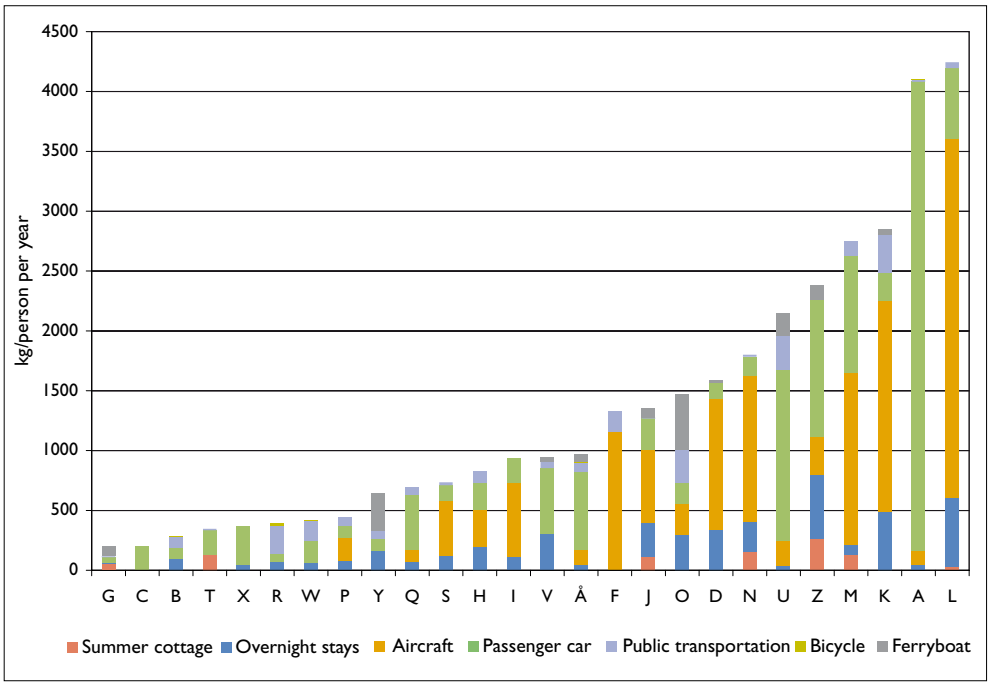

Figure 21. Contribution of the sub-components to the air consumption of tourism.

With summer cottages the private road contribution is significant in terms of the TMR (Figure 22). Travelling to the cottage is not included in the calculation of the natural resource consumption of the cottage, because it is included in travel by public transport or private car (see Figure 20). Travelling to a summer cottage by car may increase the natural resource consumption of cottage holidays, but in this study no correlation was found between owning a leisure home and the number of kilometres travelled in a year.

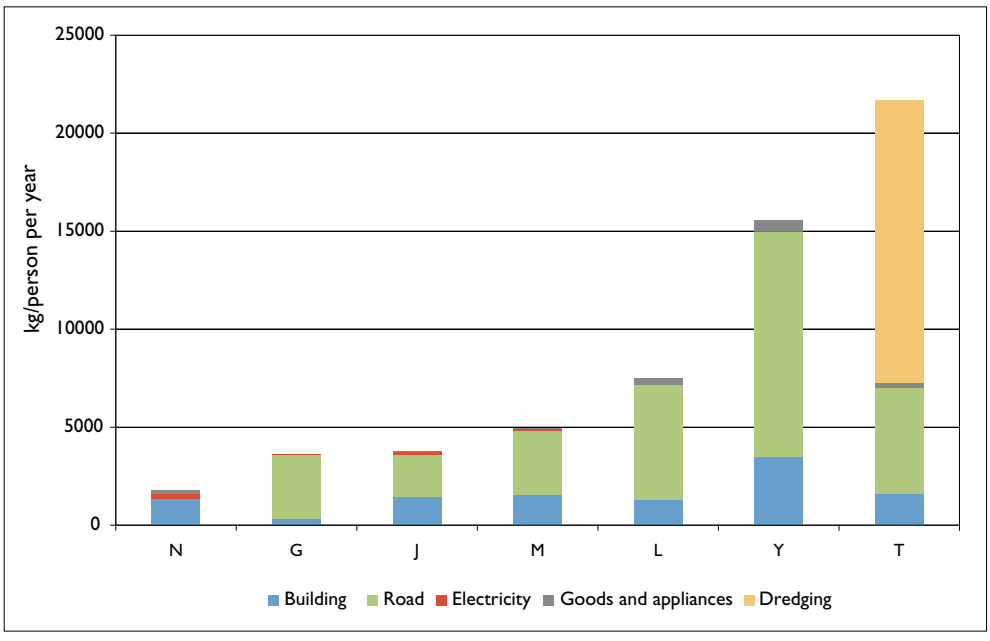

Figure 22. Factors contributing to the TMR of summer cottages.

Table 6 shows the natural resource consumption of the sub-components of tourism in all the natural resource categories. The Factor 4 level has been calculated by dividing the average by four. Households consuming the least natural resources through tourism fall well below the Factor 4 level in this study.

Table 6. Differences in the natural resource consumption of tourism.

Cottage kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	0/1,300	0/90	0/7,000	0/20	0/1,800
Highest	21,000	1,100	318,000	270	21,700
Mean	7,900	500	114,000	120	8,400
Factor 4	1,975	125	28,500	30	2,100
Overnight stays kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	0/35	0/<1	0/2,600	0/10	0/40
Highest	1,700	590	129,000	680	1,800
Mean	460	100	36,000	190	550
Factor 4	115	25	9,000	48	138
Journeys made by air kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	0/80	-	0/2,600	0/110	0/80
Highest	2,000	-	5,500	3,000	2,000
Mean	570	-	1,700	760	570
Factor 4	143	-	425	190	143
Journeys made by car kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	0/450	-	0/4,600	0/50	0/450
Highest	42,000	-	420,000	3,900	42,000
Mean	5,300	-	54,000	500	5,300
Factor 4	1,325	-	13,500	125	1,325
Journeys made by public transport kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	0/2	-	0/20	0/1	0/2
Highest	7,300	-	171,000	320	7,300
Mean	1,700	-	42,000	100	1,700
Factor 4	425	-	10,500	25	425
Journeys made by bicycle kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	0/1	-	0/20	0/1	0/1
Highest	350	-	11,000	20	350
Mean	40	-	1,200	2	40
Factor 4	10	-	300	1	10
Journeys made by boat kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	0/20	-	0/80	0/20	0/20
Highest	390	-	3,600	470	390
Mean	120	-	1,100	140	120
Factor 4	30	-	275	35	30
Tourism altogether kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	1,800	1	21,300	200	1,900
Highest	42,000	1,200	551,000	4,300	42,000
Mean	9,600	220	162,000	1,300	9,800
Factor 4	2,400	55	40,500	325	2,450

4.4

MIPS results for foodstuffs

In the food category the highest resource consumption was 7,700 kg/person per year and the smallest was 2,600 kg (Figure 24). For food the following sub-components were used: 1) cereals and potato, 2) meat, 3) fish, 4) eggs, 5) fats, 6) dairy products, 7) fruit and vegetables, 8) mineral waters, soft drinks and juices, 9) alcoholic beverages, coffee and tea, and 10) sugar and sweets. According to the consumption monitoring, the three most important sub-components are dairy products, meat, and fruit and vegetables (Figure 23).

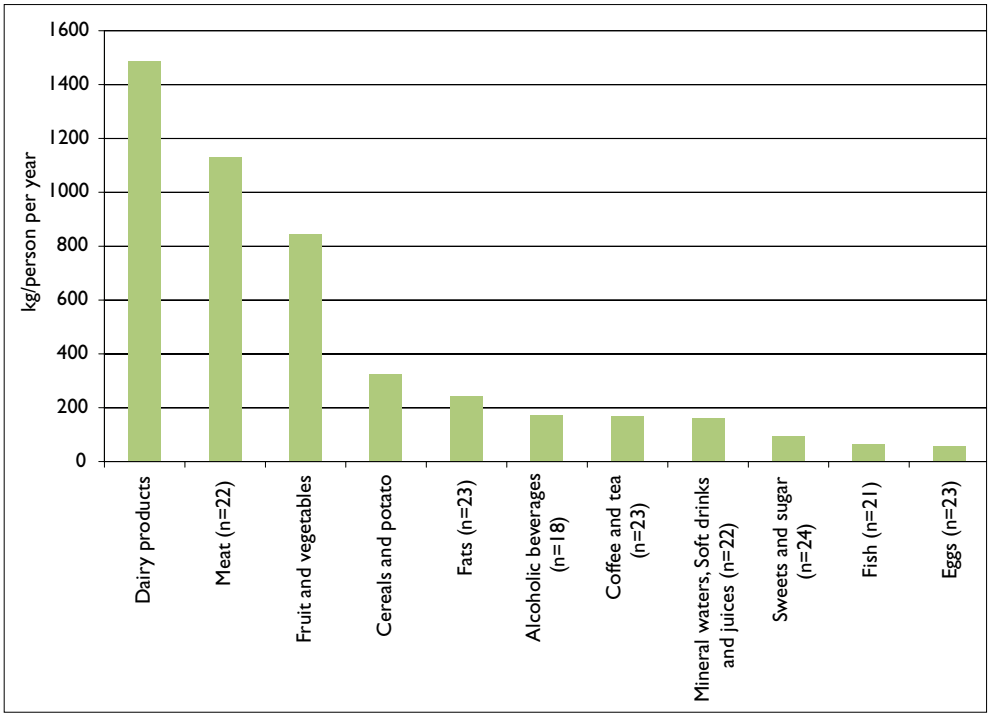

Figure 23. Average TMR of the sub-components of foodstuffs.

There were no vegans among the study group. There were four households who followed a vegetarian diet (households O, S, F and E). However, the natural resource consumption of their diet was not lower than that of those on an omnivorous diet because dairy products also consume a lot of natural resources. A completely vegan diet would have been expected to be the lowest in natural resource consumption (see also Kauppinen et al. 2008). The least amount of natural resources per person is consumed by the large, 9-member family. In terms of food, calculating the natural resource consumption per person favours families with small children. Small children do not eat anywhere near as much as adults but they share the entire family's natural resource consumption load when this is allocated per person.

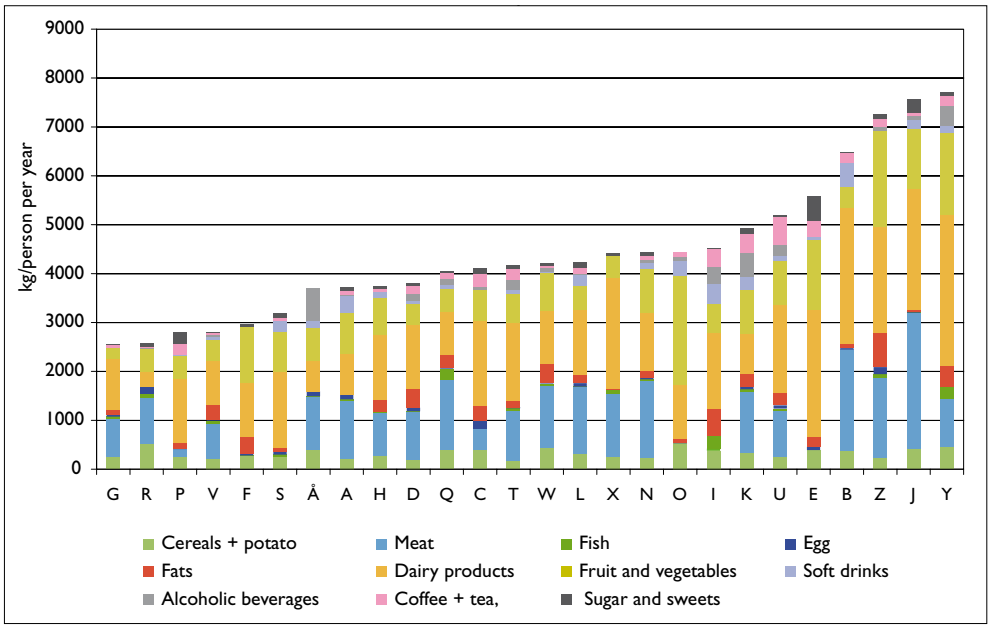

Figure 24. Contribution of the sub-components to the TMR of foodstuffs.

4.5

MIPS results for packaging and waste management

Figures 25 and 26 show the natural resources and air consumption relative to packaging used by the households and to waste management.

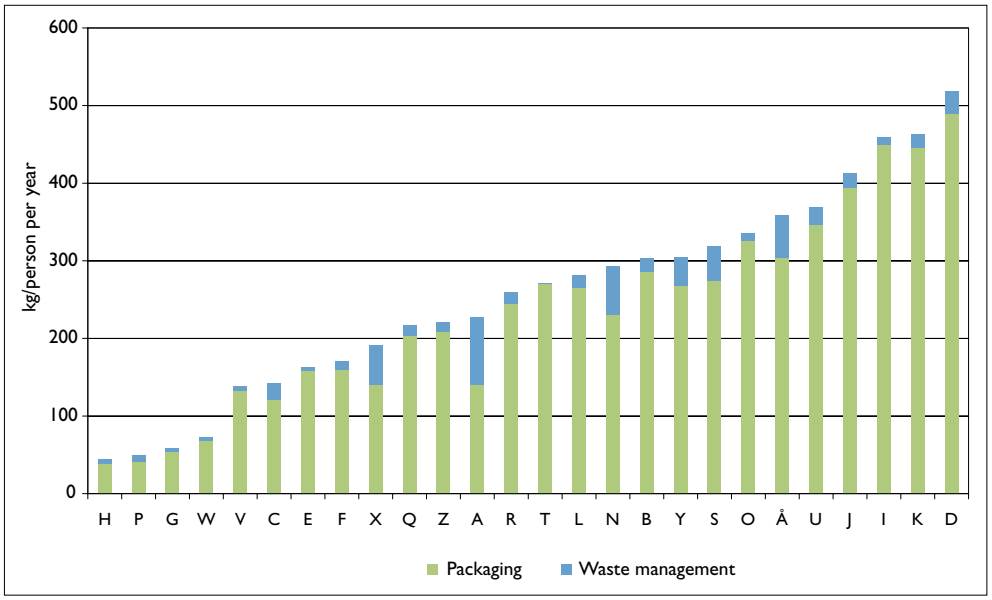

Figure 25. Packaging and waste management TMR figures.

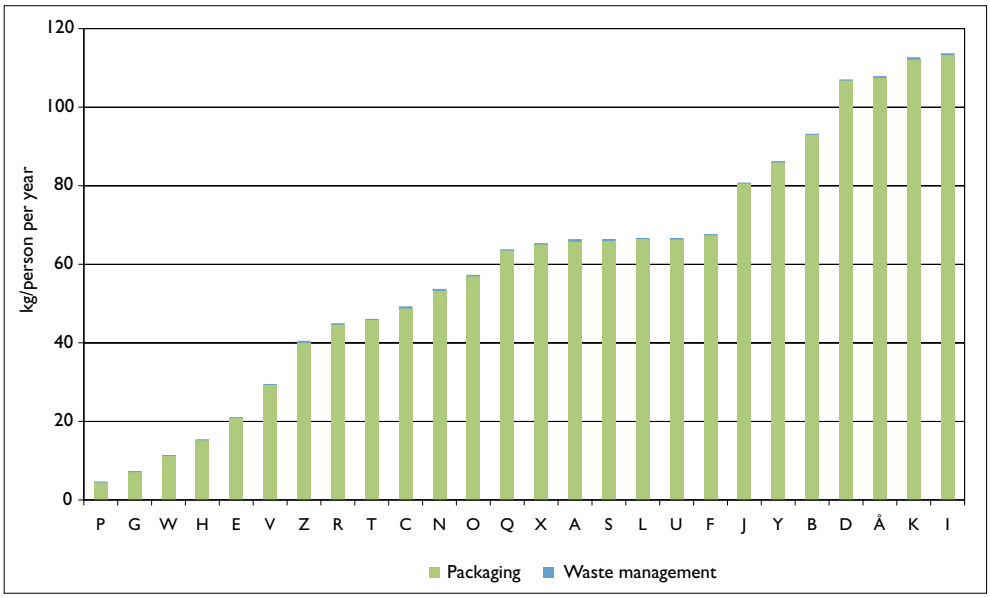

Figure 26. Air consumption of packaging and waste management.

Packaging and waste management account for only a minute fraction of the natural resource consumption of households. This result was expected. However, we wished to determine the significance of packaging and waste management to a household's natural resource consumption as there has traditionally been much talk about packaging and waste management in connection with environmental discussions relating to households.

On average, the TMR of packaging is equivalent to five percent of the TMR of foodstuffs (see Figure 24). Thus, the addition of natural resource consumption due to packaging would not significantly raise the MI figures for foodstuffs.

The contribution of waste management to natural resource consumption is even less than that of packaging. Hence, the natural resource consumption due to waste management is low as regards the overall household consumption. However, choices linked to waste are of greater significance due to wastes forming part of the lifecycle of products. The recovery of wastes, and especially their recycling, reduces the material intensity of recovered products compared to virgin products (see Salo 2004). Preventing the formation of waste means that an amount of products equivalent to the amount of waste saved plus the ecological backpack of the life cycles of these products is subtracted from the natural resource consumption. This is the most effective way of decreasing natural resource consumption connected with wastes (Salo 2004). This study supports Salo's (2004) results. If, for example, a certain product is not manufactured or purchased, it makes no addition to a household's ecological backpack. If that product is made from a recycled raw material, the MI factor of the product is smaller than in other cases. As a whole, the TMR figures for products are at least a hundred-fold compared to the TMR figures for waste management.

Air consumption due to waste management is also small (Figure 26). The importance of waste management in connection to the greenhouse effect is, however, greater than the air consumption of waste management would lead one to believe, since natural resource consumption calculations do not take account of, for example, the methane gas emissions associated with landfill treatment. In addition, there was no data available on the air consumption during the construction and maintenance of landfills.

4.6

MIPS results for household goods and appliances

The TMR of households' goods and appliances varied between 600 and 5,900 kg/person per year (Figure 27). Estimating the significance of different product groups is hampered by the fact that the households had filled in their forms to varying degrees of accuracy. The household goods and appliances inventory was the most laborious part of the consumption monitoring and by no means all households possessed the stamina to inventory all their household goods and appliances. The MIPS estimate based on the household goods and appliances inventory does, however, tell us something about the order of magnitude of natural resource consumption due to such items.

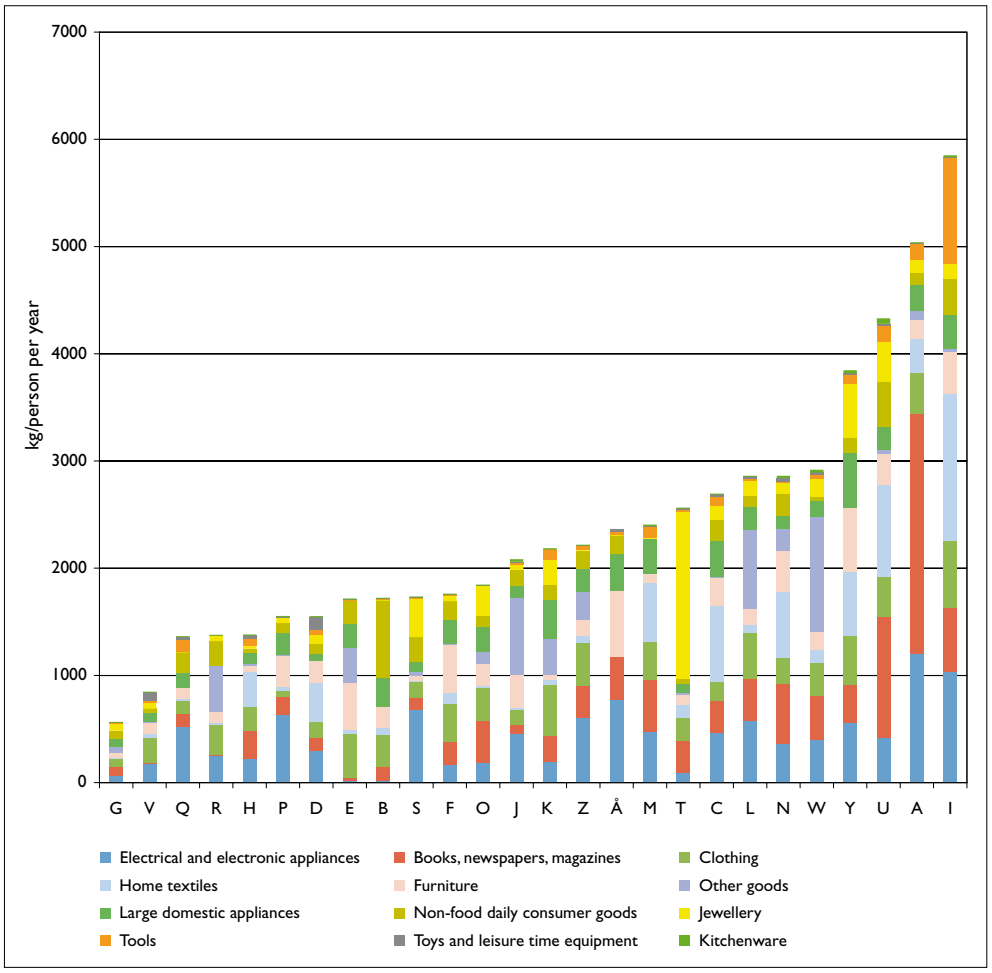

Figure 27. Contribution of the sub-components to the TMR of household goods and appliances.

Electrical and electronic appliances in many instances constitute a significant part of the natural resource consumption (Figure 28), even though their electricity consumption was not dealt with under goods but under housing. The smallest resource consumption for household goods and appliances was found in those households owning a large amount of second-hand (i.e. used) goods.

A large family that also consumed a rather small amount of natural resources in the other consumption components ranked the lowest in the comparison of household goods and appliances. This family obviously has a resource efficient mode of life,

which in the case of goods and appliances is affected by the fact that the goods and appliances are divided among several people.

One interesting group of household goods and appliances is jewellery. In some households jewellery contributes a significant amount to the TMR figures, despite the smallness of the items. The natural resource consumption of jewellery varied from 1 to 1,600 kg/person per year. The 1,600 kg natural resource consumption was due to 30 pieces of gold jewellery, three of silver, and five gold items containing precious stones. The smallest natural resource consumption due to jewellery is that of a person using mainly wooden, plastic and steel jewellery. Thus, jewellery made from precious metals can appreciably increase household natural resource consumption (see also Moisio et al. 2008).

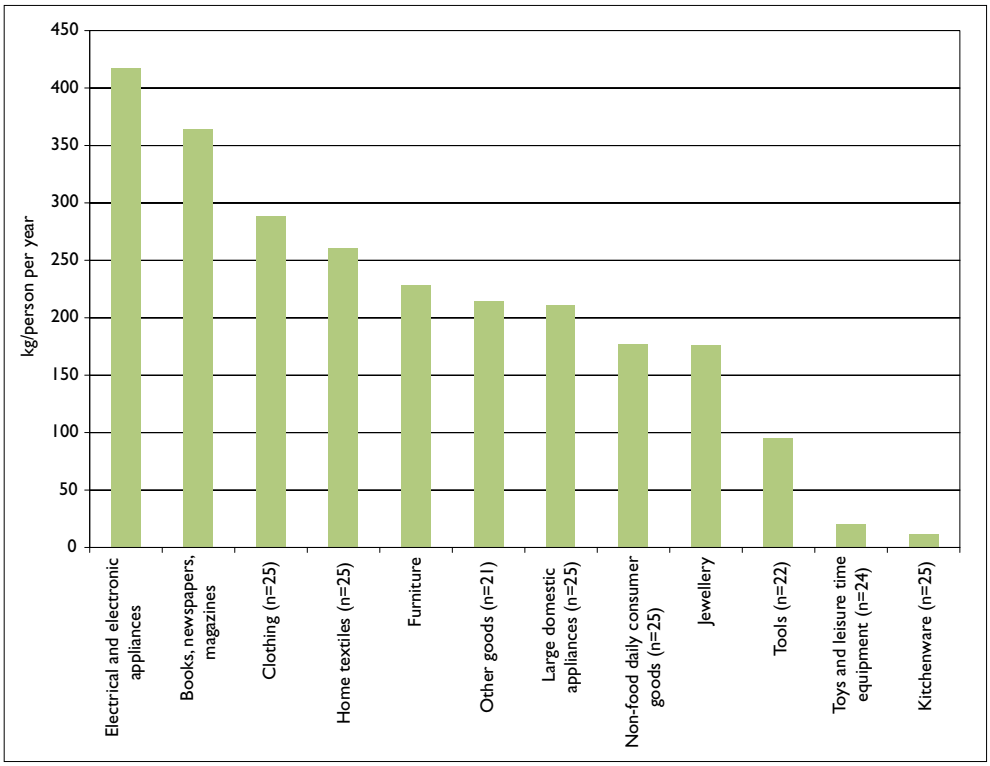

Figure 28. Average TMR of the sub-components of household goods and appliances.

The natural resource consumption of household goods and appliances as calculated here does not necessarily provide a complete picture of the resource efficiency of a household in regard to household goods and appliances, because an inventory of the household goods and appliances present at a particular moment in a home does not reveal how many products actually flow through a household. If those owning a small amount of goods and appliances have a tendency to throw these away and buy new ones in their place, the natural resource consumption could be higher than in households that retain the same goods and appliances for an extended period. On the other hand, acquiring second-hand household goods and appliances does not raise the MIPS figures calculated here, because the natural resource consumption is allocated to the first user.

When all the consumption components are compared, the significance of household goods and appliances is considerably lower than that of mobility, housing, tourism and foodstuffs (see Figure 8). One cannot, however, say that household goods and appliances have no significance at all. From the standpoint of resource efficiency, transferring to shorter term and frequently replaced products is undesirable.

Table 7 provides a summary of the natural resource categories and all household goods and appliance groups. For almost all sub-components some household or another received zero for its MIPS figure. Some of these zero results are a consequence of the family not having inventoried those sub-component items at all. Others are the result of those particular goods not being owned by the household, or of acquiring the goods second-hand. For instance, one family had obtained all its large home appliances second-hand. The Factor 4 level has been calculated as in previous sections, that is, by dividing the average figure by four. In almost all household goods and appliance groups, one household or another achieved the Factor 4 level.

Table 7. Differences in the natural resource consumption of household goods and appliances.

Clothing kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	0/30	0/30	0/3,400	0/20	0/80
Highest	320	300	113,000	240	620
Mean	110	170	27,000	80	280
Factor 4	28	43	6,750	20	70
Home textiles kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	0/10	0/1	0/2,200	0/3	0/10
Highest	440	940	50,000	120	1,400
Mean	90	170	16,000	30	260
Factor 4	23	43	4,000	8	65
Furniture kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	30	10	1,100	10	40
Highest	410	400	21,000	130	590
Mean	130	100	6,600	40	230
Factor 4	33	25	1,650	10	58
Large home appliances kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	0/70	-	0/980	0/10	0/70
Highest	520	-	8,000	80	520
Mean	210	-	2,700	30	210
Factor 4	53	-	675	8	53
Electrical appliances kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	20	-	80	1	20
Highest	1,200	-	13,000	110	1,200
Mean	420	-	4,700	40	420
Factor 4	105	-	1,175	10	105
Books, newspapers, magazines kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	10	3	160	1	10
Highest	1,700	570	52,000	240	2,200
Mean	260	110	7,000	40	360
Factor 4	65	28	1,750	10	90

Jewellery kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	1	-	0/1	0/1	1
Highest	1,600	-	260	1	1,600
Mean	180	-	30	<1	180
Factor 4	45	-	8	<1	45
Kitchenware kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	0/1	-	0/7	0/1	0/1
Highest	50	-	180	3	50
Mean	10	-	50	1	10
Factor 4	3	-	13	0	3
Tools kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	0/2	-	0/2	0/1	0/2
Highest	990	-	2,500	30	990
Mean	90	-	260	3	90
Factor 4	23	-	65	1	23
Toys and leisure time equipment kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	0/1	0/1	0/4	0/1	0/1
Highest	110	8	3,400	20	120
Mean	20	2	610	5	20
Factor 4	5	1	153	1	5
Other goods kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	0/1	0/1	0/10	0/1	0/1
Highest	840	220	15,000	110	1,100
Mean	180	30	3500	20	210
Factor 4	45	8	875	5	53
Non-food daily consumer goods kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	30	2	580	10	30
Highest	660	70	11,000	120	720
Mean	150	30	3,500	40	180
Factor 4	38	8	875	10	45
Goods and appliances altogether kg/person per year					
	Abiotic	Biotic	Water	Air	TMR
Lowest	430	130	12,000	70	560
Highest	4,200	1,600	206,000	720	5,900
Mean	1,800	590	71,000	320	2,400
Factor 4	450	148	17,750	80	600

4.7

MIPS results for leisure time activities

On average, the households studied consumed 2,900 kg of natural resources for their leisure time activities. Differences between households are huge in this consumption component, too. For the household consuming the least amount of natural resources in connection with hobbies the TMR comes to 590 kg/person per year, and for the one consuming the most, the TMR is approximately 16,000 kg (Figure 29).

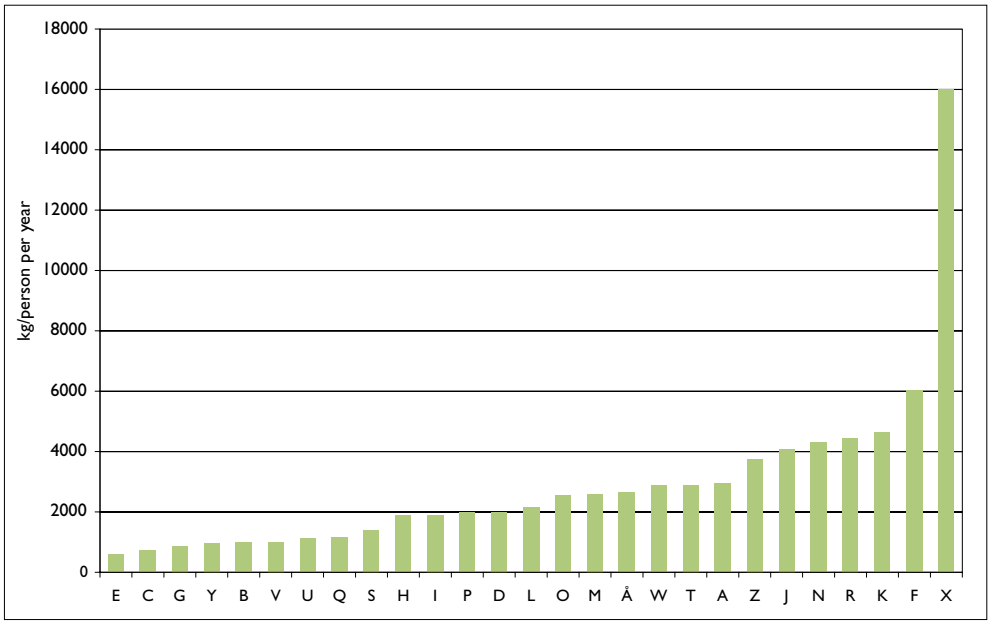

Figure 29. TMR of leisure time activities.

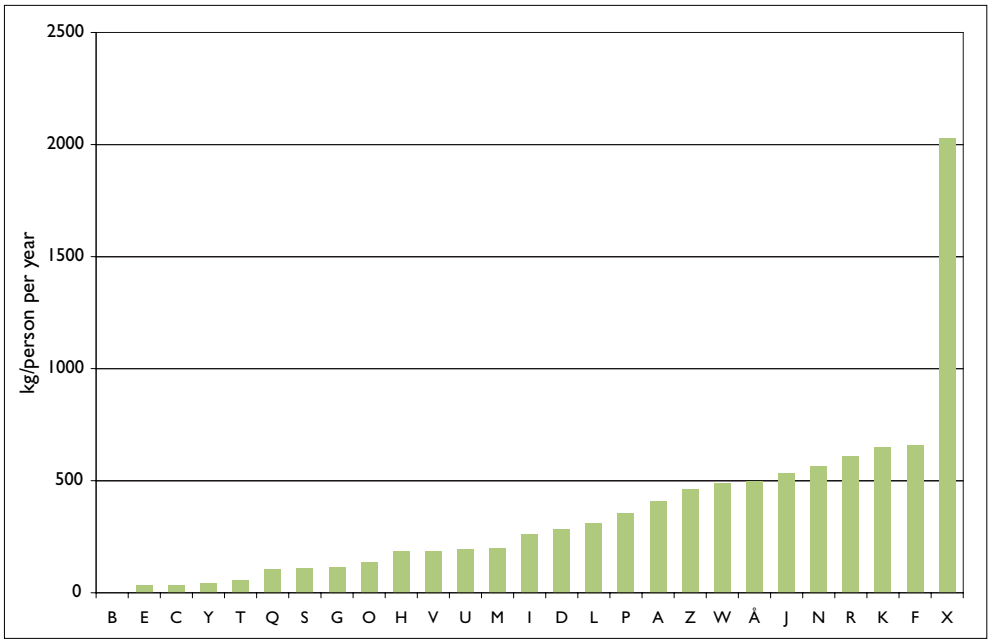

Figure 30. Air consumption of leisure time activities.

Those households consuming the least natural resources spend their leisure time engaged in such activities as fishing, wild mushroom picking, gardening, reading, watching TV, observing nature, canoeing, cross country skiing and physical exercise at home. These hobbies are the sort for which no separate facilities and other infrastructure are required. Despite this, some family members pay visits to concerts and theatres, which demands more infrastructure. The households consuming the most natural resources engaged in such hobbies as motorcycling, motocross, car sports, aerobics and physical exercise at fitness clubs. Other pastimes which consume a lot of natural resources and are engaged in by households include golf and sports requiring heated premises, like swimming at a swimming hall.

The ranking of households in relation to air consumption is practically identical to that of the TMR figures (Figure 30). Those households that consume large quantities of abiotic and biotic resources also consume a lot of air. Households B and T have changed position in the arrangement to the greatest extent. Household B's only natural resource consuming pastimes are watching TV and listening to music. Since household B uses eco-electricity, the air consumption of these hobbies is minimal. Household T plays golf, which consumes a lot of abiotic and biotic resources but less air.

In this study of households only the leisure time activity itself and not travelling to the venue, for example, by private car, is taken into account. More information about the relationship between hobbies and mobility can be found in Section 5.7.

5 Factors explaining differences in natural resource consumption

Tenfold differences were observed in the natural resource consumption of households. It is not possible to make statistical generalisations from the data, but in this section we consider a few aspects possibly influencing natural resource consumption that have arisen based on the data. The effect of different factors on natural resource consumption has been shown using proportional diagrams but for the reason stated above actual correlations were not calculated.

5.1

Relationship between size of households and natural resource consumption

The size of the household and natural resource consumption per person would appear to be negatively correlated, according to the study data. Among the larger households, not one ranks among the group with a high natural resource consumption per person. By contrast, among the smaller households there are some with a high consumption and others with a low consumption (Figure 31).

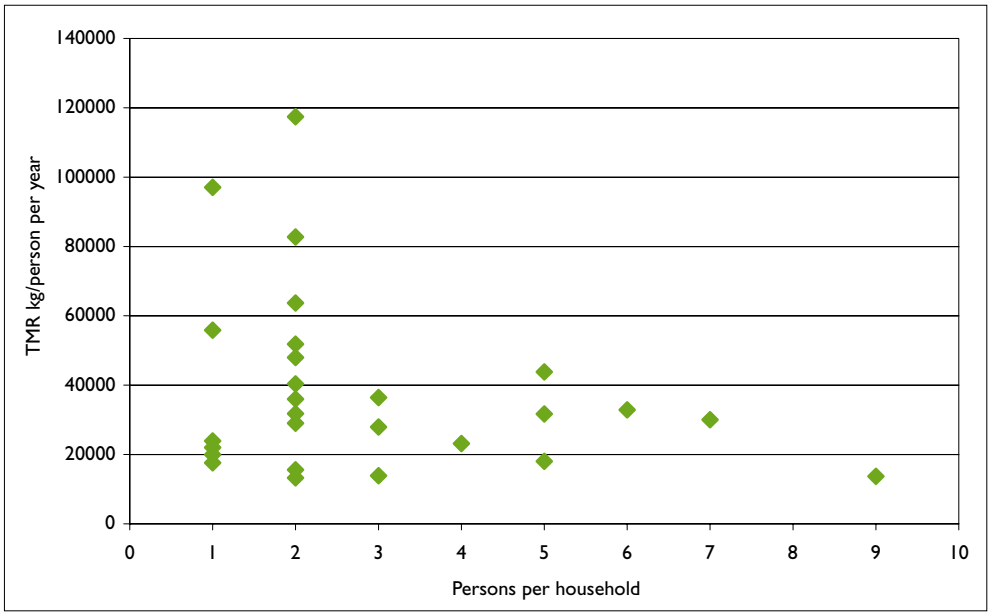

Figure 31. Relationship between the size of a household and TMR: large households may consume fewer natural resources per person.

The relationship between household size and natural resource consumption has two explanations. Firstly, in large households, for example, household goods and appliances, living space and car journeys are divided up among several people, so that they are used more efficiently and consumption per person decreases. The second explanation is associated with the calculation method. Small children often consume less than adults. When natural resource consumption is divided evenly among all members of the family, the consumption of large families on a per person basis declines.

5.2

Age in relation to natural resource consumption

The following figure shows the relationship between age and natural resource consumption. In a family with children, the children's ages are not taken into account; the age quoted is the average one for the adults. In this data the correlation between age and natural resource consumption is positive. This can most probably be explained by younger people's income as a rule also being lower than that of older people. The correlation between income and natural resource consumption is also positive (Figure 33).

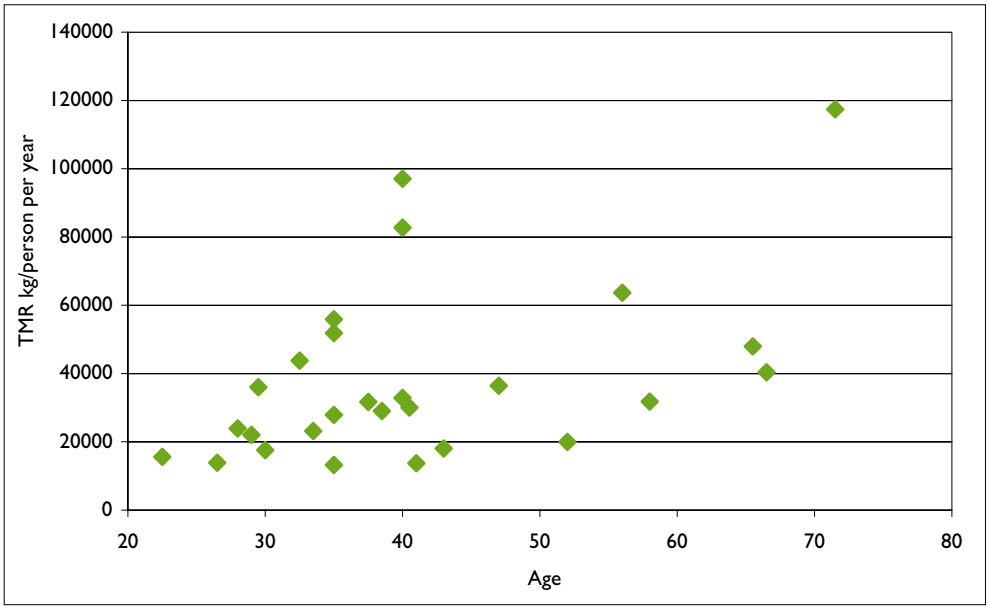

Figure 32. Relationship between age of adults in households and TMR.

In addition to the income factor, the relationship between adult age and natural resource consumption can also be explained by the fact that young people generally have less living space and they have not had time to gather very much personal property. Again, young people more frequently live in apartment buildings and older ones in detached houses with more space. Young people move according to their situation in life to a home of suitable proportions in a suitable location. This sort of movement is rarer among older people. When the children move away, many parents remain living in a house that has 'become too large' for them.

5.3

Income in relation to natural resource consumption

Natural resource consumption correlates clearly with incomes. For instance, those with higher incomes can afford to live in a large house and to travel more often, thereby increasing their natural resource consumption. In the focus group interviews (Section 6) some people said they had opted for a lower standard of living by choice. Based on this study material, it can be said that those on low incomes are at the lower end of natural resource consumption, and also that they may well have no option. Those with higher incomes have more leeway for choosing how they use their money, but those with higher incomes can also live in a material efficient way (Figure 33). The combined income of each family has been divided among its members in the same way as the household's TMR.

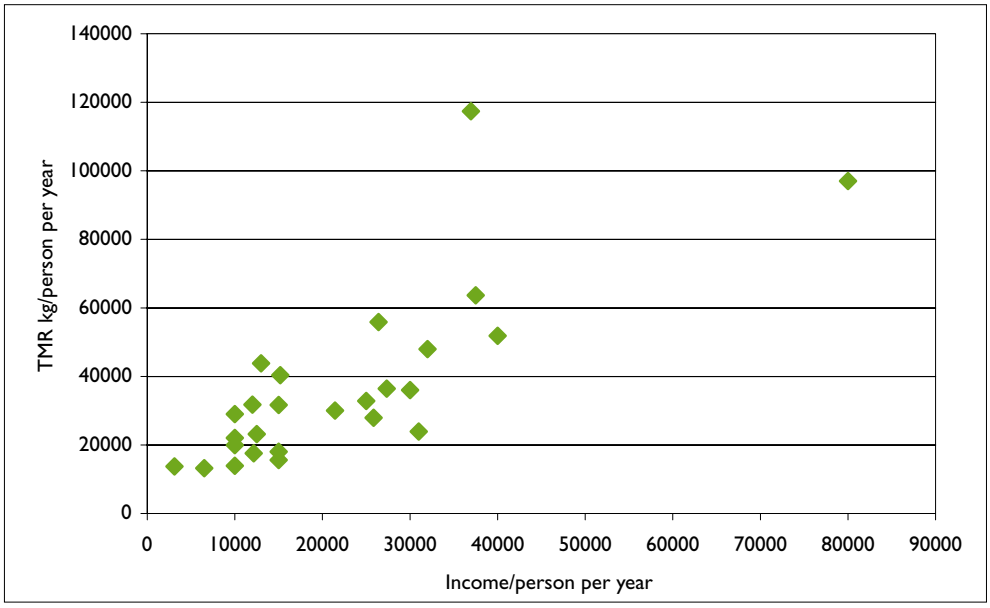

Figure 33. Relationship between gross annual income and TMR.

The households were also requested to estimate how they spent money on various needs and activities, such as housing, daily travel, and tourism. It would have been interesting to have also compared the allocation of consumption expenditure with natural resource consumption. However, resources for this within the framework of the study were not available. It can be assumed, though, that a correlation exists.

5.4

Comparison of apartment buildings and detached houses

The question of possible differences in the resource efficiency of apartment buildings and detached houses often comes up when the consumption of natural resources due to housing is considered. The usual assumption is that the apartment building as a form of housing is more efficient than a detached house. In this study the TMR per square meter in an apartment building varied between 49 kg/m^2 and 94 kg/m^2

and in the case of a detached house between 53 kg/m² and 115 kg/m². The average figure for apartment buildings was 64 kg/m² and for detached houses it was 70 kg/m². Calculated per square meter, the difference in the eco-efficiency of apartment buildings and detached houses is relatively small compared to other factors affecting resource efficiency in regard to housing. When homes are compared as a whole and not just in terms of floor space, however, differences show up between apartment buildings and detached houses.

Figure 34 shows the TMR figures for the buildings associated with the households studied. Apartment buildings are depicted on the left and detached houses on the right. The TMR figures for apartment buildings fall slightly below those for detached houses. This is not, however, due only to the apartment building as such, but also to the fact that there is more floor space in detached houses (Figure 35).

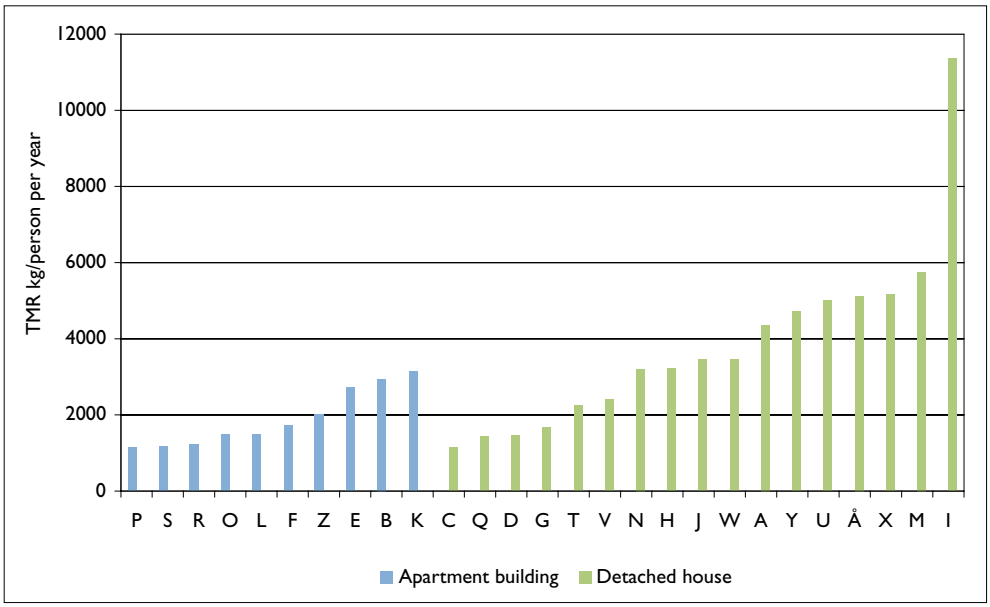

Figure 34. TMR of apartment buildings and detached houses.

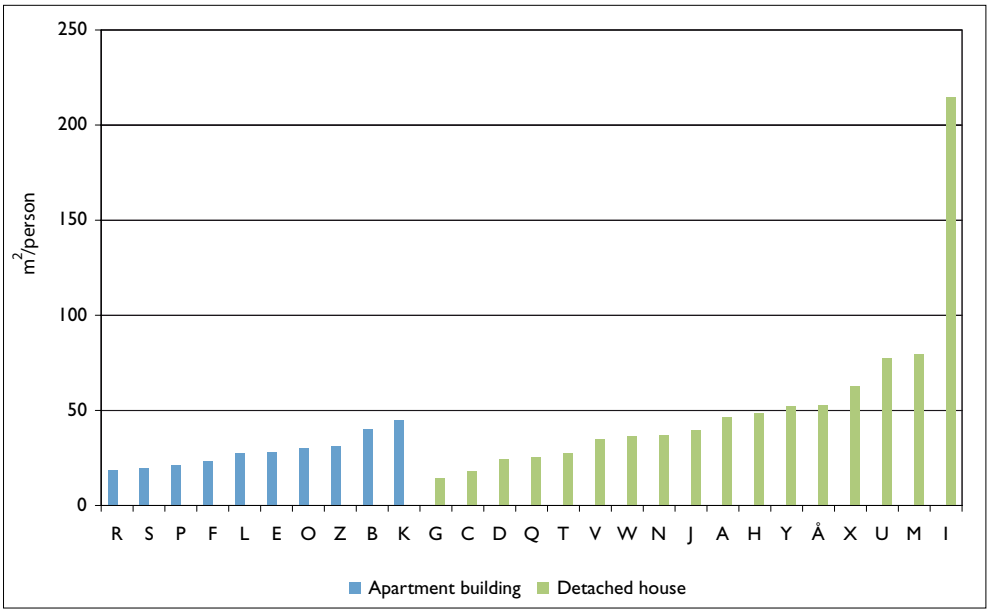

Figure 35. Floor space per person in apartment buildings and detached houses (on average, detached houses have more floor space).

If a closer look is taken at Figures 34 and 35, one can see that the problem of detached houses is not resource efficiency but rather that in detached houses people have more space than they have in apartment buildings. Only in the most spacious apartment buildings is the average Finnish consumer's 38 m^2 per person exceeded, while in detached houses the residents in over half the cases have more spacious homes. This same fact can be seen in Figures 14 and 15 in Section 4. The TMR of a building increases along with the number of square metres in it.

When looking at more than just the location of the building, that is, when taking account of housing in general, the natural resource consumption of detached houses compared to that of apartment buildings often increases because of artificial (non-natural) yards and a private road to the house (Figure 36). Apartment building yards are often more intensively constructed than those belonging to detached houses, but they consume fewer natural resources per person because the same yard is used by all the residents of the apartment building. The next graph shows housing as a whole, with apartment buildings and detached houses separated. In the graph the first ten households are located in apartment buildings and the rest occupy detached houses.

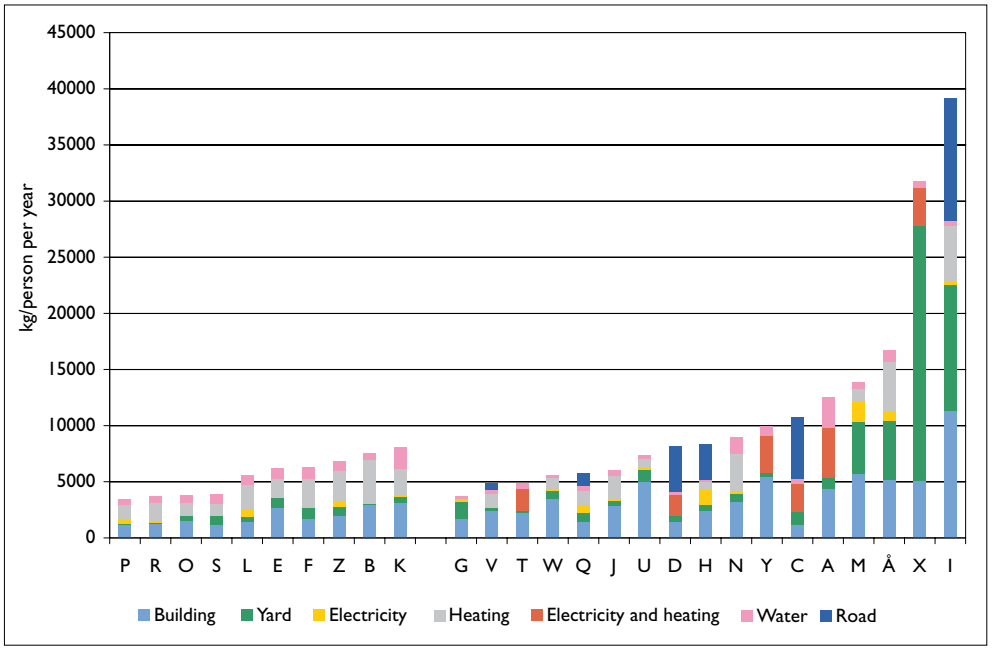

Figure 36. Comparison of the overall TMR of housing in the case of apartment buildings and detached houses.

When comparing forms of housing we noticed that the type of building is not important as concerns the natural resource consumption. One can live in a detached house just as material efficiently as in an apartment, if there are the same number of square metres per person, the yard is not too heavily constructed, and the house is not situated at the end of a long private road. However, in the households we studied the TMR for housing in the case of many residents of detached houses rises much higher than in apartment buildings. Living in a detached house may also increase the use of a private car, if the house is not situated close to good public transport connections.

In Section 5.8 the TMR figures for housing are also compared with air consumption.

5.5

Relationship between using a car and natural resource consumption

Not owning a car is considered one of the key features of an ecological lifestyle. In the following figure the number of cars owned by households is compared to the total consumption of natural resources. The figure 37 indicates the number of cars in the entire household, even though the TMR is expressed per person.

Although no clear relationship exists between the number of private cars and natural resource consumption, most households that do not own a car rank towards the lowest extreme in terms of natural resource consumption. Similarly, those owning just one car consume, on average, fewer natural resources than households with two cars. Mobility is one of the most material intensive consumption components, so that not owning a car, and thus not travelling many kilometres by car, appreciably reduces natural resource consumption. The number of cars is closely correlated with the distance travelled. Figure 38 shows the relationship between the number of kilometres the households travel by private car per year and TMR – in general, the more kilometres travelled by private car, the higher the TMR.

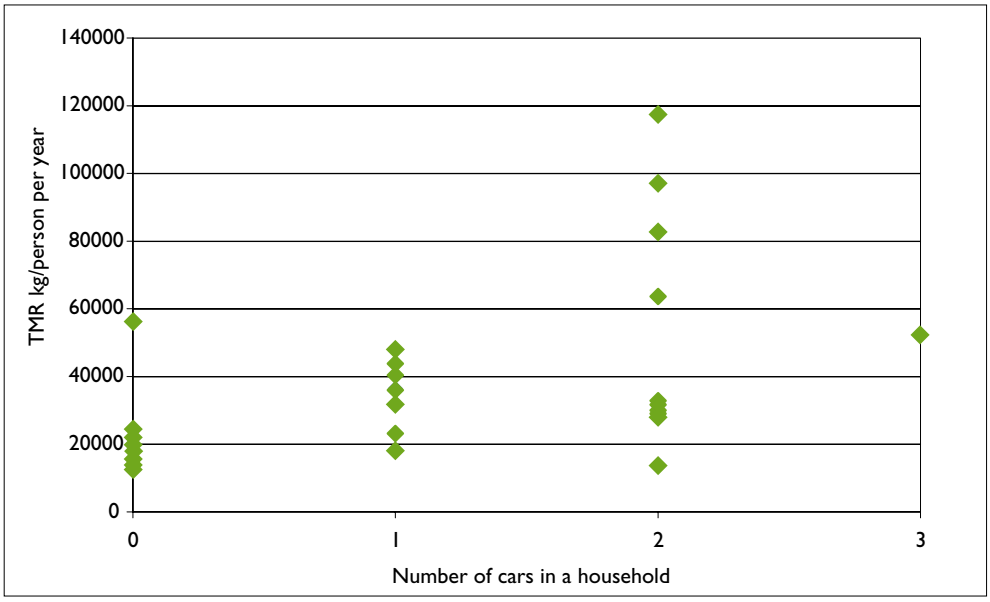

Figure 37. Relationship between owning a car and TMR.

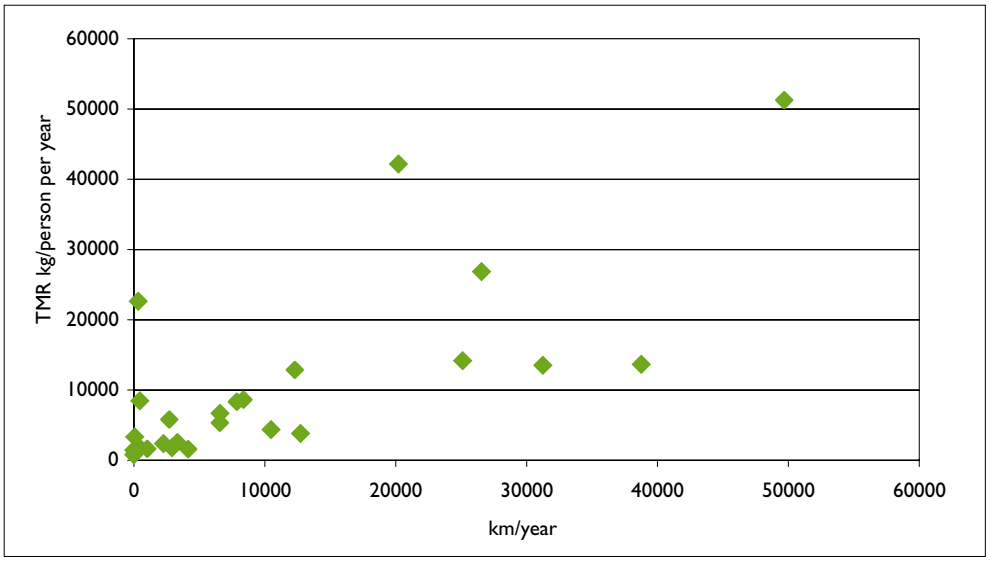

Figure 38. Relationship between kilometres travelled by private care and TMR.

5.6

The relationship between household goods and appliances and floor space

Just as the floor space influences the consumption of a building and housing in general, so too is the amount of household goods and appliances related to the size of the dwelling. Large homes have more goods and appliances (Figure 39). In this instance the number of goods does not mean the number of individual items, because goods were calculated in groups as described in Section 2.4.6. For example, one sewing kit containing 50 individual items has been regarded as a single entity.

As the number of members in a household increases, the total amount of household goods and appliances also rises to some extent, but the amount of household goods and appliances per person in large households is less than in small ones (Figure 40).

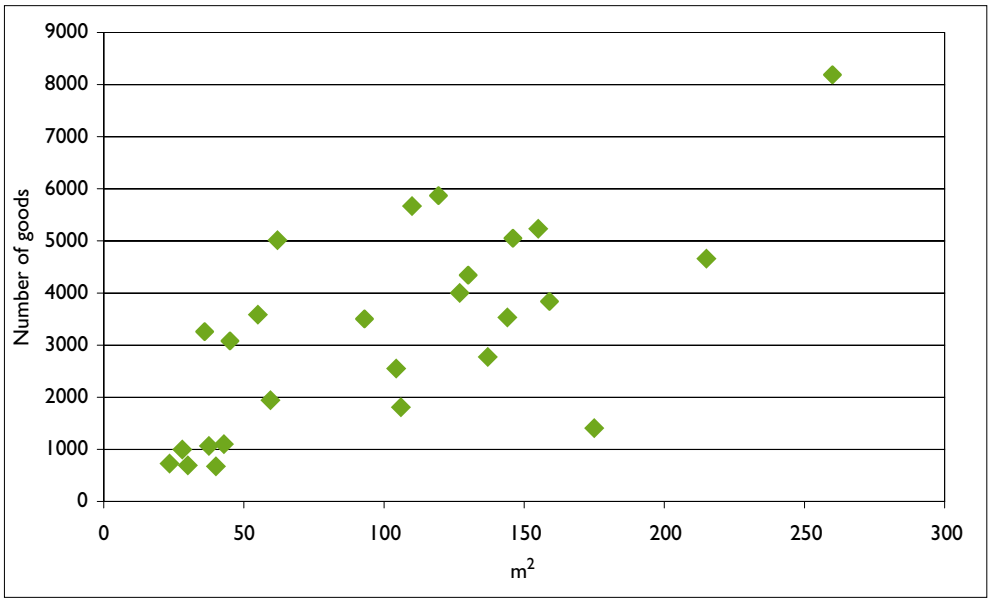

Figure 39. Relationship between the size of the home and TMR.

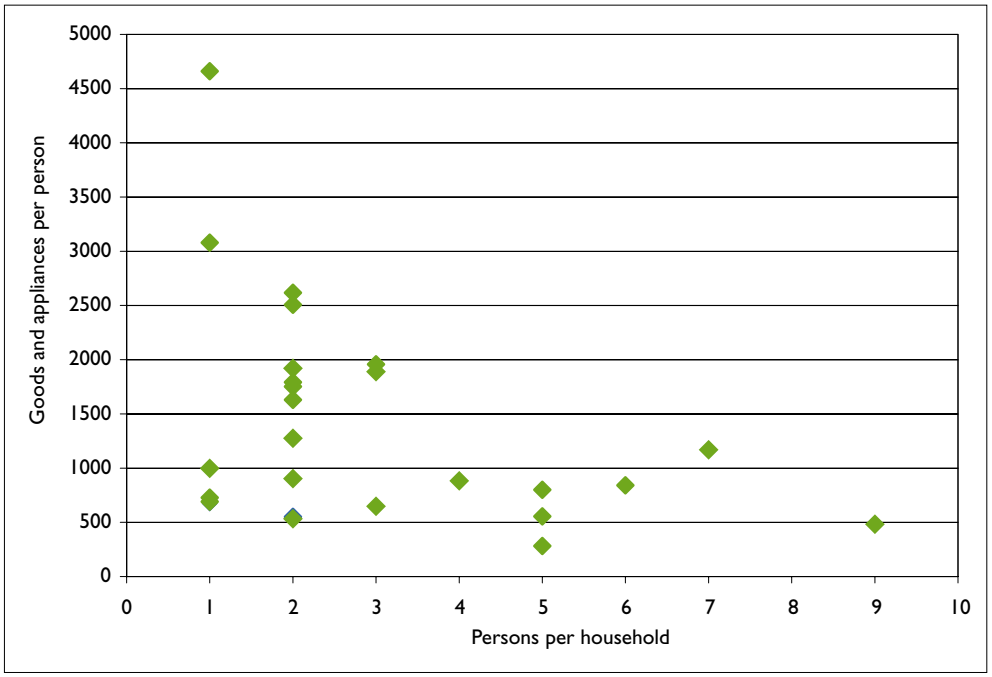

Figure 40. Relationship between the amount of goods and appliances per person and persons in a household.

5.7

Leisure time activities and mobility

The natural resource consumption of leisure time activities was presented in Section 4.7. This study was restricted to the natural resource consumption of hobbies. However, for leisure time activities, other important factors are how far away the venue is located and what means are used to get there.

When the natural resource consumption of leisure time activities and travelling to each venue are added together, among the households studied, on average, transportation to the venue contributes 48% to the TMR figures. In the following graph the ranking of the TMR due to leisure time activities among the households is vastly different from that given in Figure 29, since transportation has also been taken into account.

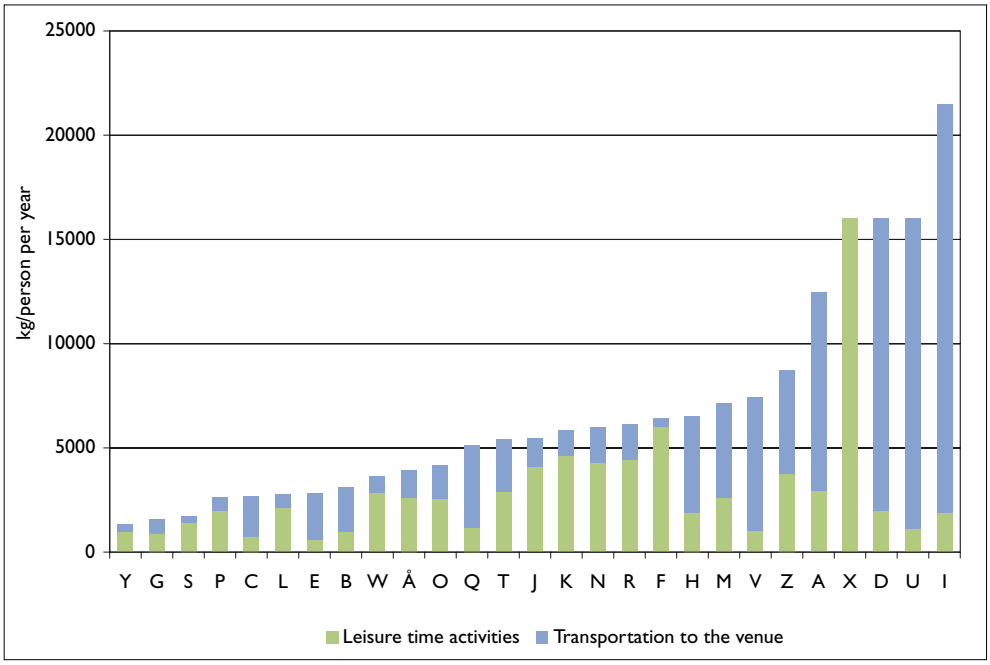

Figure 41. TMR of leisure time activities and the transportation to the venue.

Household I consumed the most natural resources in its leisure time activities (over 21 tonnes/person per year). Most (91%) of this consumption arises from transportation to the venues by passenger car. For Household I the average journey made by car for the purpose of engaging in a hobby is 41 km each way. After the household involved in motor cycling activities, Households S, Y and F consumed the least natural resources travelling to a hobby venue (under 500 kg/person per year). These households either journey to the venue by public transport, or they follow pastimes that are within walking distance or that can be engaged in at home.

Compared to the graph in the results section (see Figure 29), in which natural resource consumption connected with the households' leisure time activities is shown without regard to mobility, consumption by some households in relation to the others has drastically changed. Households V and U have moved to the top of the natural resource consumption list, whereas Households K and F have fallen to the middle. Leisure time activities like orienteering and visits to the theatre, in Households V and U, do not particularly consume much natural resources compared to other hobbies, but in these cases the average journey made to such activities is around 30 km. Despite

Household K's and F's pastimes, that is, aerobics and exercises at a gym in a fitness centre, being material intensive activities, the venues for these are located close to home and the journey to them is accomplished by walking or public transport.

5.8

Relationship between TMR figures and air consumption

Natural resource consumption is calculated in the MIPS method for five separate categories which should not be added to produce a single figure (Hinterberger et al. 1997). Nevertheless, abiotic and biotic natural resources, and erosion, can be added together to give the TMR figure for a product or service. The MIPS method thus provides a number of figures, which reveal different things. An interesting question is how these different categories relate to each other. In the MIPS method another frequently discussed question is how well natural resource consumption is related to other environmental impacts. The MIPS air consumption category offers a rough estimate of carbon dioxide emissions, so that by comparing the TMR with air consumption one can assess the relationship between the TMR and climate impact[1]. In this section we take a look at the MIPS figures for air consumption and TMR. How similar are the results given by the figures for air consumption and for TMR?

When the households' consumption was studied an obvious connection between the TMR and air consumption was seen (Figure 42). The correlation between the TMR and air consumption is clearly apparent in the next figure, which gives the air consumption and TMR of the households for all consumption components.

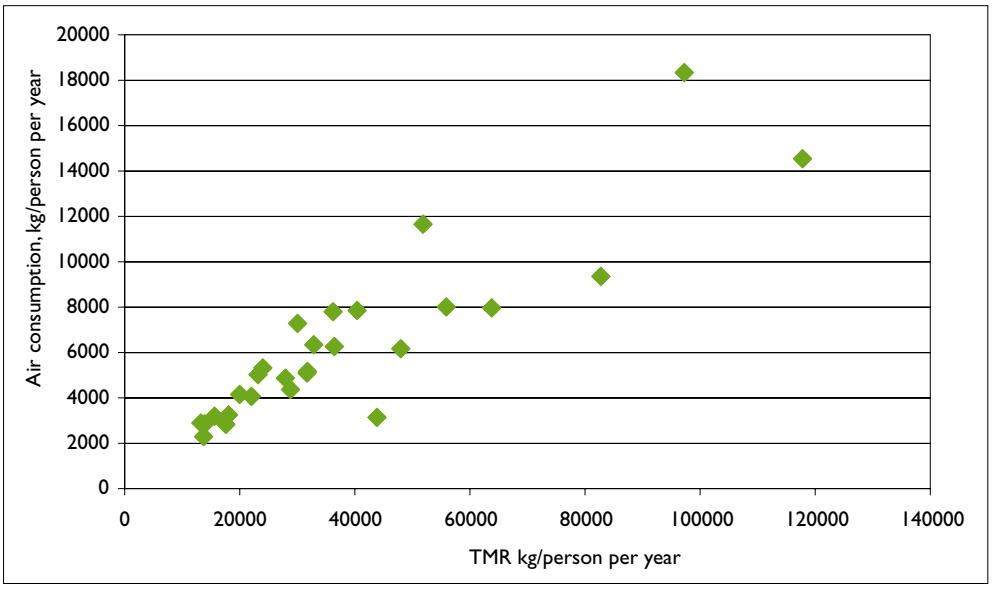

Figure 42. Relationship between TMR and air consumption for all consumption components.

When each of the consumption components is examined separately the most pronounced correlation between air consumption and the TMR is found in the housing and mobility components (Figures 43 and 44). In housing the sharpest deviation is caused by one household's large constructed yard, which considerably increases the TMR figures but hardly affects air consumption at all.

1 Air consumption comes from burning coal and hydrogen resulting in carbon dioxide and water. For this reason the carbon dioxide emissions are roughly comparable with burned oxygen, i.e. the air consumption of MIPS.

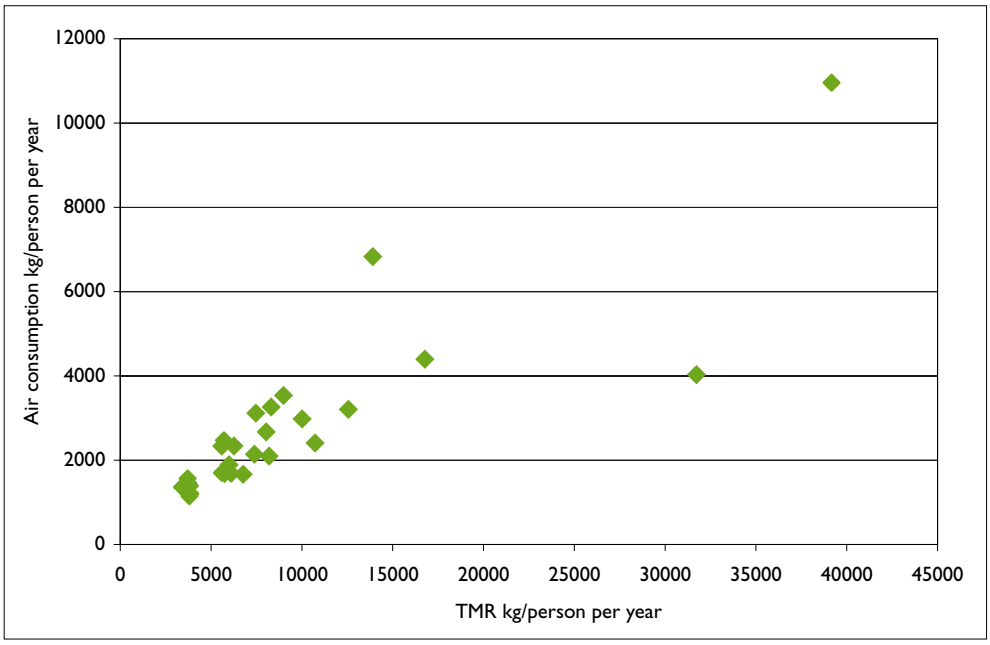

Figure 43. Relationship between TMR and air consumption in housing.

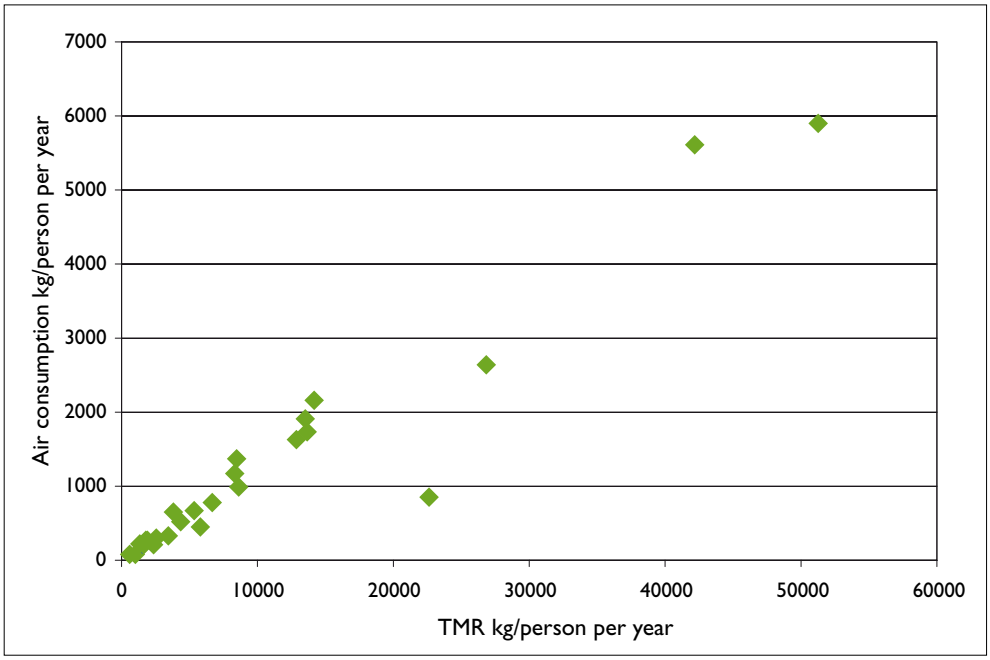

Figure 44. Relationship between TMR and air consumption in mobility.

In tourism the connection between air consumption and the TMR is not as clear cut: it is, however, apparent (Figure 45). Air consumption and the TMR are forced further apart by air travel and leisure home ownership. Little infrastructure is required for air travel, as a consequence of which the TMR figures for air travel are relatively low. However, a great deal of air is consumed by this form of travel. In the case of summer cottages, the TMR figures are inflated by private roads and dredging, which again do not increase air consumption.

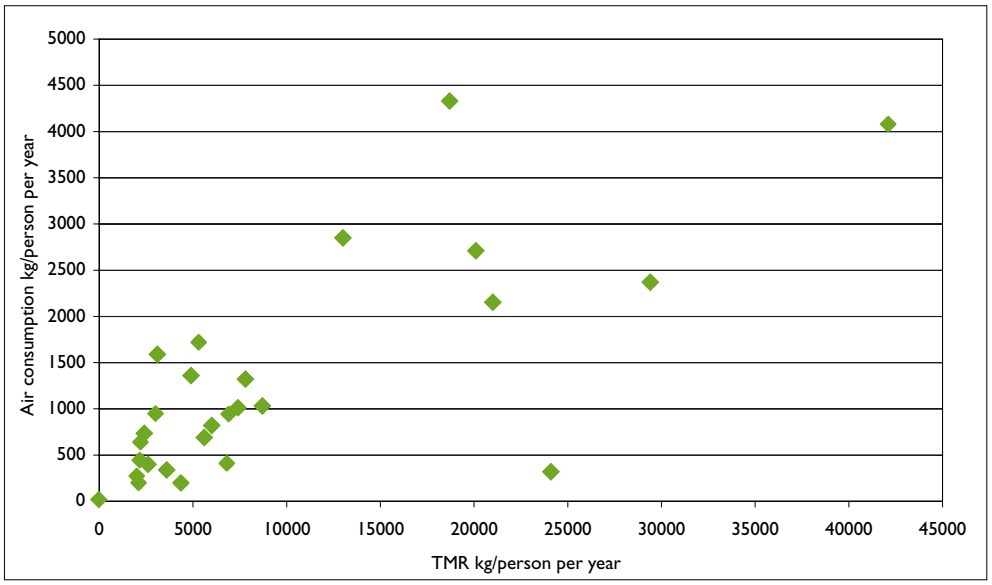

Figure 45. Relationship between TMR and air consumption in tourism.

There is no obvious connection between air consumption and the TMR in the case of household goods and appliances, nor as regards foodstuffs. In household goods and appliances the actual use of the appliances exacerbates the climatic impact, but in this study the use of appliances is not included in the calculations of household goods and appliances: it is included in the electricity consumption associated with housing. Many other climatic effects (e.g. methane emissions) are associated with foodstuffs in addition to carbon dioxide emissions, so that the MIPS for air consumption in the case of foodstuffs does not indicate climatic effects as comprehensively as, for instance, it does for mobility.

5.9

What explains the low natural resource consumption of Factor 4 households?

In this section we discuss the background of the MIPS figures of the least resource-consuming households in each consumption component. Factor 4 households were defined as households where consumption is around a quarter of the average of all the households. Each component was examined separately, but also the total consumption of the households was studied. Since the data for the households are not statistically valid, this factor level cannot be used for anything other than comparing the results within the confines of our own data.

So-called Factor 4 households were found among the study results for mobility and tourism. The Factor 4 level for the natural resource consumption of the households was calculated from the households' average in each consumption component. Differences between the households in regard to mobility and tourism in some cases even exceeded the Factor 4 level. In housing and foodstuffs no household achieved the Factor 4 level. In household goods and appliances the lowest result fell into the Factor 4 category. When the TMR for all the components is added up, the smallest single household's TMR (13,200 kg/person per yr) is slightly higher than the Factor 4 level (9,060 kg/person per yr). The TMR figures in the 'total' column (far right) in Table 8 are not figures for an actual household. They are the smallest and largest components added up. If the lowest TMR is picked from each component, the result falls below the Factor 4 level calculated for the study households.

Table 8. Smallest and largest TMR result for each consumption component and the Factor 4 level calculated from the averages.

	Mobility	Housing	Tourism	Foodstuffs	House-hold goods	Leisure time activities	Sum
Lowest	600	3,400	1,900	2,600	600	590	9,690
Highest	51,000	39,000	42,000	7,700	5,900	16,000	161,600
Mean	9,900	9,400	9,800	4,400	2,400	2,900	
Factor 4	2,475	2,350	2,450	1,100	600	725	9,060

If the lowest figure is chosen from each consumption component in Table 8, a fictional Factor 4 household is obtained. What kind of household would consume the least among all the study households in each of the consumption components of the study?

A couple consuming the least in the mobility component lives in the centre of the city next to good public transport connections. They cycle a lot and make use of public transport to some extent. In housing the least consumption is found in a family living in an apartment building. They have 21 m^2 of living space per person. This family uses conventional electricity rather than eco-electricity. If they switched over to eco-electricity, their TMR for housing would decline by another 400 kg per year. In tourism the least consuming single-person household travels approximately 3,000 km a year (see tourism definition in Section 2.4.3). Slightly over a half of these kilometres are covered by public transport and under one half by private car. The individual does not travel by air, nor does he own a summer cottage. With respect to foodstuffs, the family with many children consumed the least natural resources per person. The low natural resource consumption of this family can be partially explained by the presence of a large number of small children who do not eat as much as adults do but are included when the overall natural resource consumption is divided up among the family members. A foodstuff TMR almost as low is found in a family which consumes the least amount of dairy products among the study group and eats meat, on average, to the same extent as the households studied. The lowest TMR for household goods and appliances is found in a family where one-quarter of the household goods and appliances has been acquired second-hand, that is, used.

The four households achieving the lowest MIPS results consume only little more than a quarter of the consumption of the average Finnish consumer introduced in Section 3. One can thus say that their consumption level is close to Factor 4 from the standpoint of the average Finnish consumer. We now go on to examine the way of life of these households and the factors accounting for their lower level of consumption.

The homes of the four households consuming the least natural resources rank among the smallest in the study group. Per person they have 14, 19, 20 and 21 square metres of floor space respectively, whereas the average for the entire study group is 43 m^2 per person. One of these households owns a car but this is used relatively rarely, that is, it is driven slightly over 4,000 km a year. Public transport is the most important mode of transport for the least consuming households. These households live in an urban area. Factor 4 households, too, do not travel very much and they engage in leisure time activities that are accessible within their own residential area. Factor 4 households were also among the six lowest in terms of air consumption. The incomes of the four least consuming households per person are lower than average within the group studied.

In relation to their consumption habits, the Factor 4 households are rather similar. However, they also have some distinguishing features. Three families live in apartment

buildings and one in a detached house. The families are also of different ages. None of the least consuming households belongs to the study's oldest age group of 50–69 years. The Factor 4 group includes a young student couple of around twenty, a family with several children whose parents are around forty years old, a single parent and her school-aged child, and a couple of around thirty with a small child. Three of the families live in the city and one in the centre of a rural municipality.

6 Results of the analysis of the interview data

This section deals firstly with the consumers' views on the possibilities of making environmentally friendly choices in the different consumption components. The components here are the familiar ones of housing, mobility, tourism, foodstuffs, and household goods and appliances, which were already used in the consumption monitoring. Packaging and household wastes are also relegated to their own groups. The different components were not mentioned separately in the questions of the focus group interviews. Instead, the participants could themselves refer to whatever consumption component they wanted to. All the components were discussed to some degree at least once. In this section, environmentally friendly is referred to rather than resource efficiency, because in the focus group interviews discussion was not limited to the latter. Following the coverage of the consumption components we weigh up the consumers' action space relative to consumption choices that help conserve the environment, and also discuss why some practices changed as a consequence of the study while others did not.

6.1 Scope for choices that help conserve the environment within the different consumption components

6.1.1 Housing

Making choices to conserve the environment in the consumption component of housing was found to be difficult, because the contribution of fixed constructions to the overall natural resource consumption of housing is appreciable. There was a great deal of discussion on this matter in the focus group interviews. The home has been built at some time in the past and now it is occupied, so that the natural resource consumption of fixed structures in the dwelling is beyond the range of daily choices.

On the other hand, consumers have control over the kind of electricity and heating used, and the quantity consumed, in addition to water consumption. Some interviewees had already moved over to eco-electricity before the study, and a few said they intended changing their electricity supply agreement as a result of this study. Water consumption monitoring was also considered a possible method.

> *"And when you go through that list you can see that the consumption of hot water could be reduced somewhat, also furniture acquisition. Because these acts are at the lower end you do not need to make really radical decisions. Here the entire family could manage to make a contribution." (Woman, 20–29 years old, Päijät-Häme)*

The possibilities for people living in apartment buildings to influence their material consumption are less than in the case of detached-house residents, since they themselves are unable to choose the form of heating.

A: Detached-house residents could in some measure influence their heating mode choices, and of course consumption. But we live at these high latitudes. If I look at my own graphs, for example, I can say that if I really wanted to, I could easily reduce them by a half but in living cutting down is appreciably more difficult. Or it is a choice. (Man, 30–39 years old, Uusimaa)

B: Not if you live in an apartment building. You can't influence the heating very much, no way. (Man, 50–59 years old, Uusimaa)[2]

Debating environmental perspectives in relation to housing is complicated by the fact that when choosing a place in which to live many factors other than environmental aspects are of importance. Detached-house residents in particular find it difficult to contemplate such major choices as swapping their residence for a smaller one.

"There are so many other reasons why you choose a home. If it was just a case of swapping it for a smaller one with the same advantages that would be no problem. But, if the good thing about your apartment is that it is big, probably you wouldn't want to change it for a smaller one." (Woman, 30–39 years old, Pirkanmaa)

In conjunction with the natural resource consumption of housing, there were a lot of critical comments on the sizeable contribution made by a possible private road.

"Well, possibly, for example, that private road thing we talked about. That it accounted for half the housing consumption and for sixty years into the future as well. It doesn't seem it could be that way. The land has been turned into fields and what's done is done." (Woman, 30–39 years old, Pirkanmaa)

6.1.2 Mobility

When mobility was discussed, the focus was to a large extent on private motoring. As a group the interviewees voiced conflicting viewpoints about how they could influence their own amount of private motoring. Some were of the opinion that they already used their cars as little as was practically necessary. Others, while considering public transport a practical option, felt that it took too much time. Some considered a reduction in driving very possible.

"In fact, travelling for pleasure and travelling to work is connected with this. When we had the impression that we were reasonably good consumers, yesterday we calculated that we visit the summer cottage four hundred kilometres away eight times a year. Okay, suppose we only went four times instead of eight and we stayed there for longer, then the total distance would be reduced. Meaning, in other words, that concrete small changes would bring that column in the figure down." (Man, 30–39 years old, Uusimaa)

Opportunities for making choices in one's mode of transport are far slimmer in areas of low population in comparison to towns and cities. Many of those living in the countryside considered using public transport a practical impossibility.

2 The interviewees and discussion quotations have been coded A, B, C and so on. The letters have been added to improve understanding of the discussions and they are not connected with the household letter codes used previously in this report.

"Well, if we go shopping on the bus it will take us all day. And the milk would get warm on the way. It truly really isn't an option in summer. It's an impractical idea." (Man, 40–49 years old, Pirkanmaa)

In mobility the large contribution made by infrastructure towards natural resource consumption led to discussion. In the presentation of the results it was also mentioned that, in addition to the TMR, air consumption is an important factor in mobility. The difference between the TMR figures and air consumption did not, however, trigger much discussion in the focus group interviews. Consumers can indirectly influence the transport infrastructure because more roads are built as the number of vehicles rises. However, the interviewees considered road infrastructure a matter they could not themselves have any influence over.

6.1.3

Tourism

In the case of tourism a lot of discussion centred on summer cottages. Owning a summer cottage consumes many natural resources if long journeys have to be made to get there. Moreover, cottage roads are often private. However, the interviewees were not willing to forego leisure home ownership.

"When we ourselves go to the summer cottage for the summer, this vastly increases our tourism backpack. But we still go to the cottage for the summer." (Woman, 30–39 years old, Päijät-Häme)

Among other forms of tourism, flights were an oft-repeated topic. Air travel does well in terms of the TMR calculated by the MIPS method, but it does not do so well in regard to its air consumption. This fact did not, however, trigger any discussion among the participants. Tourism was considered to some extent to be unnecessary and there was a lot of discussion about ways of reducing it.

Interviewer: In your opinion, for which consumption component do we have the most opportunities for making environmentally friendly choices?
A: Tourism. (Woman, 30–39, Pirkanmaa)
B: Yes, that annual trip or two to Lapland, then the trip or two to southern Europe. People should have the courage to accept that if everybody did the same where would we all be? In my opinion, it's one of those unnecessary activities. (Man, 30–39, Pirkanmaa)

6.1.4

Foodstuffs

One glaringly obvious means of lowering natural resource consumption through the diet is to reduce the amount of meat consumed. In the focus group interviews most of the talk relating to food centred on eating meat and vegetarianism. Food imported from abroad was also discussed to some extent. The interviewees felt imported food is harmful to the environment, even though the origin of the food – domestic or imported – was not taken into account in the MIPS calculation. Local food has become a familiar concept to many and part and parcel of environmentally friendly activities.

"One could take a look at foodstuffs, the food we eat. It could be more important. We could look at how much domestic food we buy and so on. I have tried to reduce my meat intake in the past: I do still eat meat but not as much as before. But we could try to eat more domestic products, and more organic food besides." (Man, 50–59 years old, Uusimaa)

Organic food came up in every discussion. Many participants said they had changed to this alternative as a result of the study, even though the calculations had not taken into account whether the food consumed was of organic origin or not.

Interviewees frequently made reference to the idea that becoming a vegetarian and totally giving up the practice of eating meat would favour the environment. Reducing meat consumption (instead of relinquishing it altogether) was not often suggested, although this, too, could be a good way of helping the environment. On the other hand, at times the interviewees questioned the environmental friendliness of vegetarianism, since many foods forming a vegetarian diet are imported from abroad.

A: This is again so... Personally, I would like more information about the environmental friendliness of that type of food. (Man, 30–39 years old, Uusimaa)
B: True. (Woman, 20-29 years old, Uusimaa)
A: On account of the fact that if you are a vegetarian and you start consuming that seaweed from Japan and guavas in the winter… (Man, 30–39 years old, Uusimaa)
C: Is that a fact? (Man, 20–29 years old, Uusimaa)
A: For instance, Finnish organic lamb, what is it? (Man, 30–39 years old, Uusimaa)

When deciding about the right diet, people's choices are also affected by traditional concepts regarding what constitutes a healthy diet. A few interviewees did not believe that vegetarian food provides all the necessary nutrients.

A: Myself, I could consider a vegetarian diet. But I would probably not wish to sell the idea to growing children. (Woman, 30–39 years old, Päijät-Häme)
B: You'd have to think a lot harder about that. (Man, 40–49 years old, Päijät-Häme)
C: And it's such a lot of trouble. (Woman, 30–39 years old, Päijät-Häme)
A: Perhaps they could make the decision a bit later. (Woman, 30–39 years old, Päijät-Häme)
D: But it is possible to manage it. One of our children won't eat meat, but a lot of thought has gone into it. (Woman, 30–39 years old, Päijät-Häme)

Nutrition and foodstuffs seemed to be a particularly complicated subject. There was plenty of discussion about different foods and modes of production and transport.

A: But what about these greenhouses and all those imported fruits and stuff? (Woman, 30-39 years old, Päijät-Häme)
B: Convenience foods. (Woman, 20–29 years old, Päijät-Häme)
A: But could fruits be swapped for berries? (Woman, 30–39 years old, Päijät-Häme)
D: There's already a lot of discussion now about growing stuff in a greenhouse, in practice this is not any more ecological than bringing the produce by truck from Spain. It's quite expensive to grow stuff in Finland. (Man, 60–69 years old, Päijät-Häme)
E: But isn't it an entirely different thing when the greenhouse is used only in summer? (Man, 40–49 years old, Päijät-Häme)

6.1.5

Household goods and appliances

Different kinds of unnecessary household goods and appliances are frequently considered symbols of the extravagance of western consumption. However, the proportion of household goods and appliances in the ecological backpack of the households is relatively low, a fact which led to critical comments in some discussions. Household goods and appliance acquisitions are clear individual acts which it is

relatively easy to deal with. The minor weighting of this consumption component appeared to some interviewees to be discouraging.

"And as to 'what could I do better? I have thought I won't buy anything new, get everything repaired. This is our ecological way of life, everything being repaired, and using and buying old stuff, if we can find it. It's all the same, though as these things are so minor. I have thought doing that makes me so ecological!" (Woman, 30–39 years old, Pirkanmaa)

Many were astounded at the sheer quantity of their household goods and appliances when they began making an inventory of them. This was brought up in all the discussions. Counting their household goods and appliances caused some people to wonder whether all the items were indeed necessary.

A: When we had to list those goods I was amazed, although our clothes are almost all reused, as is the furniture, why do we need such an astonishing amount of stuff? Our daughter has 37 long-sleeved shirts, she could survive with a bit less. How many shoes did you say you've got? (Woman, 30–39 years old, Päijät-Häme)
B: 125 pairs. (Girl, 10 years old, Päijät-Häme)
A: Yep, that's a massive quantity. Or those pillow cases – 50 . (Woman, 30–39 years old, Päijät-Häme)

In the focus group interviews, the manufacturer's responsibility was also emphasised and participants were shocked at how short lived goods and appliances are these days. Repairs are uneconomical because buying a new product is often cheaper than repairing an old one.

6.1.6

Waste management and packaging

There was relatively little discussion about wastes and packaging. They were mentioned mainly to say that their low natural resource consumption was surprising. This is understandable because waste advice is probably the most visible form of consumer guidance and people have learned that recycling forms part of an ecological way of life.

A: That's something. Concentrating on some packaging matter or waste recycling, like this advice work. And – as we now saw – it's such a small thing that wouldn't it be better to focus the advice and consumer awareness on some other matter? (Woman, 30–39 years old, Päijät-Häme)
B: For those planning on building a detached house. (Woman, 20–29 years old, Päijät-Häme)

6.2

Consumers' action space in relation to consumption choices that help conserve the environment

This section deals with the consumers' action space in regard to environmentally friendly consumption choices. The theoretical background to exploring action space has already been described in Section 1. Factors determining action space become twisted into a structure from which it is difficult to disentangle individual components for separate scrutiny. In Section 6.2.1 the factors are loosely divided into social and structural dimensions, even though with this division, too, the dimensions overlap

slightly. In Section 6.2.2 it is considered how action space could be expanded and why some practices change more easily than others. In Section 6.2.3 the fundamental aspects of action space are summarised.

6.2.1

Factors determining action space

Social dimension

The social dimension of action space means that consumption choices do not take place in a vacuum, rather the action space is defined by other people's actions and the concepts of normal action predominating in the society. Other people may through their own actions bring up certain environmental issues for contemplation, but, on the other hand, practices considered normal and acceptable in the community restrict the choices the individual considers possible (e.g. Halkier 1999; Nurmio 2001).

In the focus group interviews most interviewees considered themselves more environmentally friendly than people in their own immediate circle. Some interviewees wanted, through their own example, to show others that environmentally friendly activities are possible. Actions deviating from the community norm take place, however, within certain limits. People do not like to be distanced from others too much. As one interviewee said, "I don't wish to be the one who's not invited over when recycling matters are not in order". In lifestyle, the question, on the one hand, is one of isolation from the rest, and, on the other, of adapting. People want to make their own identity distinctive, but, at the same time, most do not wish to be too different from the rest. As Nurmio (2001) says, an individual opposing a community's norm must, to some extent, be a member of that community to consider his or her opposition sensible. On the other hand, the individual must, to some extent, be outside the community to consider a change necessary.

Being ecological as a general ideal is nowadays universally accepted. Sustainable development is considered a goal to aspire to in the same way as democracy and fairness. This common attitude is not, however, apparent in practice. Many interviewees felt they had to justify their choices to other people who considered them unnecessary or unimportant. In this kind of situation the individual needs the determination to act despite others attaching little importance to his or her aims.

> *"Often when one talks to people about all sorts of things, a lot of Finns wonder whether we should actually take glass jars to the collection point when China produces so many emissions that it's all the same what Finland does. That, whatever we do over here, it's still only a drop in the ocean among the whole world's emissions and pollutants and such. Many folks feel it's a waste of time what I, just one person, can do." (Woman, 30–39 years old, Pirkanmaa)*

In acting to some extent contrary to the norms of their peers, a few interviewees felt they had extended the action space of others as well. By acting differently they were indicating the existence of opportunities for making choices, making alternative choices possible for other people.

A: When I buy sliced meat products, like salami, I use my own plastic container or whatever. And – naturally – my own bags and stuff. (Woman, 30–39 years old, Uusimaa)
B: I have respect for that sort of dedication. (Man, 60–69 years old, Uusimaa)
A: I also feel it's something that's visible to other shoppers. (Woman, 30–39 years old, Uusimaa)
C: True. (Woman, 60–69 years old, Uusimaa)
A: That they could do the same. (Woman, 30–39 years old, Uusimaa)

The idea of going into a shop with one's own containers stuns another interviewee. This type of activity is considered too much trouble. The impact of one's own behaviour on the state of the environment is perhaps minute, but by acting in this way the consumer can through his or her miniscule contribution change the concept of what is considered a normal activity. The structural framework of the activity alters (see Hay 1995).

The interviewees often pleaded comfort and convenience when defending their consumption choices. For instance, using one's own car is, in some cases, the most handy option, even though the owner is aware of the adverse environmental impact of motoring.

A: It's of course easy to say what is unnecessary. But it's so nice to be able to go at a moment's notice [by private car]. (Man, 60–69 years old Päijät-Häme)
B: Half a kilometre away. (Man, 40–49 years old, Päijät-Häme)
A: Then one's own conscience is pricked. (Man, 60–69 years old, Päijät-Häme)

It is not, however, entirely obvious what people feel comfortable with and what they regard as being too much trouble. The definitions of comfort and convenience vary both with time and between people. One interviewee rhetorically wondered whether it would be possible to go into a shop with one's own box when purchasing washing powder, but did not consider this a realistic option. Yet the woman referred to previously related that she does just that. However, the family not using their own containers go shopping with a transporter bike, despite owning a car. This, again, would in some people's opinion be considered too bothersome.

Elisabeth Shove (2003) has studied the historical changes in comfort, cleanliness and convenience standards. Shove's idea is that these standards gradually change and understanding this change is essential when studying the environmental impacts of consumption. For example, people's perception of cleanliness now includes washing far more frequently than in the 19th century and the desire for more living space in housing in order to be comfortable is also continually increasing. This constant increase in housing standards and living space deemed normal is problematical from the environmental perspective.

"It's a fact that living in an apartment nowadays means that, winter and summer, you need to wear shorts and a T-shirt. And in summer you need air conditioning. That's become more common. And it consumes energy, however efficient the heat recovery is. To me it seems that people can't make use of pullovers or woollen socks nowadays." (Man, 40–49 years old, Päijät-Häme)

According to Shove, technological advancement, which steers practices in a certain direction, is of significance to the changes occurring in these standards. In the United States, houses are designed these days based on the inevitability that they will be air conditioned. Porches previously used for cooling off have disappeared (Shove 2003). The concept of convenience is associated with a busy lifestyle. Something that is convenient not only saves time, it also enables people to attend to things at short notice. For example, ready-made meals in this respect are convenient (Shove 2003).

One solution to eliminating a busy lifestyle and its harmful environmental effects is voluntary simplicity (Shove 2003). One couple involved in this study had already decided to adopt simplicity in order to escape the rat race. They had ceased regular employment and now purposely work less than they did previously.

Those participating in this study criticised some figures of speech predominant in the society that maintain what are, in their opinion, activities harmful to the environment. Among other things, the interviewees criticised economic growth and

the idealisation of consumption. In the focus group interviews participants also wondered why Finns are said to live in cramped conditions. This message is in conflict to the reality that smaller dwellings would be more eco-efficient. Choosing a smaller home becomes more difficult when the media maintain that Finns' living conditions are too cramped.

"We haven't yet mentioned the size of the home, but this is one thing I have paid attention to. It aggravates me that the media constantly talk about Finns living in cramped homes while people in other countries have more space and living here in Finland is awful. In fact, the media should be emphasising the opposite, asking,' Why do we need all those square metres?" (Woman, 30–39 years old, Pirkanmaa)

Information supplied by the public authorities also affects what diet is deemed healthy. It is unlikely that vegetarianism will spread, if people believe that meat forms an essential component of a healthy diet.

"Then there's that awful problem of the 'food plate', which you see everywhere. You look at it and there's meat and fish. I've been taught [to eat meat] in principle and I really don't have the courage to change." (Man, 20–29 years old, Uusimaa)

Lifestyle as a theoretical concept means the overall social behaviour of people and their stories regarding this behaviour on which they justify their actions to themselves and others. To enable individuals to retain their image of themselves, their way of life needs to be relatively uniform (Spaargaren & Van Vliet 2000). A 'green' way of life is not, however, realised in all parts of life, because in some parts, other justification is more important.

In the case of summer cottages a great deal of case-specific deliberation took place. While, according to the MIPS measure, the ecological backpack due to summer cottage ownership is a bulky one, people are not ready to give up their summer cottages. The summer cottage is one of those things that make life enjoyable. However, changes to the visiting scenario to a summer cottage can be envisaged in that the owners would pay fewer visits and spend longer periods there.

"I've talked about summer cottage ownership rather a lot, that it's surely the kind of thing I would not agree to give up. If you think about it as a form of consumption. It's the sort of thing I would fight tooth and nail to keep. Where I'm concerned it's a kind of mental health service." (Man, 30–39 years old, Uusimaa)

To the interviewees, summer cottage ownership is a sensible, necessary activity, despite its possible adverse environmental impact. The individual participants justify their choices each in his or her own way. In regard to daily life, some choice or other may be extremely sensible, even if the other cost-benefit calculations point to the opposite extreme.

A: […] Once you get to your summer cottage you don't consume anything at all, or at least only a little. On the other hand, if you had no cottage you would consume resources somewhere else during your leisure time. (Man, 40–49 years old, Päijät-Häme)
B: Yes – get on a plane and fly off to the south. (Woman, 20–29 years old, Päijät-Häme)
A: You can turn this over in your mind. And people always try to think about things in their own way sensibly or for the best. (Man, 40–49 years old, Päijät-Häme)
B: For the best. (Woman, 20–29 years old, Päijät-Häme)
A: Yes, for the best, thinking 'isn't this really sensible?'. (Man, 40–49 years old, Päijät-Häme)

The following quotation also highlights the case-by-case considerations made in consumption choices. The decision to purchase meat that is past its sell-by date from a special offer display case tells us something about a customer's personal concept of the right way to behave. Throwing already produced meat away would be wasteful and wrong. Common sense thematics are closely associated with consumption choices, and also to what kind of choices people consider wise. Enlightenment from outside does not often influence people's actions because, among other things, the guidelines are not commensurate with mundane reasoning.[3]

"And, in principle, even if I became a vegetarian, I would still buy discounted minced meat on a Sunday just before the shop closes, so that it hasn't been produced for nothing. However vegetarian I might become." (Woman, 20–29 years old, Uusimaa)

As with the choice of a place in which to live, common sense is also frequently more important than an environmental perspective. When choosing a place in which to live, people aim for a comfortable and meaningful life.

A: I wouldn't dream of changing my home at any price. It is something so... In any case I couldn't imagine swapping it for something on ecological grounds… (Man, 30–39, Pirkanmaa).
B: For an apartment. (Woman, 30–30 years old, Pirkanmaa)
A: Yes, or for some other more ecological form of housing. […] It cannot be generalised. It's one of those houses built after the war to repopulate the countryside, on an idyllic sunny slope, everything perfect. It cannot be generalised. (Man, 30–39, Pirkanmaa)

The environmental impact of a person's type of home is also difficult because it is not possible to quickly choose the type of housing again. People have decided to live in a particular place and in actuality this cannot be easily changed. Thus, the environmental impact of one's type of home is extremely static compared to choices concerning daily food purchases or water consumption.

The individual's action space is also influenced by how broad the individual feels the opportunities for making choices to be. If one person's action is considered a waste of time, this does not encourage other people to make environmentally friendly choices. Most of the people participating in the study believe, however, that an individual's actions are in fact significant. They would lack the motivation to act in a manner judged to be environmentally friendly, if they did not believe in their own chances to influence matters. Some also added that it is of no concern to them whether or not others act as they do. People act for the good of the environment based on ethical considerations and acting correctly makes them feel good (Halkier 1999).

"In my opinion it wouldn't affect me, I'd not become bitter about somebody else doing something differently because they don't care. I only feel happy and satisfied about it. You get a rush when you do something right." (Man, 30–39, Pirkanmaa)

Only one couple felt that consumption choices have no significance at all and that the focus should be on industrial activities.

A: I do not believe that consumer choices could save the situation. (Man, 20–29 years old, Uusimaa)
B: In other words, in your opinion the household is not the answer to the problem? (Woman, 20–29 years old, Uusimaa)
A: They are not responsible. (Man, 20–29 years old, Uusimaa)

3 Päivi Timonen (2002) explores this theme in her dissertation. Timonen states that everyday rationality is based on simple heuristics and mundane reasoning.

B: Yes. At least one shouldn't browbeat households, point the finger at them, when industry is to blame. I would dearly love to be able to view the statistics and results from that quarter. (Woman, 20–29 years old, Uusimaa)

Structural dimension

Consumers' action space is also determined by more concrete structures than social relations and practices considered normal by the society. This is connected with what choices are possible. If a family lives in a thinly populated area, the use of public transport is a considerably more difficult option than it is for those living in the centre of a town or city.

"If we were to work in town, we wouldn't be able to go to work by bus because there isn't one." (Woman, 30–39 years old, Pirkanmaa)

On the other hand, a person has already moulded his or her action space by a previous decision to move to the countryside. The choices made also have an effect on future opportunities for making choices. If a family has taken the decision to move to the countryside, the possibility of choice between public transport and private car is radically altered. The array of possible choices has been moulded as a result of previous choices (see Hay 1995).

According to Hay (1995), the same structures can either create opportunities for people or hamper their actions. Sometimes the same structures can either limit a particular person's actions or facilitate them. One person participating in the study lives in the countryside because the life there is seen to be closer to nature and more environmentally friendly. At the same time, however, a remote home location prevents the use of public transport and obliges a person to use a private car. Living in a town means that the use of public transport is feasible, but growing one's own food there is more difficult.

"Today's world is crazy: if you want to buy milk from your neighbour, you can't because it's forbidden by the EU. First it has to be pasteurised, then it goes to the shop; you have to buy the milk from the shop and that's 20 kilometres away. So, should you really move to the country? But if I were to move to the city I wouldn't be able to grow my own food, so I'd have to buy it from somewhere in Australia and America, and every other place abroad. I mean it's difficult to do the right thing. There's a bus out our way that only runs once a day, making it necessary to hang around in town waiting for several hours." (Woman, 30–39 years old, Pirkanmaa)

Those living in urban areas may also find travelling by bus too irksome. If a work trip can be covered a lot more quickly by private car, changing over to public transport would not seem to be a sensible option. For the following couple, a change to public transport would call at least for the establishment of better public transport connections.

A: You've got to go by car. If my husband was to go to work on the bus, it would be farcical because he'd have to travel two kilometres into town and then wait to change buses to get to work. It would be a major hassle compared to a five-minute trip by car. (Woman, 30–39 years old, Pirkanmaa)

B: I tried once going by bus. It took me an hour and 20 minutes to get home from work. (Man, 30–39 years old, Pirkanmaa)

The same couple regretted that there is so much talk about the environmental impact of mobility. They endeavour to take environmental issues into account in their other

consumption choices. They find the public's repeated bombardment with facts about transportation aggravating because in their opinion the use of public transport is not a viable alternative for them.

"And to go back to that matter of mobility, it sometimes makes me mad when transport is brought up, as though there is nothing else. That it doesn't matter where you live and what you do so long as you use the bus. That seems to be the main message." (Woman, 30–39 years old, Pirkanmaa)

Many interviewees stated that society designs towns around the use of private cars. Against this reality one's own choices seem small. They think political decision-makers have a better chance of ensuring the community owns fewer private cars.

"With mobility it's easy to do something yourself, but it's frustrating when the decision-making takes place in the town or the City of Tampere, or at some general level like that. There, where it really is possible to influence matters, to make policy decisions, they just provide more parking spaces in the city centre, like they don't want to develop public transport. The individual is too small to do anything. You can't influence matters whatever you do." (Man, 30–39, Pirkanmaa)

The price of a product also affects the feasibility of some consumption choices. However, there was surprisingly little discussion about product prices during the interviews, in contrast to Timonen's study (2002), for example, in which price was the main criterion affecting washing powder choices. Mostly, people here said that price does not influence their choices. Some, though, admitted that the price was actually significant.

"What are we thinking about when we buy products? There are a lot of things. Whether they are of Finnish make, or organic, and have they been produced locally, and how far have they been brought, and naturally all in relation to the price. Sometimes the organic product stays there in the shop if it costs five times as much or more, because you are not ready to invest in it however locally and organically it's been grown." (Woman, 30–30 years old, Pirkanmaa)

6.2.2

Expanding the action space – why do some practices change while others do not?

Our personal opportunities for acting in a manner that takes environmental issues into account can be expanded in a broad variety of ways. An example of a fairly modest method is to purchase a so-called transporter trike. A transporter trike is a bicycle with a box in front, which can be used for shopping trips (see e.g. www.christianiabikes.com). This kind of transporter trike makes shopping without a car considerably easier. The situation where one asks "Shall I go to the shops by car today?" changes when the alternative to a car is a more practical option than either a conventional bicycle or walking. The ordinary bicycle was, according to the interviewee who owned one of these trikes, unsuitable as a vehicle for shopping.

At the opposite action space extreme is to give up working for a salary. One couple participating in the study has chosen to give up going regularly out to work. This kind of change expands the scope for making choices as, for instance, the constant rush is avoided. Constant rush can drive people to make choices they otherwise would not do.

Interviewer: What, then, are the things that prevent environmentally friendly choices – in our daily lives, or more generally?

A: Being pushed for time... Then the price. Lack of information. What else? (Woman, 30–39 years old, Pirkanmaa)

B: Convenience. (Man, 30–39 years old, Pirkanmaa)

A: The desire for convenience, in other words. That's quite good. (Woman, 30–39 years old, Pirkanmaa)

B: It occurred to me that all sorts of detergents bought at the shops could be put in your own containers, but the plastic bottle at that point stays at home. (Man, 30–39 years old, Pirkanmaa)

A: There would be no need to eat convenience food at all, if food would be prepared at home. Still I just don't do it. (Woman, 30–39 years old, Pirkanmaa)

One of those interviewed also ended up wondering about the chances of changing his or her workplace. The idea was that in some other line of work one could do telecommuting, making it unnecessary for the family to own two cars.

A: And we complain about that there is no public transport. We lived in exactly the same place but my husband used to be a telecommuter, doing his work at home. You can choose to do work you are able to do at home. That's also a choice. In reality opportunities do exist for making choices. (Woman, 30–39 years old, Päijät-Häme)

B: Did you have two cars at that time? (Woman, 20–29 years old, Päijät-Häme)

A: At that time we had only one. These are all things we can all make choices about. We make our own choices. I've decided to go out to work, even though I could work at home. (Woman, 30–39 years old, Päijät-Häme)

B: As a home economics teacher? (Woman, 20–29 years old, Päijät-Häme)

A: I could do some other kind of work. (Woman, 30–39 years old, Päijät-Häme)

When the focus group interview material was being analysed the question came up of why some practices change while others do not. Many interviewees mentioned having switched to organic and local food as a result of the study, even though when natural resource consumption was being calculated whether the purchased products were of organic origin or not was inconsequential. Moreover, a few interviewees said that thanks to the study they would be changing over to eco-electricity.

These changes are connected, on the one hand, to lifestyle and, on the other, to the concepts of practical consciousness and discursive consciousness. Giddens has used the concepts of practical and discursive consciousness in his theory of structuration in the book The Constitution of Society. Practical consciousness is created by routine practices which are not questioned in daily activities. Here we are dealing with hidden knowledge which enables people to act without their having to think about every choice separately (see Hobson 2003). Discursive consciousness, on the other hand, is composed of knowledge which develops, changes and poses questions through experience and discussion (see Hobson 2003).

Through participation in the study, certain unquestioned matters in the practical consciousness of daily life were elevated to the status of discursive consciousness, that is, participants began to question them (see Hobson 2003).

"But as to flushing the lavatory – I noticed that when I cleaned my spectacles with paper, toilet paper, for instance, I would throw the paper in the toilet bowl and flush it down. This sort of thing is madness but it becomes a habit without you knowing it. After cleaning my spec's. Once you notice it you can see how much you consume and you can save." (Man, 50–59 years old, Uusimaa)

If a person feels that old habits no longer suit the story they tell about their sustainable lifestyle, these habits change. Changing a habit unsuitable for a way of life helps people retain an unblemished image of themselves (see Spaargaren & Van Vliet 2000). However, often one condition for the change is for the new practice to become part of other, existing practices.

It is easy to swap conventional milk for organically produced milk, if a person trusts that organic milk is more environmentally friendly and if its slightly higher price is not considered an obstacle. For the substitution to occur one has to question the choice made unthinkingly previously. The matter is not simply one of acquiring new knowledge. Those people participating in this study have surely already heard of organic and local food. Instead, the change has originated as a result of bringing up practices connected with food in active discussion.

In the case of passenger car transport the "Yes – why do I in fact do this" experience (see Hobson 2003) did not come about in the same way as, for example, with food and eco-electricity. This may be the result of every person who is interested in environmental issues having to justify to themselves why they use a car. The choice of a mode of transport is thus already partially within the realm of discursive consciousness. A large proportion of car drivers involved in the study were of the opinion that they only drove as much as they had to.

> *"To my mind I already only drive as much as absolutely necessary. We live next to the metro, which gets us to where we want to go, even if it's expensive. If we go into town together it costs a lot more by public transport than if we go in the same car. But we came by metro anyway." (Woman, 50–59 years old, Uusimaa)*

Most of those interviewees using cars felt they had no other choice. To change their mode of transport would call for the establishment of at least more convenient public transport connections than at present.

There was a lot of talk about the harm caused to the environment by tourism, yet this is unlikely to lead to a reduction in holiday travel. As with mobility, the harm caused by air travel is a well-known fact to those who are environmentally aware. Merely being involved in this study will hardly suffice to reduce air travel, despite participants' guilty consciences. The environmental impact of tourism mainly causes a transient feeling of guilt which is not transmuted to action (see Macnaghten 2003). This is reflected in the statements "westerners would need to be strong and determined to approve the idea that if everyone did the same, where would that lead?" and "one must curb one's conscience even more in relation to air travel", and also "if I wanted to go to the Canaries or somewhere, I'm sure I'd go. Ecology would be forgotten". Additionally, according to Martens and Spaargaren (2005), environmental perspectives do not appreciably affect people's holiday plans.

Many of those participating in the study had recently begun to think about the problems of eating meat even, in some cases, before this study. However, rather more thought needs to be devoted to reducing meat consumption than to, for example, the purchasing of organic products. Adopting a more vegetarian diet means learning new recipes and making fine changes to the processes associated with food preparation. On the other hand, it is only a question of learning new routines just once. After the criticism of the current diet and the learning of new culinary techniques, the new practices can become routine.

> *"Learning to use vegetarian recipes is an enormous task. But you only have to learn once. Once you've learned how, you can always do it." (Woman, 30–39 years old, Päijät-Häme)*

An increase in vegetarianism is complicated by the fact that the environmental friendliness of vegetarian food is not considered an irrefutable fact.

"There are problems there, too. Eating soybeans means destroying rainforests, so that I couldn't become a fanatical eater of soybeans either." (Woman, 30–39 years old, Pirkanmaa)

The action space and practices can be adjusted when the concepts of what action is considered normal change. A previously apparently impossible action becomes possible. The thoughts of one interviewee's vegetarianism indicate that the question is one of a simultaneous process in both a person's own mind and in the surrounding structures. Meat consumption has become problematical and the person has started to consider other diet options as a consequence.

"Yes, it's come up here as elsewhere in recent times, this problem of eating meat. One would never have believed that I would consider the possibility of becoming a vegetarian. Well, I haven't got that far yet but the vegetarian stereotype has altered. […]It's a change of attitude. Readiness, in a way. It's not as impossible an idea as… If I can think… I think on a general level other people could be persuaded as well that they do not need a lot of chicken and meat and suchlike. If I am able to change, then the average person must be able to change as well, if you understand what I mean." (Man, 30–39, Pirkanmaa)

Gradually, through the learning of new recipes and food preparation techniques, preparing vegetarian food no longer seems troublesome. The actor has through his or her actions learned something new and has, at the same time, altered his or her action space and the structures influencing this (see Hay 1995).

Other practices are more difficult to alter because they form part of a larger conglomeration of practices. Mobility choices are connected with a person's place of residence, work place, shopping and leisure time activities. These different practices form a complexity from which it is difficult to detach one component and alter it. On the other hand, choices that are detached from the rest, like buying organic milk, are more easily accomplished. The aforementioned woman's wondering whether to change her workplace is just such an example. Since many habits are associated with going to work in a town, changing these habits would call for a radical change in the entire action space, or change of job.

A: I have talked about taking a year off from paid work. That might be possible, if one wanted to, then one could have a different lifestyle. But that would require major decisions to be made. (Woman, 30–39 years old, Päijät-Häme)
B: Then you'd lose your pension rights if you were staying at home. (Man, 40–49 years old, Päijät-Häme)
A: But if one was at home, you'd be able to manage in a different way. (Woman, 30–39 years old, Päijät-häme)
B: All the cooking and all the other heating and in general you'd be able to manage everything. (Man, 40–49 years old, Päijät-Häme)

6.2.3

Summary of action space

Armed with the information in the interviewee material we are able to form a picture of the individual's action space. Relationships with other people, the practices considered normal, one's lifestyle, and opportunities for choice provided by the community all affect the action space. The action space has its own history: the current action space has been moulded as a result of previous choices. Thus, the action space is not static but dynamic. When consumption choices are being made, it is not possible to change the entire action space at one go. These action space dimensions become interwoven into a structure that can make a person's actions possible or restrict them.

Other people around the individual affect what matters are brought up for discussion. In addition, issues that are in the limelight or being treated by the media affect what practices are questionable and what are considered normal. The social dimension of the action space is also manifest as the information on food given out by the public administration, which defines what kind of diet is the most healthy. A person's lifestyle affects how he or she approaches the practices which are considered normal. If a person has a strong 'green' identity, he or she may well oppose these social structures. Opposition may result in a gradual change in the structures such that environmentally friendly modes of action become normal and acceptable. The process of change is also linked to community changes. Changed social norms can be passed on via democratic decision-making to government action and the legislation as well. Those participating in this study – or at least some of them – can be considered pioneers whose actions alter the boundaries of practices held to be normal and expand other people's action space by pointing out alternatives.

It can be said that all those participating in the study in some way or other represent an ecological lifestyle. They would not otherwise have volunteered to participate in the project. The degree of greenness, however, varies from interest in these issues to radical lifestyle choices. For some, a purposely low standard of living is part and parcel of an ecological way of life and the abandoning of remunerative work, whereas others opt for buying second-hand goods and repairing old ones. There are all sorts of green practices. Again, a green lifestyle may not be realised in all parts of life, some other justification being more important in certain issues. For instance, people are not ready to give up their summer cottages despite the considerable environmental impact of these. People base their choices on mundane reasonig (Timonen 2002) and they do not endeavour to rationalise their behaviour on the basis of, for example, environmental perspectives (see Halkier 1999).

Action space also has its structural dimension. Some choices are more difficult to make than others. Difficult choices included the use of public transport in a rural area, and the purchasing of organic and local food, if these are unavailable in the shops.

When examining action space we should remember Giddens' idea that individuals are not merely victims of structure, nor do structures directly determine individuals' actions. Individuals have their own strategic endeavours and individuals may also oppose structures by acting contrary to what is generally acceptable. People themselves maintain social structures (see Spaargaren & Van Vliet 2000).

Through participation in the study project some people changed some of their habits. Changes occurred in practices that are easy to change and not part of a larger conglomeration of practices. Some practices – mobility choices, for instance – are rigidly bound to others. Separating mobility choices from the rest and changing them without radically affecting life as a whole is difficult. Previously made choices may shut out some other choices.

> *"Normal life has such a long history that it easily goes along its well-worn grooves."*
> *(Man, 60–69 years old, Päijät-Häme)*

It would appear easiest to change those practices in which some sort of routine is already established. For example, attending to waste is unavoidable, making recycling relatively easy to realise. When analysing action space it was seen that the environmental perspective did not have much significance in regard to established tourism habits. Tourism habits are not associated with daily choices in the same way as, for example, a choice of diet. This could be one explanation why little importance is attached to environmental perspectives when choosing a holiday location.

7 Summary of results and conclusions

7.1 Summary of consumption monitoring results

In the study project we determined how much natural resources 27 Finnish households consume and what the natural resource consumption comprises. In the first phase of the study existing MIPS data were gathered, then new data were obtained through six sub-studies. These six topics constituted tourism (Salo et al. 2008), leisure time activities (Veuro et al. 2008 and Luoto et al. 2008), household goods and appliances (Moisio et al. 2008), foodstuffs (Kauppinen et al. 2008), and residential buildings (Tamminen et al. 2008). In the second phase of the study the consumption of the 27 voluntary households was monitored over a 6-week period. The consumption components studied were housing, mobility and leisure time activities, tourism, foodstuffs (including wastes and packaging), and household goods and appliances. After the consumption monitoring had taken place the views of the households in regard to reducing their natural resource consumption were gathered by means of focus group interviews. Based on the material gathered through the consumption monitoring, the natural resource consumption of those households participating in the study was calculated. Natural resource consumption was calculated for six different consumption categories. This report focuses on the TMR figures (abiotic and biotic natural resources and erosion added together) and on a presentation of the results of air consumption, which is closely correlated with carbon dioxide emissions.

According to this study, mobility, housing and tourism are the most significant components in terms of natural resource consumption (see Figure 8). The precise ranking of these three components with respect to one another is not essential from the standpoint of the results of the project. What is fundamental are the differences between different households and what these components actually include. Foodstuffs should also be considered significant, especially since the results obtained in relation to these are considered minimal values owing to the database. Again, waste management is not in itself important from the natural resource consumption perspective, but when waste is prevented the natural resource consumption of foodstuffs and goods also decreases.

On average, the households participating in the study consumed 38,500 kg of natural resources per person per year. Appreciable differences appeared in the natural resource consumption of the households (Figure 9). The difference between the most (118,000 kg/person per yr) and the least (13,000 kg/person per yr) natural resource consuming household was almost tenfold. The differences between households in regard to housing, mobility and tourism are even greater than this (see Sections 4.1–4.3).

Figure 9 presents also the natural resource consumption of the average Finnish consumer, more details of which can be found in Section 3. The consumption of the

average Finn has been calculated from statistics on the average characteristics for consumption by Finnish households. The fact that the average Finn's consumption (approx. 40,000 kg/person per yr) is extremely close to the average natural resource consumption of the households studied (38,500 kg/person per yr) confirms the validity of the results of our consumption monitoring.

In addition to abiotic and biotic natural resources this report also deals with the results of air consumption (see Section 4.1). Air consumption is linked to carbon dioxide emissions, an extremely topical subject. In the comparison made in Section 5.8 the figures calculated for the TMR and air consumption indicated a close correlation between these. In the conclusions we do not discuss means of cutting down the TMR and air consumption separately because the means available reduce both.

7.2

What can households do to reduce natural resource consumption?

In this section we discuss how households could reduce their natural resource consumption. Section 7.2.1 describes the methods which, based on this material, are seen to have the most potential for decreasing the natural resource consumption of households. In Section 7.2.2 the significance of the different options is brought out through some case calculations. Section 7.2.3 delves into the methods of reducing the natural resource consumption of households over the long term, while also deliberating on the criticism levelled at the so-called sustainable consumption hero.

In this section we go through the methods that have come to light during the course of the study through which the various actors in the society can influence households' natural resource consumption. As the main focus of the study has been on household activities, it seems appropriate to present some figures to demonstrate the significance of the various options as well. Methods that can be employed by other actors in society are covered in less detail, these being based on issues that have come up during the consumption monitoring and focus group interviews. In our study we concentrate on short-term options, while also bringing up some options that could be possible in the future over the long term.

In Section 5.2 we described the fictitious Factor 4 household, together with households that are close to this Factor 4 level. However, the Factor 4 target in the western countries can be regarded only as an interim objective in endeavours to decrease consumption to one-tenth of its current level. The Factor 10 level which, according to the limits of this study could be 4 tonnes a year in TMR, was not yet, however, determinable on the basis of the study's figures, despite the differences between the largest and the smallest backpacks being almost tenfold. In this section we wonder where the potential lies for an appreciable reduction in natural resource consumption.

Speaking of potential, we need to determine exactly what this means. This study included a quantitative MIPS section from which data were obtained on the quantities of natural resources consumed by different household activities (results in Section 4). By contrast, qualitative data were obtained from those interviewed on the factors affecting the consumer's action space in consumption choices that conserve the environment (Section 6). It can be said of almost any consumption choice that the consumers could also choose a more eco-efficient option. However, the ease of choice varies. For example, opting for a smaller home in principle is possible at any time, but this is a major issue which from the standpoint of the household is mainly topical at a certain time of life.

This report does not really take economic factors into account, but when talking about potential the costs are also important. Thus, 'potential' means those actions that are significant in relation to the MIPS figures, which from the standpoint of those households participating in the study could be accomplished relatively cheaply. For potential, we confine ourselves to the four largest components of consumption, that is, housing, mobility, tourism and foodstuffs. Potential can be divided into long- and short-term potential. In this section we mainly discuss the short-term potential, that is, the sort of action which is possible during the next few years. In relation to the reduction of natural resources there may be a lot of future potential which we are unable at the present time to visualise. For instance, technological development may very well alter the situation rapidly.

7.2.1

Where in the opinion of the study households does the potential lie?

Housing

In housing the households considered the reduction potential to be in small deeds, like changing the electricity supply agreement in favour of eco-electricity, and in conserving electricity and water. On the other hand, it is difficult for a household to have an influence on solid structures like buildings and yards through its daily choices.

Opting for a green electricity supply is nowadays a simple affair and this form may not even necessarily cost more than conventional electricity (Norppaenergia 2008). Wind power does not cause air consumption (which is in relation to CO2 emissions) and only one-seventh of the amount of abiotic resources are used compared to a Finn's average electricity consumption. One-third of those participating in this study already used eco-electricity, while almost all of the rest mentioned they were considering changing their form of electricity after having participated in the study. There is thus potential on the demand side. However, the supply must be able to respond to the demand for the potential to be real. In regard to eco-electricity, we should invest in wind power, as, for instance, the environmental impact of an increasing use of hydropower raises questions (see e.g. Illusion Ökostrom 2008).

Companies offering eco-electricity should also invest in new eco-electricity production plants as the demand increases. Nowadays, choosing eco-electricity does not necessarily lead directly to an increase in renewable electricity generation. Most of the eco-electricity sold comes from hydropower, but electricity from hydropower is also sold to customers ordering conventional electricity. Often the selling of eco-electricity means that electricity produced from hydropower is transferred directly to those ordering eco-electricity, so that most of the electricity sold to customers buying conventional electricity is changed to electricity generated from coal, for instance (Toivonen 2008, pers. comm.).

Home heating accounts for around a fifth of the TMR figures for housing among the households studied, and also for air consumption almost in its entirety (see Section 4.1). A decrease of one degree Celsius reduces energy consumption by around five percent (Motiva 2007). In some climate change campaigns households have, in fact, been encouraged to lower their home temperature. Another place where temperatures could be lowered is in the stairways of apartment buildings. These large spaces are generally kept unnecessarily warm. Apartment building residents could be motivated to conserve heating energy by estimating, then possibly lowering, the heating consumption in individual flats. Here apartment block residents found it difficult to find information on how much energy is expended on heating. Some households also said that the opportunities for regulating the heating were severely

restricted. The mode of heating is also significant but this is not as easy to change as electricity. As things stand at present, private district heating customers cannot themselves choose the source that generates the district heating. In detached houses, changing the form of heating calls for rather substantial investments.

Water heating also utilises a lot of energy and natural resources (Sections 3 and 4.2). With the aid of a water meter in a prominent position significant savings can be made in hot water consumption. Section 7.2.2 quantifies the effect of reduction options associated with housing on the consumption of a sample household.

Mobility and tourism

Section 4 focused on consumption differences between households in the different consumption components. As can be seen in Figure 10 in Section 4, the greatest differences between households lie in mobility and tourism. If some households already consume only a fraction of what others do in mobility and tourism, at least in theory there exists some potential for reduction. It is not, however, quite as simple as that. People had a bad conscience about tourism, because it was not deemed necessary and its environmental impact is appreciable. Yet a bad conscience does not appear to manifest itself as concrete actions (see Section 6). Over the short term tourism is unlikely to decrease, but having a bad conscience at the moment may in the future result in reduced leisure travel, particularly through the rise in oil prices. The amount of travel is radically influenced by its cost. In the focus group interviews people were appalled at the low cost of air tickets, which nowadays are even cheaper than train or passenger vessel fares and thereby encourage people to make poorer choices as concerns the environment.

In regard to reducing daily mobility, the scope varied among the households. Consumers' choices were restricted by structural aspects like the absence of public transport connections. Most of those using private cars felt they only drove when they had to. Other kinds of comments were also heard: one interviewee thought that in future the family could visit their summer cottage less often but for longer stretches at a time. He said that this kind of change in holidaying behaviour would most probably take place in the future.

Decreasing the amount of daily driving is hampered by the close link between mobility and the family's other practices, such as leisure time pursuits, shopping and travelling to work (see Section 6.2.2). In many cases reducing daily mobility would call for a restructuring of family routines.

Transport accounts for a significant proportion of natural resource consumption through leisure time activities (see Section 5.7). The natural resource consumption of hobbies could be reduced a lot if people endeavoured to live within the constraints of their residential environment. Different leisure time pursuits are offered by urban and rural areas and thought ought to be given to the distance to a hobby venue before a choice of leisure time activity is made. An eco-efficient household seeks its thrills and fresh experiences from close to home. It was noted in Section 5.9 that households utilising the least natural resources are active, and comfortable, in their own residential area. There was little mention of leisure time activities in the focus group interviews simply because the MIPS results of hobbies had not been processed prior to the interviews.

Foodstuffs

Differences between households relating to natural resource consumption on the nutrition front were smaller than for the other consumption components. This is partially explained by the fact that all people have to consume a certain amount of

food, so that it is difficult to lower a particular natural resource consumption level. Moreover, there were no vegans among the households studied. The vegetarians included among the participants consumed dairy products, among which the natural resource consumption of cheese is comparable to that of meat (see Appendix 4).

Reducing the amount of food of animal origin has a significant effect on the environmental loading caused by food. When they examined the results, the participating households in this study considered it entirely possible to shift to a more vegetarian diet. The problem with eating meat has featured in the media a great deal in recent times, and eating meat is no longer regarded as a problem-free matter. Here we have potential for minor action: one 'vegetarian day' a week is already a significant act for many. The adverse effect of cheese, on the other hand, has not been prominent in the media.

The people taking part in this study are more interested in environmental issues than Finns on average. The study households were recruited through the kinds of channels that target people interested in environmental issues (see Section 2.2). According to Pykäri (2008), those participating in this study have more environmentally compatible attitudes than Helsinki residents on average. Finns with less interest in environmental issues are not necessarily as aware of the problems associated with consuming meat as the people we studied. Thus, influencing peoples' diet is also related to education and public information, which are explored in more detail in Section 7.3.1.

7.2.2
Impact of a household's choices: a case calculation

In this section the consumption components where households can reduce natural resource consumption are quantified. Because, owing to the limited material of this study, it is not possible to present broader quantitative assessments of the potential of actions, methods for increasing material efficiency, and the impact of different procedures are demonstrated with the aid of a single case. The household selected (Household L) contains a couple without children living in the city who are in terms of their consumption habits and natural resource consumption close to the average Finn referred to in Section 3. The household consumes around 36,000 kg per person per year, which is roughly the same as the average Finn (approx. 40,000 kg/person per yr).

Table 9 gives ways through which the case household's natural resource consumption could be reduced by around 28 %.

According to the household, all the means listed in the table were in principle possible sooner or later. Some of them are of the sort that will probably be realised very soon after participation in this study, when information about the relevance of the options increases. These options include changing to wind power, spending more time at the summer cottage but paying fewer visits, and decreasing the consumption of meat. Many other people also mentioned in the focus group interviews that they would in future be moving over to eco-electricity and were considering reducing their meat consumption. Spending more time at, but taking fewer trips to, a summer cottage would mean decreasing the number of journeys by private car from the previous eight to just four. In this case, as the journey is 380 km each way the household would be saving 3,040 km a year.

The case household had flown a lot during the 'tourism monitoring year', including taking one long-haul flight (around 7,900 km each way), one shorter journey abroad, and two flights to Europe. If all the flights apart from the one to Europe were to be left out, the household's TMR for tourism would decrease by 1,700 kg, or approximately 8%. In terms of air consumption the impact would be much greater – this would fall from 4,300 kg to 1,750 kg, or by around 60 %. The case household uses a private car as

Table 9. Ways in which the case household can reduce its natural resource consumption and their influence.

	Situation now kg/person per year	After the changes kg/person per year
Housing	5,600	4,770
Changing to wind power	-580	
Lowering the room temperature by 2 degrees	-250	
Mobility and tourism	20,800	13,260
Going to the summer cottage less frequently	-3,000	
Only one flight to Europe per year	-1,700	
Going to the cottage by bus or by train	-1,000	
No everyday transport by private car	-1,840	
Foodstuffs	4,200	2,960
Changing 50% of meat consumption to vegetables	-600	
Changing 50 % of cheese consumption to cottage cheese	-320	
Decreasing milk consumption by 50 %	-320	
Household goods	2,900	2,730
50 % fewer magazine subscriptions	-170	
Leisure time activities	2,100	1,790
50 % fewer visits to swimming halls, jogging instead	-310	
Altogether kg/person per year	35,600	25,510
The decrease altogether kg/person per year	10,090	

transport to the extent of about 2,250 km a year. If half of these kilometres were to be travelled by bus and half by walking, the natural resource consumption of mobility would decline by approximately 1,800 kg/person per year.

As mentioned previously in this report, the floor space of a home appreciably affects its natural resource consumption. Our case household already lives in more cramped conditions than the average among the study households. The floor space of the dwelling works out to 27 m^2 per person, whereas the average for all the participating households is 43 m^2 per person. The most space is occupied by a person who has 215 m^2. If the person living in this spacious household had the same number of square metres as the average for all the households, his or her natural resource consumption for housing (all else being equal) would be cut by some 9,000 kg/person per year.

Through the measures outlined in this section the CO2 emissions of the case household would decrease by 7 tonnes a year, equivalent to around one-half of the average emissions per person in Finland (Kosonen 2007, pers.com.). The natural resource consumption would be reduced by slightly less, that is, 28 %. Through the reduction methods a household uses it is difficult to lower the natural resource consumption as much as with carbon dioxide because natural resource consumption also includes infrastructure. The contribution of infrastructure to the households' consumption is an interesting question. For instance, reducing visits to the swimming hall in this calculation would reduce the household's consumption by 310 kg/person per year. Conserving natural resources means, of course, that the activity cannot be replaced by another one that likewise consumes a lot of natural resources. Additionally, for sustainable consumption we also need to take well-being into account. To ensure that a person's well-being remains the same, the health benefits from swimming must be derived from some other activity.

In reality the swimming hall will not disappear, if a single household fails to make use of it. If the popularity of the swimming hall wanes sufficiently, this would in the long run lead to a decrease in the number of swimming halls and through this to conserving natural resources.

However, the natural resource consumption of a swimming hall is small compared to, for instance, the road infrastructure that forms most of the abiotic natural resource consumption of transport. In the case of roads the situation is the same as for the swimming hall: a decrease in the traffic does not directly affect the infrastructure. A decline in demand, however, affects traffic predictions and through this, construction plans for new roads (see Lähteenoja et al. 2006a).

Measures available to the consumer for influencing the infrastructure are limited and are correlated mainly with the choice and construction of permanent residences and leisure homes. In practice, the government has more means at its disposal for influencing the amount of infrastructure: these means are dealt with in greater detail in section 7.3.1.

7.2.3 Does the "sustainable consumption hero" determine the potential for the future?

As mentioned at the beginning of this section, the potential changes with time. What is now possible in the opinion of the households was not necessarily feasible 5 years ago, for example, a favourable attitude towards vegetarian food (see Section 6.2.2). In ten year's time some choices which at present seem difficult may well be considered possible.

Eräranta and Moisander (2006) have criticised the concept of improving the environment by means of consumption choices. According to these authors, one ought to question the concepts emphasising the significance of choice in the consumer's role as environmental-policy practitioners. Understanding the consumer's behaviour requires recognition of what kind of communities and social networks the consumers belong to. The consumer's free choices are often directed and frequently only certain choices and choice criteria are understandable, acceptable and normal (Eräranta & Moisander 2006). For example, the community structure has an effect on whether the consumer is able to choose public transport instead of his own car, so that the community structure creates the conditions for actions compatible with sustainable development.

It is true that responsibility for sustainable consumption cannot only rest squarely on the consumer's shoulders. Despite this, consumers also have their own important role to play, even if they are no longer considered "sustainable consumption heroes" who will save the world by steering the markets on to an environmentally friendly course. In sustainable consumption it is no longer a question of a consumer who makes sacrifices on behalf of the environment, but of how we can adapt to a changing world. Climate change and rising prices for natural resources are facts that can no longer be avoided. While the world will not be saved solely by publicising consumer's choices, these choices, at the same time, indicate alternative modes of action to others as well (see Sections 6.2.2 and 6.2.3). The actions of a pioneering group can help mainstream useful practices from the environmental standpoint. A good example is recycling, which 20 years ago was held to be 'eco-nonsense' advocated by 'recycling movement activists', but which if neglected nowadays seems unacceptable.

The age of adults in the households was found to affect the level of natural resource consumption (see Section 5.2). This leads one to wonder whether growth in natural resource consumption actually goes hand in hand with age. Does today's twenty-year old couple necessarily have to increase its consumption level to that of a current

middle-aged couple? Nowadays, the problem is mostly a lack of leisure time and there has already been talk of voluntary income reduction in order to improve one's own well-being (e.g. Soininvaara 2007). Even among the participating households in this study one had made a conscious decision to decrease its amount of income-earning work in order to secure more free time. With decreasing expenditures also natural resource consumption is likely to decline. Emphasising improvements in well-being to be gained through additional leisure time and voluntary simplification could constitute one possible development trend leading to decreasing natural resource consumption. There is a great deal of discussion nowadays about the concepts of happiness and the 'good life' through the happiness economy. For instance, Hirvonen and Mangeloja (2006) have studied Finnish happiness in relation to economic growth and have observed that happiness no longer increases along with economic growth. Thus, a happy, 'good' life is a question of more than just economic prosperity and an aspiration towards constant growth.

7.3

Households cannot act alone

Talking of consumers' choices does not mean that the responsibility for sustainable consumption rests solely on the consumer's shoulders. As was shown by this study in the focus group interviews, households cannot themselves influence everything, even should they wish to. For change to occur, three main community actors are required, namely, the consumer, the business sector, and the government (see Figure 46). Alone, none of these is able to make consumption practices sustainable, for each has its role to play. Goods and services used by people, and the available infrastructure, link the business world and the government with consumers (Sustainable Consumption Roundtable 2006). The government's tasks include dismantling the barriers to environmentally friendly choices. The foundation of progressive environmental policy is the support of voluntary action among citizens (Haila 2001). Through its actions, the government can assist in diverting structural and cultural change in a more sustainable direction, while people's changed attitudes bring legitimacy to necessary, but possibly unpleasant, measures (Halkier 1999). In this section we take a look at the measures that have emerged within the framework of this study through which the government and business sector could improve the resource efficiency of households.

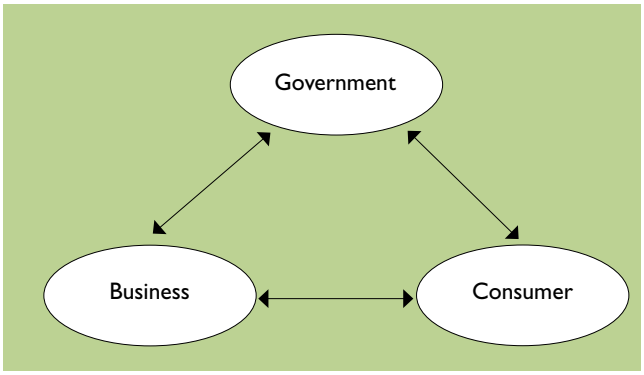

Figure 46. Sustainable consumption cannot be achieved through the efforts of only one active group: all the actors in society are needed. Figure modified according to the Sustainable Consumption Roundtable (2006).

7.3.1

Administrative tools for reducing the natural resource consumption of households

In this section we discuss measures through which the government could improve the resource efficiency of households.

Housing

As stated in Section 5.4, the amount of floor space in a dwelling is a factor that radically affects the natural resource consumption of housing. With housing, the governmental authorities ought to realise that the constant increase in the number of square metres does not represent a sustainable trend. Apart from the floor space markedly affecting the natural resource consumption of housing, it also raises the heating need and through this carbon dioxide emissions. One social aim ought thus to be a decrease in the size of dwellings, or at least to put a stop to such growth. At present there are no signs of this tendency and, for example, the land use and housing implementation programme for the City of Helsinki states that "From the standpoint of the opportunities for growth in the size of residences, Helsinki's current residences should, over the long term, be renewed through combining apartments or demolishing and newbuilding in order to clearly increase the average size of dwelling." (City of Helsinki 2008.) On the other hand, increasing the size of dwellings in downtown Helsinki could, in certain cases, be justified. One of the reasons for a dispersed community structure is the withdrawal of families with children to the peripheral areas of the city and to nearby municipalities, owing to the impossibility of securing the desired amount of living space in the city centre.

A reduction in the size of homes over the short term is improbable, despite this being a desirable development trend. Living space is generally regarded as a positive matter and its impact on material efficiency is not generally known. Recognising the problem is the first step in a sustainable direction. The government has an opportunity to take this first step and assist in changing the social structures that guide consumers towards increasingly spacious homes. The number of square metres in a detached house could be guided by, for example, urban planning.

When speaking of sustainable housing, the question as to which is better, an apartment or a detached house, is frequently discussed. The Finnish idyll continues to be a detached house and, in the light of this study, a detached house in itself may not necessarily be a less material-efficient choice than a flat. As was pointed out in the comparison in Section 5.4, there is no remarkable difference in the natural resource consumption per square metre between a detached house and an apartment block. However, people generally have more space in a detached house, thereby raising its natural resource consumption. There may also be a large input of natural resources in building yards of and streets and roads to detached houses.

Thus, promoting less spacious housing is also necessary in terms of community structure. Living in large detached houses not only increases the natural resource consumption of housing, but often also the need for a passenger car. Depending on the type of home, an increase in living space of 10 m^2 would raise the natural resource consumption of housing by 500–1,000 kg a year, while a weekly increase of 50 km would increase the consumption of work trips by some 4,500 kg per year. A denser community structure would be favourable not only because it has less impact on the climate, but also because of its resource efficiency.

The government also regulates how much energy houses consume. In this particular matter we are proceeding in the right direction, as the energy efficiency regulations in the construction sector are to be tightened in the near future by around 30–40 % of

the current level (Ministry of the Environment 2008). The construction of low energy housing could also be increased more rapidly than at present by including low energy requirements in urban and rural planning.

According to Section 68 of the Finnish Waste Act, arranging advisory services and waste guidance is the responsibility of the municipalities. In the focus group interviews of this study (Section 6.1) participants raised the point many times that waste advice should be extended to more generally cover sustainable consumption, for example, in home energy conservation. Guidance should also be focused on the right time and place, for example, at the home building stage, because it is then that most of the decisions are made which influence home energy choices and material efficiency.

In regard to housing, it was noticed in the results of this study that the role of heating is especially significant for air consumption, and also non-renewable natural resources consumption (see Section 4.2). Although district heating is an efficient way of generating heat, even this comes mainly from fossil fuels. District heating production also causes emissions, just as with other fossil fuels, so that its consumption over the long term must be reduced along with replacing it with renewable forms of energy.

In the future, resource efficiency can be increased by introducing whole life housing models. As became apparent in the focus group interviews for this study, life's circumstances alter but homes are not easily adaptable to new situations. Flexibility and adaptability are key terms in sustainable building in the future.

Mobility and tourism

There was a lot of talk about private motoring in the focus group interviews, with the majority of those who drive a lot feeling they could not cut down their driving without changes in the structural factors limiting their action space. People hoped for more public transport, especially outside the Helsinki Metropolitan Area, to ensure that this mode of transport would at least be a viable alternative. There was room for improvement, the interviewees thought, in ticket pricing and ticket options. More practical public transport connections would make leaving a private car at home an attractive proposition. Urban and regional planning could also influence mobility needs. For private motoring to decrease, social structures should also be changed so that short journeys by car would no longer be considered a sensible activity. A well-organised and extensive cycling network could reduce the need for a private car on short trips. Encouraging cycling and walking would also be beneficial for public health.

On the other hand, within the Helsinki Metropolitan Area, for example, the growth in passenger car traffic is difficult to blame on poor public transport connections. In such areas, in addition to promoting good connections, networks and planning for public transport and cycling, it is possible that other measures are required to pave the way towards a reduction in the amount of traffic. During the Stockholm congestion charge trial period, traffic was reduced by 22 % (Worldwatch Institute 2008). During this six-month period people's attitudes also shifted towards favouring congestion charges.

New automotive technology could help to reduce air consumption and thus CO2 emissions, but not necessarily the abiotic resource consumption of the traffic system. To reduce these, above all administrative tools are required, as abiotic natural resource consumption is mainly caused by road infrastructure (see Lähteenoja et al. 2006a).

The use of public transport or cycling is not possible in all circumstances. In such a case one alternative would be the arrangement of car pooling for work trips, for instance. Interest in car pooling was also evident in the focus group interviews. The material efficiency of a car increases when more than one person is travelling

in it, because the natural resources needed to produce a car journey are divided over several users. Car pooling could supplement public transport where the public transport network is not sufficiently comprehensive. In the case of work trips, this would call for, among other things, changes to the law. Nowadays, Finnish work places cannot organise car pooling for their employees because of taxation reasons.

The results in the tourism category reveal that summer cottages account for an appreciable proportion of natural resource consumption in the tourism sector. At the moment, Finns own 478,000 leisure homes (Statistics Finland 2008). The Finnish 'summer cottage culture' ought to be discussed and the question rose as to whether people in fact need their own cottage. The need for construction of new summer cottages would decrease, if the shared use of summer cottages were to become more common than at present. The municipalities could promote the shared use of cottages by coordinating private cottage rental activities and reserving plots for rental cottages in their land use plans.

Foodstuffs

In the focus group interviews a few people mentioned that health considerations worried them in conjunction with adopting a vegetarian diet and one interviewee said that the advice given in the recommended food plate would affect meal planning, and vegetarian food could not necessarily be considered a safe alternative. Thus, when informing consumers, it should be clearly emphasised that replacing meat protein with plant protein as a component of meals does not lead to risks of poor health. For example, in the National Nutrition Council's (2005) recommendations the replacement of meat or fish in the traditional dietary model by legumes is referred to, but the diagram showing the food plate only says that one-quarter of the dish should consist of fish, meat or egg.

Further, the European association for the fresh produce industry, Freshfel Europe, has published a report stating that potential exists for increasing the consumption of vegetables in Finland (article published in Helsingin Sanomat on 8 June 2008). According to this study, Finns consume only 55 kg of vegetables per capita per year, whereas the average for the EU member states is around 98 kg. The World Health Organisation (WHO) recommends that people should consume 400 grams of vegetables a day (WHO 2006). The daily intake of vegetables in Finland is only around 150 grams. There is thus room for an increase in vegetable consumption for health considerations as well.

Even though animal-based foodstuffs consume a lot of natural resources, there is no reason for any dispute over eating vegetables or eating meat. A "meat eater" can also eat vegetarian food. We should move towards a point at which meat is considered more of a luxury than a necessary part of a daily staple diet. The government can influence those social norms that restrict the individual's opportunities to make choices. One obvious measure would be to offer vegetarian food more widely in schools and other public institutions to everyone, not just to vegetarians, for example, twice a week. In this way the ecological backpack from food would be reduced. Besides, offering vegetarian food would help make this food a normal part of the diet, thereby enlarging the consumer's action space (see Section 6).

7.3.2

Business tools for reducing the natural resource consumption of households

The business sector can act to promote household natural resource consumption at many levels. Figure 47 shows the measures at different levels which business has at

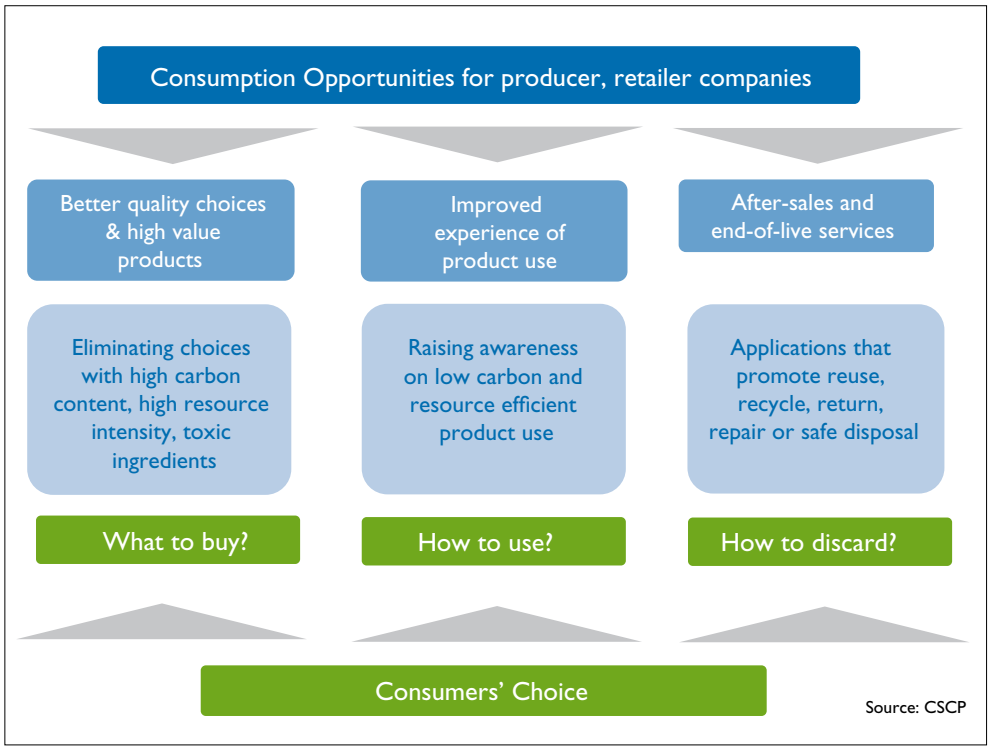

Figure 47. The role of the business sector as a promoter of sustainable consumption. Figure adapted from CSCP 2008.

its disposal. In this section we first describe the measures that have emerged during this study, based on the division in Figure 47. At the end of the section we consider the longer-term opportunities open to the business sector in this respect.

The business world has a marked effect on consumers' choices, starting with the range of items offered to consumers for them to base their choices on (see Figure 47). By choice editing, a shop can have an influence even before the consumer makes a purchase decision, by providing the consumer with only good choices. In housing this means new buildings providing long-term energy and material efficiency. In mobility the best options are, for example, small cars with low consumption. Resource-efficient products have a long life span and thought has also been given to their utilisation and disposal phase. The season of the year should be obvious by the fruits and vegetables available in the produce section of a grocery shop. With electronic goods it should be possible for the item to be switched off automatically, thereby saving the consumer from having to remember to switch off the appliance's electricity supply.

To help the consumer make better choices new tools already exist and others are currently under development. For example, in Britain's Tesco chain store customers can get a green customer card with which they earn points for certain contents of the shopping trolley (Tesco 2008). The items with which the customer earns points are gradually being extended. In similar fashion in Finland, for example, the bonus system could be developed by awarding more points or bonuses to vegetable products compared to meat. In Germany, among other places, there is an ongoing discussion about a CO2 card with personal emission quotas. This would display information about the carbon dioxide emissions of different products and would have to be used whenever the consumer goes shopping (www.co2card.de). This type of instrument could also be extended to natural resource use. A personal emission or resource use quota does not, however, appear to be on the agenda for the near future.

The business sector's role does not end at offering material- and energy-efficient products and services. Consumers require advice and information to make it possible

for them to use products that have a long life span and consume as little energy as possible. Regarding advice on energy conservation, this means, for instance, the correct use of appliances or the regulation of heating systems. In housing the use of the product, that is, the home, also includes repairs. Existing houses can also be renovated to make them more energy-efficient, but this calls for information and expertise at the right time (see focus group interviews Section 6.2).

The third column in Figure 47 indicates what happens to a product when it is no longer in use. By taking disposal into account already at the planning stage one can more effectively prevent waste. For companies, accepting used products back is mandatory in the case of, for example, electrical and electronic goods, but it could also form a part of the business activities. For instance, many furniture companies take back used furniture, but the reuse and recycling of the latter still needs improving.

Company responsibility and opportunities extend way beyond optimising existing products and services. Even during the course of this study many examples came up of how companies could produce services consuming less natural resources by the introduction of new innovations and service concepts. These included innovations associated with solar energy and energy-saving technology, as well as various shared-use services.

The comparison in Section 5.5 between owning a car and natural resource consumption shows that the number of vehicles affects the total number of kilometres driven, which has a direct correlation with the overall consumption of natural resources. Reducing the number of privately owned cars could be assumed to lower natural resource consumption. In a study on companies offering car-sharing it has been noted that the customers of the service spend more time deliberating before using a car, so that their total car transport performance decreases. In a car-sharing system, a single car is used much more efficiently than when owned privately. For example, one vehicle from City Car Club, which offers a car-sharing service in Helsinki, replaces eight private cars (City Car Club 2008). In Finland the service is currently available only in the Helsinki Metropolitan Area.

In the future the service notion may become broader, if instead of the current structures we think of what the consumers require: for example, how can people move about the city flexibly and, at the same time, in a material- and energy-efficient way? Taking the environmental perspective into account in marketing would be extremely well suited to, for example, the local tourism business. Seeking fresh experiences and renting summer cottages close to one's place of residence will most likely offer potential to the tourism sector of the future.

7.4

Summary of the applicability of the method to an examination of households' activities and the raising of awareness

The households appreciated the fact that MIPS gives concrete results when consumption choices are being compared. However, they criticised the fact that MIPS does not take account of many issues of importance to them, since MIPS measures solely the consumption of natural resources. This same problem applies to all measures with which an attempt is made to graphically demonstrate environmentally friendly consumption choices. Even the carbon footprint concept, which has received so much attention lately, also excludes many things from the calculation. There is no complete agreement on the method of calculation of the carbon footprint and various viewpoints have been put forward on how all the greenhouse gases in the carbon footprint ought

to be taken into account (Wiedmann & Minx 2007). Even if all possible greenhouse gases were to be taken into account in the carbon footprint, and not just carbon dioxide, the carbon footprint still only would take climate change into consideration as a criterion of an environmentally friendly choice. For example, the carbon footprint does not tell us anything about eutrophication of water bodies and loss of biodiversity. When using indicators of various sorts we always have to leave some dimension of environmental problems out of the picture. LCA (life-cycle analysis) endeavours to take different environmental loading perspectives into consideration, but this method, too, at present generally focuses on selected emissions. The LCA values depend on what are considered important emissions or environmental problems at any particular moment. The advantage of studying material flows compared to these is that it is preventive environmental protection, because decreasing material flows will reduce also environmental problems that are still unknown.

Air consumption calculated according to the MIPS method is also related to carbon dioxide emissions. It is a good thing to include the figures for air consumption when the results of MIPS calculations are relayed to the consumers. On the other hand, quoting two (or more) different figures may be confusing for the consumers. According to MIPS methodology, air consumption and TMR figures should not be added together. In fact, adding the TMR figures derived from the results of this study to air consumption has been experimented with only in one particular Internet application (Onedidit, www.onedidit.com). Combining the TMR with air consumption produced figures which in mobility and tourism are more suitably combined with the climate perspective, but these continue to take into account also the natural resource consumption due to infrastructure.

The households participating in the focus group interviews considered the study project interesting. Through participation in the study, some of their habits also changed (see Section 6.2). The change in practices, however, is not necessarily directly correlated with the method of measurement used. Many interviewees announced their intention of changing to organic products, even though in the results of the consumption monitoring presented to the households there was no statement to the effect that organic products measured according to the MIPS indicator were superior to conventional products from the environmental standpoint. The practices changed as a consequence of focusing attention on environmental impact, not because of the results obtained. No changes would have even been possible within the time scale of this study. Rather, this aspect must be studied again a year or two after the focus group interviews.

Many interviewees appreciated the fact that the study rated the different consumption components from the best to the worst. As a result of this ranking it is easy to see what components require attention.

> *"The greatest result for me was that these different consumption areas fell into order. At the initial meeting I believe I said that one has certain faults, and what is the importance of them. Then there were some surprises, so that in a way one received an overall impression as to what was a small thing and what a big one." (Man, 30–39 years old, Uusimaa)*

Another thing considered favourable was that the study indicated how much natural resources households consume and also that the choices made by a single person are significant. At the end of the focus group interviews we distributed a leaflet among the participants which listed possible ways of improving eco-efficiency. Most of those interviewed considered that this list well illustrated the opportunities available to do one's bit for the environment.

"In that respect this is good because far too often you hear people say that the individual cannot do anything to help. But then the world consists of well over six billion people. When it's looked at this way, one can really see that there is something." (Man, 60–69 years old, Päijät-Häme)

In contrast, some interviewees felt that the data produced by the study was discouraging, creating the impression that one's own choices are of no consequence. They were disappointed that those aspects of consumption – household goods and appliances and recycling, for example – which they are able to influence form such a small part of natural resource consumption as a whole.

"Housing, mobility and tourism are the big ones and everything else seems like useless tinkering when you look at those diagrams. But they are the things you can most easily influence." (Woman, 30–39 years old, Uusimaa)

To many the mere ranking of the consumption components in order of the size of their contribution, and their comparison with the average Finnish consumer, fell short of the mark: these people wished for even more concrete and detailed data. The interviewees would have preferred to have received a clear answer to the question of whether they live ecologically or not. At the same time, the participants also demanded information about what the sustainable consumption limit actually is. How many kilos of natural resources can each of us consume?

"That we have some sort of goal we are trying to reach. If you live in a detached house which is approximately this big or that big and you heat it something like this or that, you should on average be able to fit into this category, or you consume too much or you conserve natural resources." (Woman, 30–39 years old, Pirkanmaa)

The interviewees feel that genuine comparisons are the most interesting thing about consumption choices. Of these comparisons the interviewees mentioned a new car versus an old one, the comparison of Spanish and Finnish tomatoes, and the comparison of various kinds of drink containers.

"Immediately when you are given two things to compare it's easy. Like that bottle and can thing. Right away there's something concrete to base your choice on." (Man, 30–39 years old, Pirkanmaa)

However, the interviewees felt that they had not received this kind of results through participation in the project, even though with the aid of MIPS data it should be possible to make comparisons of this sort. The results papers distributed to the households were, in many people's opinion, set at too general a level. This was partly because the authors had not had sufficient time to analyse and process the results of the consumption monitoring before the scheduled focus group interviews took place. For instance, one interviewee regretted the lack of comparison between detached houses and apartments, but there was simply no time to make these comparisons before the results were shown to the households.

Within the confines of this study, there has been a lot of discussion about whether the plethora of sustainability indicators leads to confusion. Owing to the extensive publicity devoted to climate change, increasingly more people are participating in public debate on the environmental impact of human activities. For example, several politicians mention in their blogs and in news interviews a potpourri of indicators, such as emissions, carbon footprints, and MIPS, without being aware of what these actually measure. However, this profusion of indicators does not seem to bother people because they all stand for some sort of measure reflecting the impact of human

activities on the environment. Similarly, only monitoring one's own consumption in this study resulted in more attention being paid to environmental issues and consumption.

7.5

Assessment of the reliability of the results

In regard to natural resource consumption, this study found the most significant consumption components to be identical to those that have been highlighted by other studies (e.g. EIPRO 2006, Michaelis & Lorek 2004). There is no sense in ranking different consumption components in order of size based on the results of this study unless this is done at a very rough level, because the MIPS figures used for the calculations are not totally consistent in regard to their system boundaries and assumptions. For mobility the most comprehensive MIPS data was used and it is possible that the data at least partly affected the fact that mobility – including leisure time mobility – was shown to be overwhelmingly the most resource-consuming consumption component in this study. For example, vehicles are included under the mobility component, but kitchen appliances and equipment are not included in the foodstuff component and neither is their electricity consumption. The same goes for shopping trips. Foodstuffs were in any case most probably relegated to the lower end of the scale due to their database. Since equivalent studies have not been previously carried out, more research is required in order to augment the results. It would also be possible to calculate the results of this study again using more precise data and alternative measurement methods.

Twenty-seven households participated in the study. It is not possible to make statistical generalisations applying to the entire population based on this small group. Such was not, though, the intention of the study. Instead, the aim was to study the fluctuations in natural resource consumption among different households and to determine in what components of consumption opportunities exist for reducing natural resource consumption and by how much. Despite all the households participating in the investigation being to some extent interested in environmental issues, there were appreciable differences in their natural resource consumption (see Section 4.1). The target group also included, for instance, people who travel a lot and people living in spacious homes.

The data from the focus group interviews has been approached from the case study angle. In the case study the example is described as accurately and intensively as possible. If the study has been carefully carried out, generalisation is also possible. Saarela-Kinnunen and Eskola gave as an example bullying at school. Bullying is hardly unique in every school, rather the logic, form and reasons of the phenomenon are much the same (Saarela-Kinnunen & Eskola 2001). Similarly, the reactions and the consumers' concepts of their action space engendered by MIPS are most likely the same from one case to another.

One of the traditional ideals of scientific investigation is repeatability. However, in many cases this is not a practical demand (Saarela-Kinnunen & Eskola 2001). Cases are frequently unique and cannot occur in precisely the same form again. This study should be repeated with respect to its essential characteristics. One could select 27 new households and accomplish the same kind of consumption monitoring with them, followed by focus group interviews. If the project were to be repeated in the same way, we would expect extremely similar observations to be made.

The people participating in the study were not told very much about the MIPS measure before the commencement of the consumption monitoring. If more

information had been given at the outset, the results might have been slightly different. The people would not necessarily have been so surprised at the results they obtained. On the other hand, if the participants had been less interested in the environment, the criticism arising during the focus group interviews could have been of a different nature.

7.6

Proposals for further study

The MIPS figures used as the source data for this study are not compatible in terms of their coverage, neither are they sufficiently comprehensive to form a basis for the carrying out of more precise MI calculations. More data are required, in particular on the natural resource consumption of housing, foodstuffs (especially imported foods) and household goods and appliances. There is also a need for additional information in relation to certain factors falling under leisure time activities and tourism. For example, there is lack of data on hotels and holiday activities abroad.

For this study comprehensive data were gathered on household consumption. Much data remained which could not be dealt with within the confines of the study. For example, the correlation between consumption expenditure and natural resource consumption was not examined. Again, the contribution of foodstuff-related activities in mobility as well as in electricity consumption was disregarded. The primary data produced by the households are available in Finnish and in English in the form of Excel spreadsheets on the website of the Finnish Association for Nature Conservation (www.sll.fi/luontojaymparisto/kestava/mips/kotimips/kulutusseuranta). The data can be used freely in other studies.

Even though the research households were not actually urged to change their practices after the study, it would be interesting to see what will remain in the participants' minds, say, one year from now in regard to their participation in the study and whether anything will change on a more permanent basis. Modifying natural resource consumption according to time and circumstances was also discussed in the focus group interviews. Students on low incomes, for instance, felt that their lifestyle would alter as their incomes grew.

The use of money was examined in this study only to a very small extent. However, it led to much discussion while the study was in progress. It would be interesting to examine in more detail the relationship between the results and spending in regard to natural resource consumption. What ought the consumer to do to improve resource efficiency with savings, if he or she wishes to avoid the rebound effect in consumption. If money saved by rationalising daily activities is later used for travelling, the deserved savings may well be forfeited. On the other hand, it is not possible to say how much the different activities presented in Sections 7.2 and 7.3 for improving the material efficiency of households would cost or save over the long term. In this respect a lot more research is called for. Furthermore, it would be interesting to continue the quantification of the improvement potential, which in this study was given only as a case example for one household (Section 7.2.2).

During the course of the study the question arose as to whether the conclusions of the MIPS results conflict with, for example, discussions on mitigating climate change. MIPS brings infrastructure into the picture, an aspect that is omitted from the climate change discussions. On the other hand, including infrastructure may result in the consumption components being re-ranked and the message needs to be clear, if changes are to take place.

It would be interesting to compare the MIPS results with those obtained using the LCA method. Both MIPS and LCA set out to demonstrate the importance of choices from the environmental standpoint, yet they measure different things: MIPS measures inputs – that is, the natural resources consumed, while LCA concentrates on outputs – that is, emissions. It would be interesting to see in what connections these two methods give the same results and where they possibly differ.

It would be worth improving the MIPS method: could different natural resource categories be combined to form a more suitable tool for raising awareness in the consumer? The air consumption and TMR categories of MIPS when combined would also indicate to some degree the effect of choices on climate, as well as on natural resource consumption. Similarly, it would be interesting to investigate how well the ecological footprint and the ecological backpack correlate. At present, these two indicators have not been comprehensively compared. However, following this study it will be possible, for example, to compare our results with ecological footprint results based on similar system boundaries.

Studies of this kind ought also to be done in other countries. In Turkey, for example, consumption is currently at an entirely different level than in Finland, yet it is rapidly rising (Eurostat 2008). How would the average Turkish citizen rate compared to the households in this study? What would the Factor 4 figures be, if Europe decided to reduce its natural resource consumption?

7.7

In conclusion

This study has in many respects been a trailblazer. Never before has the natural resource consumption of households been investigated as deeply as here; nor did we find any studies that, for instance, counted the goods and appliances owned by households to the same extent as in this one. On the other hand, it is for this very reason that we had to make the calculations at a rather general, rough level. This study provides an excellent starting point from which those interested in the resource efficiency of households can continue the task and develop the various parts of the study.

The FIN-MIPS Household study received a lot of attention from the media almost from the outset. It became clear that this kind of study has a broad societal appeal, and also raises interest internationally. MIPS cannot be the only tool used when striving for sustainability, but it does help us establish the right pathways to progress and helps in pointing out those aspects that need special attention.

This study does not cover all the policy instruments and other measures available: it focuses only on those that arose in the course of our investigation of households. For example, there are various studies for promoting resource efficiency through policy instruments at the government's disposal (see e.g. Policy Instruments for… 2006).

When talking of a sustainable society and sustainable consumption we need to remember that this is not just a question of making human activities more efficient. In order to achieve 'Factor' targets, not only is resource efficiency required, but also sufficiency thinking: What is an adequate level of consumption for making a person happy? We hope that in the future sufficiency and happiness, in addition to resource efficiency, will also feature in the discussions on the requirements for sustainable development.

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Appendix 1

An example of the MIPS results obtained for the households

Results of the Household MIPS study: Your household's ecological backpack

Thank you for participating in the FIN-MIPS Household study project! Here is a summary of your results for each consumption component. It would be nice, if you could find time to study these results prior to next week's meetings and to supplement the summary of the results at the end with your own information.

MIPS (material input per service unit) is a measure of eco-efficiency developed by Germany's Wuppertal Institute in the early 1990s. It portrays the natural resource consumption of products or services over their entire lifespan. Reducing the natural resource consumption of products and services throughout their lifespan is considered essential for securing sustainable development. The MIPS measure has been used as an example in hundreds of companies around the world.

We demonstrate here the ecological backpacks of different household activities. The ecological backpack includes the consumption of all so-called solid natural resources. This includes abiotic (non-renewable) and biotic (renewable) solid materials, as well as the erosion caused by agriculture. Additionally, water and air consumption during the lifespan of the products or services form part of a MIPS calculation. In regard to these, we have limited ourselves to the most interesting aspect, that is, air consumption in relation to tourism (see below). In all other respects water and air consumption often follow the distribution of solid natural resources.

To make a comparison of households of different sizes valid, the results are expressed here as per person per year. Thus, you can obtain the household's total consumption by multiplying the figures given by the number of people in that household.

HOUSING

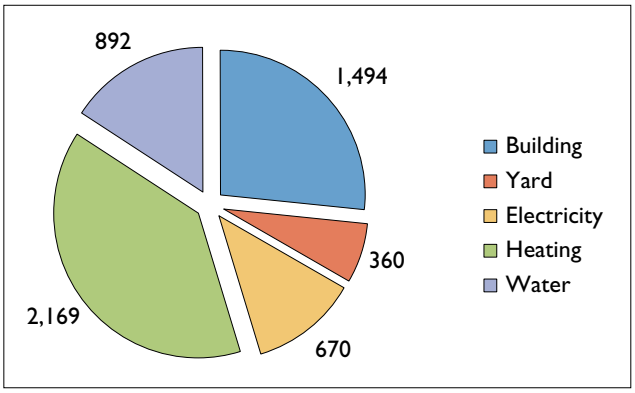
The pie chart below summarises the natural resource consumption due to housing. This includes both the main elements (buildings, yard, possible private road required by a detached house) and the continuous consumption of natural resources due to electricity, heating and water supply. The natural resource consumption of the buildings and other structures has been evenly spread over the estimated years of use. The figures for buildings include their most important constituents, like the foundations, walls, roofs and ceilings, doors and windows. The figures do not include, for example, modern convenience systems and interior coverings.

The ecological backpacks for yards are composed mainly of assumed earth removal. Earthworks requested on the detached house forms have been deliberately ignored to avoid duplication. We assume that lawns have been mechanically laid and provided with subsurface drainage, which raises the consumption of natural resources by yards. If this assumption is incorrect, please inform us at the meeting. If slabs are indicated as being laid in the yard, one assumes that sand and gravel foundations have been provided to support them. The natural resource consumption of a possible private road has been equally allocated among the households using it. Other roads come under the figures for mobility.

In the solid natural resource consumption discussed here the significance of construction is great, frequently accounting for a half or more of natural resource

consumption due to housing. Heating is a major factor in natural resource consumption. Water heating is included in water consumption and a high proportion of the natural resource consumption accountable to water often comes from heating it. In those households using eco-electricity the share of electricity in terms of natural resource consumption is small. The ecological backpack of households using conventional electricity is appreciably fatter.

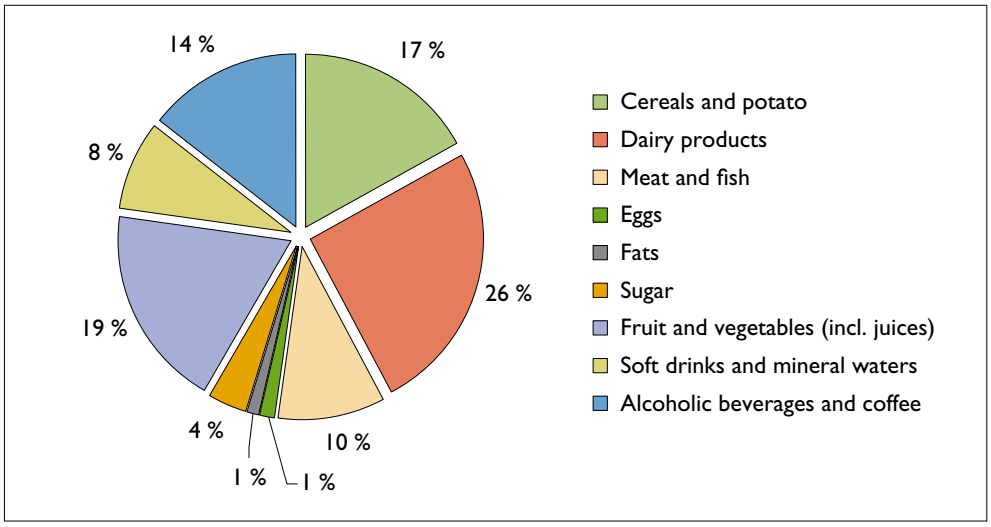
There is no figure here of air consumption due to housing. However, air consumption is, in principle, interesting as it has a direct link to the carbon dioxide emissions that cause global warming. Energy consumption is emphasised in air consumption, with the significance of the building becoming less than shown here.



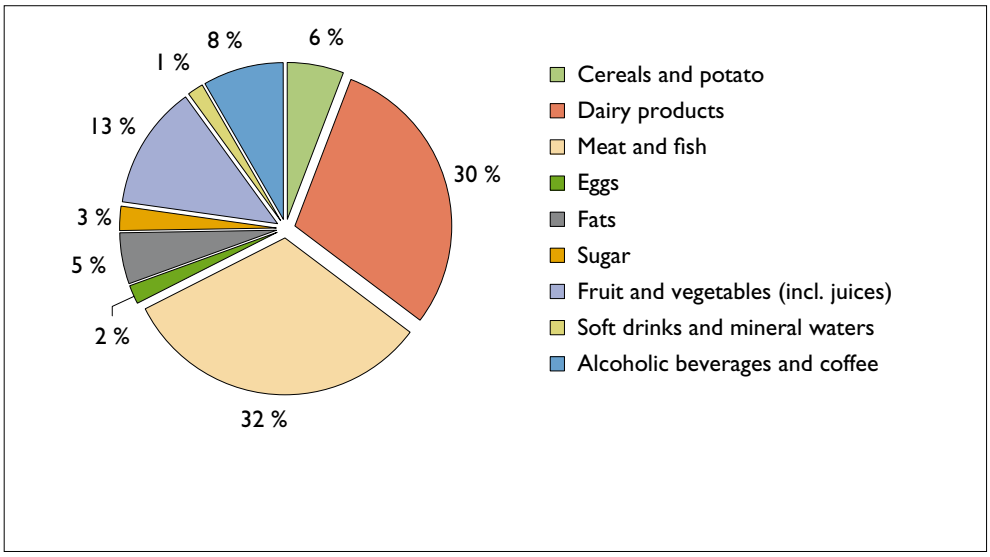
The natural resource consumption of housing, total 5,590 kg/ person per year.

FOODSTUFFS

The results for eating and drinking are given in the two following pie charts. The first of these shows the consumption of food in kilograms. In the second the ecological backpacks have been added to the data. By comparing these two diagrams you can see which foodstuff categories consume relatively more natural resources and what your ecological backpack in relation to food consists of. The pie chart headings give the total figures calculated per person per year.



Food eaten in one year, total 840 kg/person per year.



The natural resource consumption of foodstuffs, total 6000 kg/person per year.

PACKAGING AND WASTES

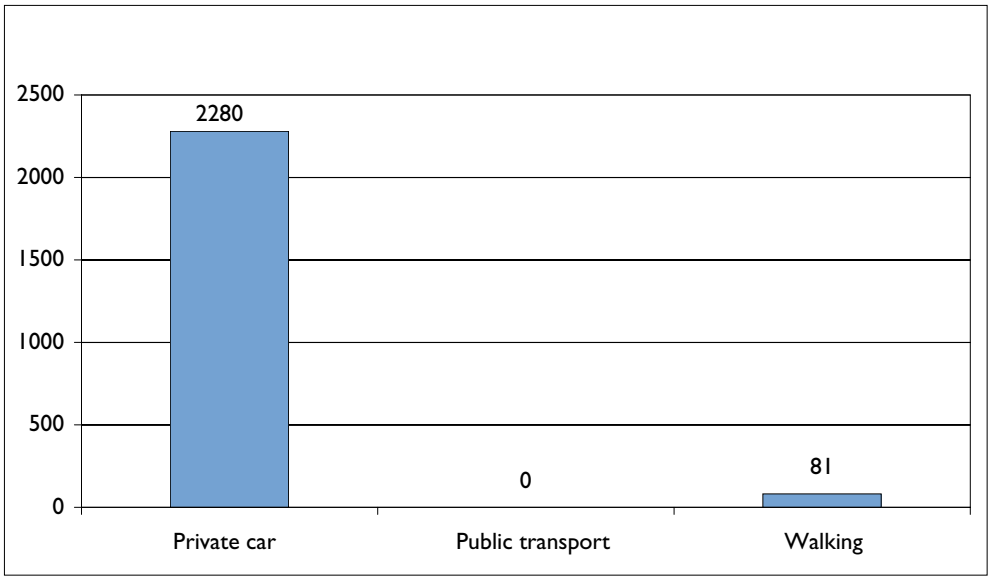
The manufacturing and utilisation of the packaging used by your household accounts for 270 kg of solid natural resources per person per year. The natural resource consumption of waste management as a whole is 16 kg per person per year. Thus, packaging and wastes are only a small contributor compared to foodstuffs and housing.

MOBILITY

Mobility only includes daily mobility. Households' much less frequent holiday trips are included in the tourism category. While mobility figures applying to each individual household member were asked for, we decided to add all trips together and to then divide them evenly among the household's members, as for the other components. Although we have attempted to avoid duplication, this may still exist. Walking or running for the sake of physical exercise, as well as trips made during work time, have been ignored.

For understanding the results a table showing the kilometres you travelled using different modes of transport is useful. The number of kilometres travelled annually was calculated by multiplying the weekly number by 45. We have taken into account the difference between the monitoring week and a normal week as reported by you. Naturally, the final figures are only estimates. However, they do reveal where consumption is concentrated and the order of magnitude involved.

A summary of the journeys made by one household	
	km/year
Private car	2 250
Public transport	0
Bicycle	900
Walking	1 089
In total	4 239



The ecological backpack of everyday mobility, total 2360 kg/person per year.

In the ecological backpack for mobility the infrastructure factor/element, i.e. road construction, is emphasised. In the following example the ecological backpack for private motoring is divided into three: road infrastructure, automobile manufacturing, and use of the car, that is, fuel provision. In air consumption terms the relationship is reversed, that is, fuel consumption has the greatest significance from the climate change perspective.

LEISURE TIME ACTIVITIES

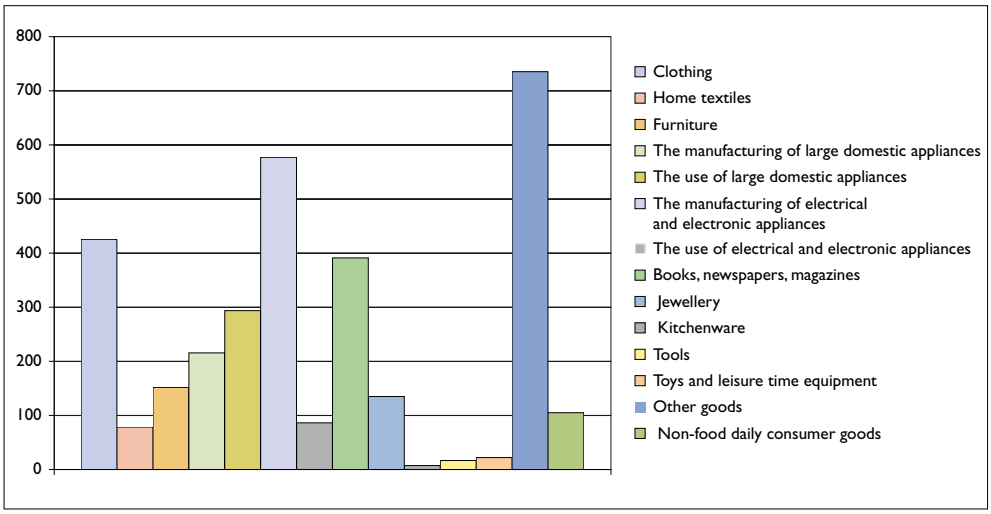
We were unable to make a complete calculation in the case of leisure time activities (hobbies), because there are many hobbies for which no ecological backpack data is as yet available. What became clear, though, is that the hobby itself (with the exception of motor sports) often accounts for little natural resource consumption compared to the kilometres travelled by private car to engage in the hobby. Here we give a few examples of consumption due to some leisure time activities per activity hour. By multiplying the figures by the number of hours spent on the hobby per year you can obtain the consumption by the hobby in the course of a year.

- Swimming in a lake, orienteering, berry-picking and backpacking consume very little unless a car has to be used to engage in them. Motoring, however, is significant: one kilometre travelled by car consumes two kilograms of natural resources.
- Gym, 6 kg/activity hour
- Watching TV, 1 kg/activity hour
- Swimming at a swimming hall,11 kg/activity hour
- Physical exercise at a fitness centre, approx. 6 kg/activity hour
- Jogging along an illuminated track, approx. 1 kg/activity hour

HOUSEHOLD GOODS AND APPLIANCES

Summary of the household goods and appliances inventory			
Goods and appliances group	No. pieces in total	%	No. of used items
Clothing	481	13	0
Textiles	183	5	35
Furniture	34	1	23
Big household appliances	8	0	0
Electrical appliances	67	2	0
Books, newspapers, magazines	1123	31	100
Jewellery	21	1	2
Kitchenware	507	14	131
Tools	26	1	0
Toys and leisure time equipment	54	2	6
Other goods	1080	30	0
In total	3584	100	297

The graph below shows the natural resource consumption of the different groups of household goods and appliances. The graph also includes the use of electrical and electronic devices. However, the indicated total of 2,900 kg/person per year does not include the power for using electrical and electronic devices because the use of appliances has already been included in electricity consumption due to housing.



The natural resource consumption of household goods, total 2,900 kg/person per year excluding the use of electrical and electronic devices.

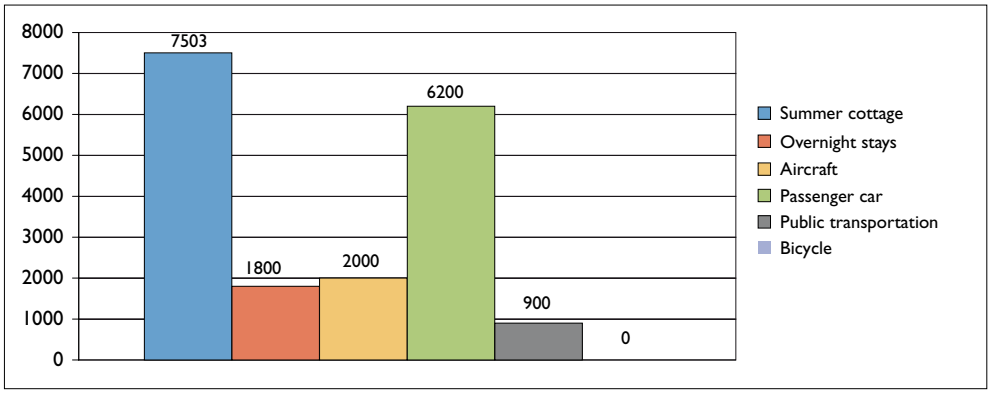
LEISURE TIME ACTIVITIES

The figures below show the ecological backpack of tourism divided among the factors/elements of tourism. A summer cottage accounts for a large chunk of the ecological backpack in those households which own one. A private road, where there is one, adds considerably to the backpack. In such a case a summer cottage may consume a lot more natural resources than a permanent dwelling. The ecological

backpack of a private road decreases per person the more people there are using it. The entire backpack for the cottage dwindles when, for example, the cottage is shared with another household.

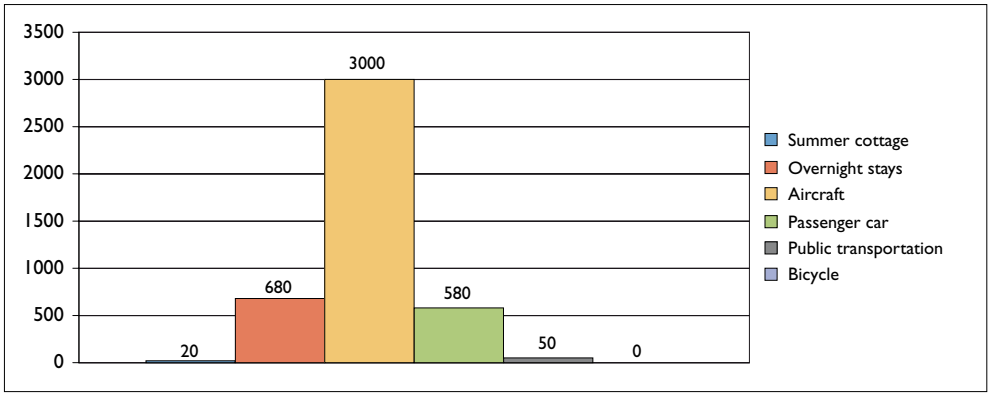
Overnight stays include nights spent at hostels or hotels, and also nights spent 'away' in cottages owned by acquaintances or in rented summer cottages.

Summary of your household's tourism kilometres during one year	
	km/year
Journeys by plane	43 360
Journeys by private car	6 780
Journeys by public transport	2 085
Journeys by bike	6
Journeys by boat	0
In total	52 231



The ecological backpack of tourism, total 18,720 kg/person per year.

Work trips have been excluded from the tourism figures. Air travel does not consume solid natural resources as much as motoring because air travel does not call for as much infrastructure. The greatest sin of air travel, that is, the generation of large quantities of carbon dioxide, is revealed when air consumption is calculated. The bar graph below shows air consumption for the different factors/elements of tourism.



The air consumption of tourism, total 4,500 kg/person per year.

Appendix 2

MI factors used for the calculations and MIPS results for the natural resource consumption of housing

MI factors.

	Abiotic k per m^2 g	Biotic kg per m^2	Water kg per m^2	Air kg per m^2	Reference
Apartment building, average	64,00	1,00	299,00	2,00	1
Detached house, average	70,00	9,00	975,00	3,00	1
Yard with asphalt	1 196,23		475,90	5,85	2
Artificially laid lawn	725,40		308,00	6,60	2
Gravel surfacing	413,00				2
Stone tiles	756,92		416,50	4,90	1
Wooden terrace	720,00	42,00			1
Balcony made of concrete	59,00				5
Balcony made of steel	33,00				5
Shed	4,35	10,20	951,60	0,48	3
	Abiotic kg per l	Biotic kg per l	Water kg per l	Air kg per l	Reference
Cold water	0,01		1,30	0,00	4
Hot water	0,04		1,35	0,02	1
	Abiotic kg per kWh	Biotic kg per kWh	Water kg per kWh	Air kg per kWh	Reference
Standard electricity	0,53		189,00	0,22	7
Eco-electricity (wind power)	0,07		0,17		6
District heating	0,49	0,00	0,78	0,36	7
Pellet heating	0,29	0,00	73,41	0,10	3
Wood pellets, combustion air				1,34	3
	Abiotic kg per m^2	Biotic kg per m^2	Water kg per m^2	Air kg per m^2	Reference
Solar panels	2318,00				8
	Abiotic kg per kg	Biotic kg per kg	Water kg per kg	Air kg per kg	Reference
Heating oil	1,36		9,40	0,02	4
Heating oil, combustion air				3,20	4
	Abiotic kg per tonne-km	Biotic kg per tonne-km	Water kg per tonne-km	Air kg per tonne-km	Reference
Transportation of firewood with a tractor	2,10		37,00	0,09	3
	Abiotic kg per m	Biotic kg per m^2	Water kg per m	Air kg per m	Reference
Private road	109,00		2400,00	1,00	9

1 = own calculation
2 = Tamminen et al. 2008
3 = Salo et al. 2008
4 = Wuppertal 2003
5 = Autio & Lettenmeier 2002
6 = Schmidt-Bleek 1998
7 = Nieminen et al. 2005
8 = Klemish et al. 1999
9 = Talja et al. 2006

MIPS results (kg/person per year) for abiotic resource consumption of housing.

House-hold	Building	Yard	Electricity	Heating	Electricity & Heating	Water	Road	In total
P	1 110	65	530	1 189		489		3 384
V	2 187	256	72	217		339	545	3 616
O	1 310	500	112	1 062		669		3 653
G	1 628	1 576	226	20		230		3 681
R	1 265	37	232	1 601		561		3 695
S	1 145	783	38	1 002		870		3 838
T	2 152	142			1 304	470		4 069
W	3 148	761	92	874		231		5 107
Q	1 041	817	742	1 195		458	1 090	5 344
L	1 467	360	670	2 169		892		5 558
J	2 776	428	101	2 093		496		5 894
E	2 598	827	84	1 617		949		6 075
F	1 694	997	71	2 496		977		6 236
U	4 480	1 033	172	580		325		6 588
Z	1 929	762	490	2 682		875		6 739
B	2 848	114	102	3 784		572		7 421
D	999	465			1 952	223	4 088	7 727
H	2 042	547	1 325	555		175	3 134	7 777
K	3 087	543	84	2 391		1 879		7 984
N	3 069	770	212	3 305		1 485	3	8 844
C	781	1 156			1 192	441	5 450	9 020
Y	5 026	403			3 302	890		9 621
A	4 078	1 033			4 202	2 697		12 010
M	5 146	4 555	1 855	1 068		629		13 253
Å	4 822	5 344	830	4 257		1 044		16 296
X	4 335	22 629			3 403	538		30 906
I	8 818	11 227	197	3 497		437	10 900	35 077

MIPS results (kg/person per year) for biotic resource consumption of housing.

House-hold	Building	Yard	Electricity	Heating	Electricity & Heating	Water	Road	In total
R	18	0	0	0	0	0	0	18
S	20	0	0	0	0	0	0	20
P	21	0	0	0	0	0	0	21
F	24	0	0	0	0	0	0	24
L	28	0	0	0	0	0	0	28
E	29	0	0	0	0	0	0	29
Z	33	0	0	0	0	0	0	33
G	40	0	0	0	0	0	0	40
B	42	0	0	0	0	0	0	42
K	46	0	0	0	0	0	0	46
J	98	2	0	0	0	0	0	100
N	140	4	0	0	0	0	0	145
O	155	0	0	0	0	0	0	155
V	216	0	0	0	0	0	0	216
Y	394	0	0	0	0	0	0	394
Q	395	0	0	0	0	0	0	395
W	301	0	0	149	0	0	0	450
D	471	0	0	0	0	0	0	471
Å	304	0	0	167	0	0	0	471
H	374	0	0	159	0	0	0	533
A	283	0	0	0	268	0	0	551
M	610	0	0	0	0	0	0	610
U	536	0	0	270	0	0	0	806
T	95	5	0	0	714	0	0	813
X	820	0	0	0	0	0	0	820
C	375	0	0	0	1 338	0	0	1 713
I	2 535	0	0	1 554	0	0	0	4 089

MIPS results (kg/person per year) for air consumption of housing.

House-hold	Building	Yard	Electricity	Heating	Electricity & Heating	Water	Road	In total
O	53	3	0	781		309	0	1 146
S	37	6	24	736		402	0	1 206
P	42	1	220	874		226	0	1 363
G	44	14	94	1 186		110	0	1 448
V	42	1	0	1 084		402	0	1 529
R	36	0	96	1 176		259	0	1 569
E	53	6	0	1 188		438	0	1 685
Q	81	5	308	1 069		212	10	1 685
T	105	0			1 387	217	0	1 709
J	129	3	0	1 593		169	0	1 894
D	83	4			1 869	103	38	2 097
L	52	2	278	1 593		408	0	2 334
F	44	8	0	1 834		452	0	2 338
C	31	0			2 078	247	50	2 407
U	278	0	0	2 142		32	0	2 452
W	45	8	0	2 326		94	0	2 473
Z	58	11	204	1 971		402	0	2 644
K	83	4	0	1 718		867	0	2 672
Y	230	2			2 420	326	0	2 978
B	74	1	0	2 780		263		3 118
A	180	0			2 048	980	0	3 207
H	54	0	550	2 504	0	125	29	3 262
N	170	6	0	2 676		685	0	3 537
X	256	198	0	0	3 390	186	0	4 031
Å	59	47	345	3 467		479	0	4 396
M	227	31	770	5 320		482	0	6 831
I	303	4	0	10 290		261	100	10 957

MIPS results (kg/person per year) for water consumption of housing.

House-hold	Building	Yard	Electricity	Heating	Electricity & Heating	Water	Road	In total
O	7 435	154	272	1 691		39 064		48 615
B	12 123	44	247	6 024		33 848		52 286
S	6 077	325	75	1 596		50 849		58 921
W	27 577	87	224	6 044		26 205		60 136
E	8 603	341	204	2 574		55 594		67 316
F	7 202	415	173	3 973		57 049		68 813
J	20 617	151	245	3 332		40 830		65 175
U	42 185	0	417	0		42 185		84 787
G	9 275	683	80 745	432		25 140		116 275
N	24 328	305	515	5 261		87 060	57	117 525
R	5 675	15	82 688	2 549		32 768		123 694
K	13 799	237	204	46 706		110 001		170 947
P	6 526	28	189 000	1 893		28 594		226 041
Z	9 395	951	174 825	4 270		51 737		241 178
L	8 431	162	239 085	3 452		52 958		304 088
Å	27 520	2 193	295 974	8 127		61 701		395 515
V	49 865	31	174	55 254		49 865	12 000	167 189
T	27 490	17			471 744	27 490		526 741
I	233 779	28	478	24 325		45 031	240 000	543 641
C	32 535	0			417 319	17 260	120 000	587 113
Q	37 470	450	264 600	425 758		26 768	24 000	779 046
D	44 630	76			693 288	13 044	90 000	841 039
H	30 818	18	472 500	158 899		25 460	69 000	756 696
M	59 332	1 841	661 500	271 227		92 440		1 086 342
Y	62 175	83			1 180 531	68 965		1 311 754
X	102 101	9 240			1 209 508	43 767		1 364 615
A	46 394	0			1 526 997	210 438		1 783 828

Appendix 3

MI factors used for the calculations and MIPS results for the natural resource consumption of mobility and tourism

Mobility MI-factors.

	Abiotic kg per passenger-km	Biotic kg per passenger-km	Water kg per passenger-km	Air kg per passenger-km	Reference
Train	1,2		28,99	0,04	1
Tram	0,36		48,1	0,07	1
Metro	0,29		29,4	0,04	1
Bus	0,32		3,23	0,06	1
	Abiotic kg per vehicle-km	Biotic kg per vehicle-km	Water kg per vehicle-km	Air kg per vehicle-km	
Bicycle	0,38	0	12,1	0,02	1
Passenger car	2,02	0	20	0,19	1
	Abiotic kg per kg	Biotic kg per kg	Water kg per kg	Air kg per kg	
Diesel	1,36		9,7	0,02	2
Diesel combustion air				3,2	2

For the calculations for tourism, the same MI factors were used as for mobility. In addition, the following MI factors have been used.

	Abiotic kg per passenger-km	Biotic kg per passenger-km	Water kg per passenger-km	Air kg per passenger-km	Reference
Domestic flight	0,56		26,60	0,28	1
Intra-European flight	0,11		3,40	0,14	1
Long-haul flight	0,06		0,90	0,13	1
Boat trip	0,26		2,42	0,31	1
	Abiotic kg per overnight	Biotic kg per overnight	Water kg per overnight	Air kg per overnight	
Overnight in a hotel	45	0,2	3 396	18	4
Overnight in a rented cottage	60	42	5 693	27	4
	Abiotic kg per h	Biotic kg per h	Water kg per h	Air kg per h	
Time spend in a sailing boat[1]	35		261	8	8
[1] without driving to marina					

MI-factors, cottages.

	Abiotic kg per m^2	Biotic kg per m^2	Water kg per m^2	Air kg per m^2	Referen-ce
The cottage building	96	36	1 984	4	4
	Abiotic kg per m	Biotic kg per m	Water kg per m	Air kg per m	
Private road	109		2 400	1	5
	Abiotic kg per m3	Biotic kg per m^3	Water kg per m^3	Air kg per m^3	
Dredging (density of sand)	1 800				3
	Abiotic kg per kWh	Biotic kg per kWh	Water kg per kWh	Air kg per kWh	
Electricity	0,53	0,00	189,00	0,22	6
Wind power	0,07		0,17		7

1 = Lähteenoja et al. 2006a
2 = Wuppertal 2003
3 = Rakentajain kalenteri 1999
4 = Salo et al. 2008
5 = Talja et al. 2006
6 = Nieminen et al. 2005
7 = Schmidt-Bleek 1998
8 = Veuro et al. 2008

MIPS results (kg/person per year) for abiotic resource consumption of mobility.

Household	Passenger car	Public transport	Bicycle	Moped	In total
R	0	372	222	0	595
B	0	216	693	0	909
P	0	1 286	60	0	1 346
G	948	512	119	0	1 578
S	682	951	0	0	1 633
O	455	940	308	0	1 702
H	1 510	144	132	0	1 786
F	727	1 172	0	0	1 899
L	2 280	0	81	0	2 361
V	1 356	818	374	0	2 549
E	0	1 202	1 932	0	3 134
N	3 416	372	29	0	3 817
T	4 347	0	0	0	4 347
W	4 531	370	434	0	5 335
Å	2 768	2 875	154	0	5 797
Y	6 652	0	17	0	6 669
C	8 309	0	22	0	8 331
J	312	8 057	102	0	8 471
U	8 585	0	38	0	8 622
M	12 786	0	68	0	12 855
Q	13 218	249	48	0	13 515
D	13 241	310	0	112	13 663
Z	13 382	790	0	0	14 171
K	659	21 972	0	0	22 631
X	26 844	0	0	0	26 844
I	42 176	0	0	0	42 176
A	51 269	0	0	0	51 269

MIPS results (kg/person per year) for air consumption of mobility

Household	Passenger car	Public transport	Bicycle	Moped	In total
B	0	41	36	0	77
R	0	72	12	0	83
G	119	81	6	0	206
S	64	144	0	0	208
L	204	0	6	0	210
P	0	215	3	0	218
O	43	177	16	0	236
H	227	27	7	0	261
F	68	206	0	0	274
V	127	153	20	0	300
E	0	208	102	0	310
J	37	279	5	0	321
Å	328	110	8	0	447
T	524	0	0	0	524
N	579	70	2	0	651
W	582	69	23	0	675
Y	776	0	1	0	777
K	62	790	0	0	852
U	989	0	2	0	991
C	1 168	0	1	0	1 169
M	1 622	0	4	0	1 625
D	1 414	54	0	266	1 734
Q	1 858	47	3	0	1 908
Z	2 047	109	0	0	2 156
X	2 645	0	0	0	2 645
I	5 610	0	0	0	5 610
A	5 896	0	0	0	5 896

MIPS results (kg/person per year) for water consumption of mobility.

Household	Passenger car	Public transport	Bicycle	Moped	In total
G	8 261	6 518	3 781	0	18 561
H	13 152	1 454	4 206	0	18 811
L	19 945	0	0	0	19 945
V	11 778	8 256	11 925	0	31 959
T	37 526	0	0	0	37 526
R	0	35 074	7 079	0	42 152
N	29 025	12 504	919	0	42 448
O	4 574	29 494	9 801	0	43 869
B	0	22 052	24 233	0	46 285
F	7 319	45 039	0	0	52 358
W	39 293	3 735	13 812	0	56 841
Y	58 862	0	545	0	59 406
C	70 878	0	708	0	71 586
U	74 885	0	1 198	0	76 083
S	6 861	74 867	0	0	81 728
Å	24 190	68 129	4 901	0	97 219
P	0	101 404	1 906	0	103 310
E	0	44 297	61 529	0	105 825
M	110 317	0	2 178	0	112 495
Q	112 752	2 515	1 525	0	116 791
D	115 220	3 824	0	801	119 044
Z	113 777	80 042	0	0	193 818
J	2 684	201 731	3 249	0	207 664
X	236 225	0	0	0	236 225
I	363 707	0	0	0	363 707
A	444 273	0	0	0	444 273
K	6 633	530 574	0	0	537 207

MIPS results (kg/person per year) for abiotic resource consumption of tourism.

House-hold	Cottage	Overnights	Airtravel	Passenger car	Public transport	Bicycle	Boat trips	In total
B	0	210	0	990	502	48		1 750
P	0	195	374	1 097	420			2 086
C	0	0	0	2 119	2			2 121
Y	0	405	0	1 104	371	5	260	2 145
S	0	297	359	1 416	292			2 364
R	0	160	0	706	1 306	352		2 523
I	0	270	492	2 182				2 943
D	0	840	865	1 353	0		17	3 076
X	0	105	0	3 464				3 569
G	3 538	35	0	591	166		69	4 400
N	1 332	618	961	1 651	195	2		4 758
F	0	0	910	0	4 025			4 935
Q	0	171	84	4 821	538	1		5 615
H	0	478	246	2 448	2 766	7		5 945
V	0	695	0	5 500	262	5	31	6 494
W	0	157	0	2 041	4 511	25		6 734
O	0	662	202	1 924	3 848	13	390	7 039
J	3 347	640	475	2 828	28	1	69	7 389
Å	0	113	98	6 912	1 526	13	52	8 714
K	0	1 112	1 386	2 469	7 344		39	12 350
L	6 947	1 575	1 991	6 242	895	0		17 649
M	4 522	302	786	10 423	3 600			19 633
U	0	94	163	15 232	5 344	59	156	21 049
T	21 129			2 183	150			23 462
Z	14 448	1 320	246	12 120	0	1	104	28 239
A	0	120	88	41 673	184	6		42 070

MIPS results (kg/person per year) for biotic resource consumption of tourism.

House-hold	Cottage	Over-nights	Airtravel	Passen-ger car	Public transport	Bicycle	Boat trips	In total
C	0	0	0	0	0	0	0	0
F	0	0	0	0	0	0	0	0
Å	0	1	0	0	0	0	0	1
Q	0	1	0	0	0	0	0	1
I	0	1	0	0	0	0	0	1
Y	0	2	0	0	0	0	0	2
U	0	3	0	0	0	0	0	3
D	0	4	0	0	0	0	0	4
X	0	11	0	0	0	0	0	11
S	0	20	0	0	0	0	0	20
A	0	21	0	0	0	0	0	21
H	0	37	0	0	0	0	0	37
R	0	49	0	0	0	0	0	49
W	0	56	0	0	0	0	0	56
P	0	74	0	0	0	0	0	74
G	94	0	0	0	0	0	0	94
B	0	147	0	0	0	0	0	147
J	397	31	0	0	0	0	0	428
V	0	430	0	0	0	0	0	430
O	0	432	0	0	0	0	0	432
N	431	12	0	0	0	0	0	444
M	423	21	0	0	0	0	0	445
T	525	0	0	0	0	0	0	525
K	0	591	0	0	0	0	0	591
L	557	131	0	0	0	0	0	688
Z	1 102	110	0	0	0	0	0	1 212

MIPS results (kg/person per year) for air consumption of tourism.

House-hold	Cottage	Over-nights	Airtravel	Passenger car	Public transport	Bicycle	Boat trips	In total
G	48	14	0	48	6	0	83	199
C	0	0	0	199	0	0	0	200
B	0	95	0	93	94	3	0	284
T	128	0	0	205	13	0	0	347
X	0	43	0	326	0	0	0	369
R	0	70	0	66	237	19	0	392
W	0	59	0	192	161	1	0	413
P	0	83	187	103	71	0	0	445
Y	0	162	0	104	70	0	310	646
Q	0	68	107	453	64	0	0	693
S	0	120	457	133	25	0	0	735
H	0	194	313	230	92	0	0	829
I	0	108	626	205	0	0	0	939
V	0	309	0	545	53	0	37	945
Å	0	45	125	650	83	1	62	966
F	0	0	1 158	0	171	0	0	1 329
J	109	291	604	266	1	0	83	1 354
O	0	296	257	181	269	1	465	1 468
D	0	336	1 101	127	0	0	21	1 585
N	157	248	1 224	155	17	0	0	1 801
U	0	38	207	1 433	281	3	186	2 148
Z	266	536	314	1 140	0	0	124	2 379
M	125	91	1 433	980	120	0	0	2 750
K	0	487	1 764	232	316	0	47	2 845
A	0	50	112	3 920	16	0	0	4 098
L	23	585	3 000	587	50	0	0	4 245

MIPS results (kg/person per year) for water consumption of tourism.

House-hold	Cottage	Overnights	Airtravel	Passen-ger car	Public transport	Bicycle	Boat trips	In total
C	0	0	0	21 330	16			21 346
B	0	19 926	0	9 962	5 071	1 513		36 471
X	0	8 215	0	34 866	0	0	0	43 081
Y	0	30 564	0	11 114	3 747	151	2 420	47 996
R	0	13 434	0	7 107	20 841	11 193		52 574
P	0	16 755	17 742	11 043	9 941			55 480
I	0	20 376	15 198	21 956	0	0	0	57 530
S	0	22 906	11 107	14 254	14 245	0	0	62 512
Q	0	12 905	2 604	48 516	8 808	24		72 857
G	83 480	2 641	0	4 552	3 997		83	94 753
D	0	63 392	26 738	13 621	0		161	103 912
Å	0	8 490	3 043	69 562	33 972	424	484	115 975
V	0	64 409	0	55 704	5 122	145	290	125 670
H	0	37 006	7 599	24 642	66 822	227		136 296
F	0	0	28 118	0	109 828			137 946
W	0	10 203	0	20 540	107 979	807		139 528
T	162 717	0	0	21 973	2 862			187 552
J	108 348	49 075	14 677	28 462	676	40	645	201 924
N	107 795	46 905	29 717	16 613	3 748	52		204 829
O	0	61 953	6 232	19 364	117 140	424	3 630	208 742
M	11 518	10 996	16 604	104 903	86 970	0	0	230 991
L	6 971	100 932	54 628	62 820	20 960	0	0	246 311
U	0	7 199	5 035	153 305	119 763	1 882	1 452	288 636
K	0	100 268	42 840	24 845	171 291		363	339 607
A	0	9 639	2 720	419 408	3 545	182		435 493
Z	318 315	102 529	7 616	121 980	0	30	968	551 437

Appendix 4

MI factors used for the calculations and MIPS results for the natural resource consumption of foodstuffs

MI factors used for foodstuffs (kg/kg).

Foodstuff category	Abiotic	Biotic	Water	Air	Erosion	Soil	TMR	Reference
Milk	1,1	3,0	31	0,094	0,31	274	4,4	Kauppinen et al. 2008
Butter	9,8	25	208	0,67	2,6	2329	37,6	Kauppinen et al. 2008
Vegetable spreads, soy oil	7,6	19	162	0,7	2,0	1783	28,8	Kauppinen et al. 2008
Vegetable spreads, rape oil	8,3	20	168	0,557	2,2	1927	30,2	Kauppinen et al. 2008
Cheese	11	29	260	1,1	3,0	2675	43,2	Kauppinen et al. 2008
Beef	12	31	439	0,99	3,2	2839	45,9	Kauppinen et al. 2008
Pork	8,3	10	240	1,9	2,8	2434	21,2	Kauppinen et al. 2008
Fish (rainbow trout)	2,8	4,7	271	0,83	0,17	148	7,6	Kauppinen et al. 2008
Poultry (chicken)	7,0	4,6	228	1,5	1,2	1088	12,9	Kauppinen et al. 2008
Eggs	5,7	4,0	141	1,0	1,1	942	10,8	Kauppinen et al. 2008
Soy	1,3	1,4	157	0,92	0,35	310	3,0	Kauppinen et al. 2008
Beer	1,5	0,31	280	0,51	0,085	75	1,9	Kauppinen et al. 2008
Potato	0,29	1,7	52	0,016	0,080	71	2,0	Kauppinen et al. 2008
Sugar	3,1	1,6	24	0,8	0,38	336	5,1	Kauppinen et al. 2008
Wheat bread	1,1	1,3	20	0,14	0,35	308	2,7	Kauppinen et al. 2008
Rye bread	1,6	0,8	111	0,21	0,29	259	2,8	Kauppinen et al. 2008
Mixed bread	1,3	1,1	99	0,21	0,34	304	2,7	Kauppinen et al. 2008
Barley bread	1,1	1,4	21	0,15	0,39	341	2,9	Kauppinen et al. 2008
Tomato	8	1	793	4	0,006	36	9,4	Kauppinen et al. 2008
Cucumber (Finnish average)	7	1	570	4	0,004	25	8,4	Kauppinen et al. 2008
Cucumber (year round cultivation)	14	1,4	2481	7,0	0,002	11	15,2	Kauppinen et al. 2008
Apple	1	1	7	0,01	0,32	93	2,0	Kauppinen et al. 2008
Arctic cloudberry	2	1	17	0,2	0	0	3,0	Kauppinen et al. 2008
Strawberry	1	1	17	0,2	0,63	555	2,8	Kauppinen et al. 2008
Rice		1,00			1,85		2,85	Bringezu 2000
Maize		1,97			1,80		3,77	Bringezu 2000
Coffee, readymade drink	0,1				1,5		1,6	According to Bringezu 2000
Tea, readymade drink	0,01				0,15		0,16	According to Bringezu 2000
Cocoa		1,00			42,87		43,87	Bringezu 2000
Chocolate		5,02			14,14		19,16	Bringezu 2000
Wine		1,25			3,63		4,88	Bringezu 2000
Pineapple		1,00			0,25			Bringezu 2000
Sunflower seeds		2,68			2,96		5,64	Bringezu 2000
Peanut		1,00			8,12		9,12	Bringezu 2000

Foodstuff category	Abiotic	Biotic	Water	Air	Erosion	Soil	TMR	Reference
Hazelnut		1,00			21,41		22,41	Bringezu 2000
Drinking water	0,01	0	1,3	0,001			0,01	Wuppertal Institute 2003
Wild caught fish		2,2						Own estimation
Reindeer meat		10,00	2,50	1,00			10,00	Own estimation
Game meat excl. transport		1					1	Schmidt-Bleek 2000
Orange juice	3							Own estimation
Readymade drink from juice concentrate	0,9						0,9	Own estimation

MI factors used for ready-made meals (kg/kg). All the calculations are based on own estimates. Includes raw-materials, but excludes energy consumption for meal preparation.

Meal	Abiotic	Biotic	Water	Air	Erosion	Soil	TMR
Casserole with chicken	2,34	4,63	88	0,34	0,54	480	7,50
Chicken meatballs	3,88	3,09	179	1,00	0,57	512	7,54
Chilli con carne	8,83	14,50	479	2,40	1,44	1290	24,77
Feta salad	7,20	5,57	513	3,06	0,57	468	13,35
Pea soup	2,74	2,54	125	0,90	0,65	568	5,93
Italian salad	4,34	4,42	220	1,46	0,70	587	9,46
Minced meat sauce	9,02	12,07	616	2,65	1,19	1073	22,28
Minced meat soup	3,13	7,11	153	0,45	0,71	628	10,94
Baked macaroni with minced meat	4,18	9,81	133	0,40	1,10	976	15,10
Pizza with minced meat	5,66	6,40	386	1,83	0,68	619	12,74
Patty made of root vegetables	1,98	2,54	66	0,30	0,43	374	4,96
Fish soup	0,40	1,61	22	0,03	0,11	97	2,12
Fish casserole	1,45	1,65	113	0,69	0,08	70	3,17
Turkey sauce	2,61	2,84	78	0,48	0,79	395	6,24
Chicken curry	5,16	3,50	218	1,42	0,75	679	9,41
Chicken soup	3,13	2,82	170	1,12	0,38	318	6,32
Chicken pasta	7,74	2,28	655	3,35	0,32	315	10,34
Chicken risotto	2,06	2,30	91	0,49	0,54	307	4,91
Chicken salad	5,62	3,64	338	2,30	0,58	430	9,84
Vegetarian hamburger	4,68	1,56	336	2,33	0,21	193	6,45
Vegetarian soup	1,87	3,95	68	0,36	0,40	359	6,21
Vegetarian lasagne	4,89	4,30	351	1,89	0,43	394	9,62
Vegetarian pasta	5,69	1,29	528	2,81	0,10	107	7,08
Vegetarian casserole	2,46	0,94	234	1,13	0,07	69	3,47
Vegetarian meatballs	5,73	1,83	421	2,91	0,20	184	7,76
Oat porridge	1,12	2,74	40	0,11	0,31	278	4,18
Cream potatoes	0,85	2,80	49	0,06	0,23	207	3,88
Double burger	8,17	18,66	324	1,10	1,98	1757	28,80
Ham casserole	2,52	5,41	89	0,40	0,77	677	8,70
Pizza with ham	5,41	5,00	373	1,89	0,66	592	11,07
Fish soup with rainbow trout	0,80	1,98	62	0,15	0,13	118	2,91

Meal	Abiotic	Biotic	Water	Air	Erosion	Soil	TMR
Casserole with rainbow trout	2,62	6,26	141	0,37	0,53	465	9,41
Mutton casserole	1,96	27,05	192	0,94	30,21	32	59,22
Lasagne	6,39	8,21	425	1,93	0,84	755	15,43
Cabbage casserole with minced meat	2,56	6,87	112	0,22	0,68	599	10,11
Meat soup	2,65	7,17	113	0,22	0,71	628	10,53
Meat loaf	7,21	17,03	259	0,76	1,96	1728	26,19
Minced meat mashed potatoes casserole	2,86	7,36	88	0,24	0,76	677	10,99
Meat pie	1,46	2,71	38	0,17	0,72	388	4,89
Meatballs	4,23	4,55	182	1,10	1,00	877	9,78
Sausage sauce	7,70	10,38	310	1,81	1,96	1713	20,04
Sausage soup	3,19	2,34	229	1,19	0,46	409	5,99
Liver sauce	4,55	9,60	195	0,75	1,01	870	15,16
Liver casserole	2,31	5,45	75	0,22	0,75	517	8,51
Semolina porridge	1,10	2,82	30	0,10	0,31	278	4,23
Noodle soup	1,19	1,21	75	0,45	0,14	128	2,55
Apple pie	2,40	3,89	50	0,25	0,65	494	6,93
Spinach soup	2,09	3,34	103	0,60	0,34	301	5,77
Spinach sauce	2,53	2,44	124	0,81	0,36	319	5,33
Sauce with pork meat	6,06	10,29	154	0,99	1,87	1626	18,22
Lingonberry sorbet	2,13	2,67	44	0,32	0,38	334	5,18
Rice porridge	0,69	1,98	20	0,06	0,40	170	3,06
Game meatballs	1,98	2,11	117	0,59	0,24	218	4,33
Rye porridge	0,19	0,09	13	0,02	0,03	28	0,30
Mushroom soup	0,77	1,33	16	0,07	0,13	113	2,23
Sausage dumplings soup	1,58	2,42	59	0,33	0,52	454	4,52
Pasta with bolete sauce	2,18	3,54	41	0,20	0,44	385	6,16
Tuna salad	1,83	0,93	123	0,83	0,21	23	2,97
Stuffed bread roll without meat	4,96	7,12	229	1,46	0,82	734	12,90
Stuffed bread roll with sausage	4,93	7,05	180	1,21	1,20	1061	13,19
Stuffed tortillas	7,02	8,24	469	2,30	1061,89	773	16,11
Whipped porridge	0,57	0,35	7	0,10	0,07	58	0,98

MIPS results for the total of foodstuffs in each household (kg/person per year).

House-hold	Abiotic	Biotic	Water	Air	Erosion	Soil	TMR
G	683	1 429	29 241	130	442	126 057	2 553
R	1 126	1 186	63 532	299	263	166 579	2 575
V	1 094	1 457	56 049	277	243	161 128	2 795
P	934	1 382	42 002	206	483	142 756	2 799
F	1 129	1 563	64 593	333	278	147 776	2 971
S	1 428	1 468	75 804	387	297	150 868	3 194
Å	1 629	1 530	114 405	429	554	203 911	3 713
A	1 694	1 664	55 730	314	357	201 314	3 714
H	1 528	1 925	75 778	410	297	190 429	3 749
D	1 310	1 951	62 350	269	529	217 868	3 790
T	1 438	2 090	74 081	308	503	233 575	4 030
Q	1 395	2 232	79 073	295	429	230 466	4 056
C	1 352	2 142	67 369	304	607	219 339	4 102
W	1 531	2 098	87 717	424	589	226 281	4 217
L	1 294	2 334	50 691	265	608	220 899	4 236
X	1 449	2 574	47 268	251	384	300 785	4 408
N	1 484	2 044	79 312	397	912	170 152	4 440
O	2 514	1 576	199 000	1 033	352	279 144	4 441
I	1 742	2 211	85 235	263	696	195 553	4 649
K	2 222	1 889	140 338	632	813	242 777	4 923
U	1 879	2 331	90 399	482	974	247 050	5 184
E	2 067	2 534	126 725	611	985	238 770	5 586
B	2 384	3 450	74 462	354	654	401 940	6 488
Z	2 926	3 573	164 212	894	774	393 857	7 273
J	2 053	3 037	98 452	442	2 477	312 552	7 567
Y	3 061	3 682	172 020	843	959	386 469	7 701

MIPS results (kg/person per year) for TMR of foodstuffs in each household.

House-hold	cereals + potatoes	meat	fish	eggs	fats and spreads	dairy	fruits and vege-tables	non-alcoholic beverages	alcoholic bevera-ges	coffee + tea	sugar + sweets	In total
G	262	761	51	49	85	1 047	236	3	0	41	17	2 553
R	518	954	62	163	0	287	479	0	24	13	75	2 575
P	260	157	0	3	124	1 305	464	37	0	206	237	2 793
V	203	731	59	31	289	909	426	54	56	30	8	2 795
F	278	0	3	35	354	1 096	1 153	1	0	0	51	2 971
S	252	0	47	58	91	1 537	830	218	0	72	87	3 194
Å	389	1 095	9	98	0	626	669	156	671	0	0	3 713
A	207	1 193	30	96	0	848	838	329	27	74	71	3 714
H	265	893	19	1	257	1 310	755	142	0	49	59	3 749
D	189	991	5	71	390	1 308	420	73	144	158	42	3 790
Q	400	1 434	220	28	260	869	492	69	131	116	37	4 056
C	407	421	0	155	319	1 741	635	0	48	263	111	4 102
T	177	1 011	58	24	123	1 588	613	83	199	216	71	4 164
W	434	1 279	38	32	371	1 093	772	21	75	58	44	4 217
L	317	1 364	8	73	176	1 327	488	235	6	132	111	4 236
X	247	1 302	65	0	35	2 271	437	0	0	0	50	4 408
N	245	1 556	39	38	130	1 183	915	115	51	98	69	4 440
O	536	0	0	7	86	1 091	2 242	290	97	92	0	4 441
I	375	48	254	0	572	1 535	604	408	346	367	11	4 519
K	326	1 267	41	62	255	815	902	278	480	376	122	4 923
U	259	941	40	66	262	1 794	897	119	206	578	21	5 184
E	391	0	0	67	205	2 593	1 437	51	0	343	498	5 586
B	380	2 066	0	31	79	2 795	429	489	0	204	16	6 488
Z	232	1 641	70	144	714	2 147	1 979	0	71	175	100	7 273
J	417	2 788	4	10	33	2 493	1 213	198	70	67	275	7 567
Y	459	984	254	0	408	3 106	1 665	156	413	189	66	7 701

Appendix 5

MI factors used for the calculations and MIPS results for the natural resource consumption of packaging and waste management

MI-factors used in calculations of packakings and waste management.

	Factor used	Abiotic g per g	Biotic g per g	Water g per g	Air g per g	TMR g per g	Transported distance km	Reference
Aluminium	Aluminium primary	37,00		1047,70	10,87	37,00	140	WI 2003
Bio waste	Non-bleached paper	8,94	2,38	268,10	1,29	11,32	35	WI 2003
Energy waste	1/2 plastic, 1/2 paper						30	WI 2003
Energy waste	LDPE- plastic	2,49		122,20	1,62	2,49	35	WI 2003
Energy waste	Paper bleached	9,17	2,56	303,00	1,28	11,73	20	WI 2003
Carton	Paper bleached	9,17	2,56	303,00	1,28	11,73	20	WI 2003
Cardboard	Corrugated cardboard	1,86	0,75	93,60	0,33	2,61	20	WI 2003
Waste paper	Primary newsprint	0,38	0,94	3,50	0,08	1,32	20	WI 2003
Glass	Container glass, primary	3,04		17,10	0,72	3,04	120	WI 2003
Glass bottles, disposable	Container glass, primary	3,04		17,10	0,72	3,04	120	WI 2003
Glass bottles, reusable	Container glass, primary	3,04		17,10	0,72	3,04	100	WI 2003
Metal	Basic oxygen steel	9,32		81,90	0,77	9,32	140	WI 2003
Plastic bottles disposable	PET 01	6,45		294,20	3,72	6,45	35	WI 2003
Plastic bottles, reusable	PET 01	6,45		294,20	3,72	6,45	100	WI 2003
Mixed waste	PVC, bulk	3,47		305,30	1,70	3,47	35	WI 2003
Land filling	Land filling	0,70		1,50				Salo 2004, own estimation
Transportation (g/tkm)	Light lorry	580,00		6200,00	70,00			Lähteenoja et al. 2006

MIPS results of each household for packaging (kg/person per year).

House-hold	Abiotic	Biotic	Water	Air	Erosion	TMR
H	38	0	1 062	15	0	38
P	32	9	1 071	5	0	41
G	42	11	1 426	7	0	53
W	58	11	2 244	11	0	68
V	115	18	4 425	29	0	133
C	121	0	6 174	49	0	121
E	124	35	4 606	21	0	159
F	158	2	5 858	67	0	160
X	141	0	11 597	65	0	141
Q	176	28	7 080	63	0	204
Z	176	33	7 649	40	0	209
A	140	0	10 755	66	0	140
R	219	27	6 809	45	0	245
T	221	50	7 619	46	0	270
L	243	22	10 935	66	0	265
N	203	28	8 150	53	0	231
B	266	20	8 189	93	0	286
Y	250	18	12 115	86	0	268
S	249	25	7 936	66	0	274
O	266	60	9 030	57	0	326
Å	288	16	16 313	107	0	305
U	293	53	9 419	66	0	346
J	339	55	14 214	81	0	394
I	395	54	12 752	113	0	449
K	397	49	11 676	112	0	446
D	416	74	15 301	107	0	489

MIPS results of each household for waste management (kg/person per year).

Household	Abiotic	Water	Air
H	5	20	0
P	8	28	0
G	5	14	0
W	5	22	0
V	6	24	0
C	21	88	1
E	4	22	0
F	10	46	0
X	50	143	0
Q	13	54	0
Z	12	61	0
A	87	249	1
R	14	58	0
T	1	9	0
L	16	58	0
N	62	179	1
B	18	61	0
Y	36	109	0
S	45	143	1
O	10	49	0
Å	55	158	0
U	22	80	0
J	19	61	0
I	10	60	1
K	17	82	1
D	29	89	0

Appendix 6

MI factors used for the calculations and MIPS results for the natural resource consumption of household goods and appliances

MI-factors used in calculations of household goods (kg per product).
All figures are based on a study by Moisio et al. (2008) TavaraMIPS (Goods MIPS).

Clothing and footwear	Abiotic	Biotic	Water	Air
Jeans	5	1,6	1 200	0,2
Outdoor trousers	4		126	2,0
Other trousers	5	1,1	2 718	2,3
Skirt	5	1,1	2 718	2,3
T-shirt	2	1,2	1 480	12,5
Other shirt (dress shirt)	3	0,4	906	1,4
Knit shirt (polyester/cotton)	6			
Woollen shirt	31	95,0	624	5,4
Woollen jackets	80	242,4	1 809	39,3
Outdoor jacket	7		240	3,8
Other jacket (winter outdoor jacket)	11		707	6,7
Leather shoes	9	22,4	432	2,4
Running shoes	6	0,1	425	3,6
Other footwear	7	11,2	428	3,0
Woollen accessories (caps, glows etc.)	8	25,7	169	1,5
Underwear	0	0,1	341	0,1
Socks	0	0,1	341	0,1
Leather belt	5	6,3	223	1,2
Nightshirt	3	0,4	906	1,4
Shorts	3	0,6	1 359	1,1
College shirt	3	0,4	906	1,4
Rain outfit	1		57	0,7
Tie, scarf etc.	1	0,1	227	0,4
Evening dress	5	1,1	2 718	2,3
Down jacket	80	242,4	1 809	39,3
Fur coat	14	8,2	608	5,7
Leather jacket	10	8,2	427	4,2
Suit (jacket, skirt or trousers each calculated as individual piece)	5	1,1	2 718	2,3
Fleece jacket	6	0,0	193	3,1
Home textiles	Abiotic	Biotic	Water	Air
Rugs				
Cotton, small (approx.100 cm*150 cm)	20	4,2	10 118	8,8
Cotton middle size (140 cm*200 cm)	57	11,9	28 603	24,6
Cotton large (200 cm*300 cm)	92	19,4	46 730	39,9
Wool small	327	1 001,4	6 591	57,1
Wool middle size	830	2 541,9	16 730	144,9
Wool large	1 669	5 109,5	33 628	291,2

Synthetic fibre (polypropylene) small	19		523	12,5
Synthetic fibre middle size	34		929	22,3
Synthetic fibre large	70		1 900	45,7
Rag rug made of new weft, small	20	4,2	10 118	8,8
Rag rug made of new weft, middle size	57	11,9	28 603	24,6
Rag rug made of new weft, large	92	19,4	46 730	39,9
Rag rug made of second hand weft	2	0,6	1 363	0,5
Dirt stopper	14	2,9	6 960	7,4
Other home textiles				
Bed sheet cotton	6	1,2	2 841	2,6
Bed sheet synthetic fibre (polyester)	6	0,0	187	3,0
Blanket cover cotton	15	3,2	7 658	6,7
Blanket cover synthetic fibre (polyester)	15	0,0	494	7,8
Bath towel	5	1,0	2 446	2,2
Hand towel	2	0,4	1 050	1,0
Pillowcase	2	0,4	1 050	1,0
Pillowcase synthetic fibre (polyester)	2	0,0	69	1,1
Pillow	8	0,2	584	3,9
Blanket	17	0,9	2 514	8,2
Down blanket	17	0,9	2 514	8,2
Down pillow	8	0,2	584	3,9
Bedspread	28	6,0	14 311	12,4
Fleece felt (polyester)	12	0,0	386	6,1
Curtains	15	3,2	7 658	6,7
Sofa pillow	8	0,2	584	3,9
Bathrobe	5	1,0	2 446	2,2
Table cloth	6	1,2	2 841	2,6
Wool blanket	80	242,4	1 809	39,3
Furniture	Abiotic	Biotic	Water	Air
Beds and mattresses				
Frame bed (width 90cm), transport from Far East	265	96,9	15 476	145,0
Frame bed (width120cm), transport from Far East	353	128,7	22 571	192,0
Frame bed (width160 cm)	369	164,7	25 690	131,8
Mattress (width 160 cm), transport within Finland	125	1,2	12 616	57,2
Mattress (width 80cm), transport within Finland	62	0,6	6 308	28,6
Bed and mattress (width 140 cm), transport from Far East	585	78,6	7 828	182,1
Sofas				
Sofa with solid wood structures for 2 persons, transport within Europe	261	144,8	37 175	95,9
Sofa with solid wood structures for 2 persons, transport from Far East	331	144,8	37 712	198,3
Sofa for 3 persons, transport within Europe	377	36,6	54 478	151,3

Sofa for 3 persons, transport from Far East	381	90,6	45 828	222,3
Sofa for 3 persons, transport within Finland	363	36,6	54 383	148,8
Sofa-bed, transport within Finland	333	38,6	31 212	71,1
Chairs, tables and shelves				
Kitchen chair (solid pine wood), transport within Europe	43	101,9	916	15,4
Kitchen chair (fibre wood), transport within Europe	17	2,7	585	6,3
Armchair, transport within Finland	107	12,0	16 229	40,0
Armchair, transport from Far East	334	155,1	9 878	174,8
Armchair, transport within Europe	266	155,1	9 355	75,2
Office chair	107	12,0	16 229	40,0
Cane chair, transport from Far East	72	118,1	4 198	44,2
Footstool, transport within Finland	13	6,6	2 710	4,2
Bar chair (solid wood)	43	101,9	916	15,4
Solid wood bench	86	203,8	1 832	30,7
Kitchen table and 4 chairs (solid pine wood), transport within Europe	86	203,7	1 128	27,0
Kitchen table (solid birch wood), transport within Europe	62	162,2	1 658	17,1
Kitchen table (fibre wood), transport within Europe	159	29,5	2 629	24,0
Coffee table (solid oak wood), transport within Finland	76	79,1	4 871	24,2
Desk/ working table, transport within Europe	128	110,4	3 723	34,0
Small table, transport within Europe	17	2,7	584	6,3
Bedside table, transport within Europe	17	2,7	584	6,3
TV table (solid pine wood), transport within Europe	45	117,1	1 224	11,5
Bar table	83	79,1	4 918	25,5
Cane trolley	72	118,1	4 198	44,2
Wooden rack	43	101,9	916	15,4
Solid wood book shelf, transport within Finland	260	878,9	19 972	63,0
Fibreboard book shelf, transport within Europe	360	69,9	11 161	110,8
Drawer, transport within Europe	181	37,1	5 331	52,6
Cane shelf	72	118,1	4 198	44,2
Glass cabinet	311	34,9	6 324	85,6
Electrical and electronic devices, manufacturing	Abiotic	Biotic	Water	Air
Refrigerator	1 378		15 868	133,3
Combined fridge and freezer	2 159		22 255	222,2
Freezer	1 527		28 097	290,2
Electric stove and oven	1 646		19 676	181,7
Dishwasher	768		9 845	70,9
Clothes washer	1 036		19 386	179,2

Tumble drier	939		11 841	109,1
Microwave oven	367		4 621	42,6
Vacuum cleaner	71		1 669	13,3
Electric sauna stove (only materials)	153		1 921	23,2
Coffee maker	53		474	4,3
Kettle	75		234	3,4
Hair dryer	46		118	0,9
Curling iron	14		42	0,6
Toaster	85		283	2,1
Iron	32		27	6,9
TV 14-16" CRT	1 133		18 871	24,0
TV 18-24" CRT	2 832		47 176	61,0
TV 26-36" CRT	7 175		62 092	125,7
TV LCD	2 614		78 928	51,9
TVPLASMA	2 395		39 898	51,3
Videocassette recorder	1 714		17 662	214,8
DVD player	1 714		17 662	214,8
Digital converter box	276		2 846	34,6
Desktop computer	1 464		5 309	87,8
Laptop computer	442		6 180	300,7
Printer	712		11 861	24,0
Mobile phone	26		100	0,5
Incandescent light bulb	1		4	0,1
CFL	2		13	0,2

Shelf metre of books	Abiotic kg per shelf metre	Biotic kg per shelf metre	Water kg per shelf metre	Air kg per shelf metre
	161	45,1	303	22

Calculation of newspaper, magazines and jewellery is based on MI-factors published by the Wuppertal Institute in 2003.

MI-factors used in calculation of daily consumer goods kg per kg

Factors have been estimated by using material content of the products and MI-factors published by the Wuppertal Institute.

Product	Abiotic	Biotic	Water	Air
Kitchen roll	10	3,6	304	2,3
Recycled paper	0	0,2	25	0,1
Lotions	3	0,7	1 433	1,3
Detergents	3		24	1,3
Sanitary napkins	7	1,3	189	4,0
Gauze napkin (cotton+viscose+PA)	8	2,1	2 277	2,4
Coffee filter, unbleached paper	9	2,4	268	1,3
Catlitter	32	0,2	61	2,2
Plastic foil	3		168	1,8
Parchment paper, unbleached	9	2,4	268	1,3
Charcoal	1	4,7	9	0,2
Gravel incl. 50 km transport	1		0	0,1
Incandescent light bulbs	1		4	0,1
CFL's	2		13	0,2
Aluminium foil	37		1 048	10,9
Outdoor candle	4		134	2,2
Candles	3		106	1,9
Candle in a aluminium cup	3		111	2,0
Batteries	9		82	0,8

MIPS results (kg/person per year) for abiotic resources of the goods and appliances in each household.

Household	Clothes	Fabrics	Furniture	Large household appliances	Electrical appliances	Books and magazines	Jewellery	Dishes and cutlery	Tools	Toys and leisure time equipment	Miscellaneous goods	Daily consumer goods	In total
G	30	8	37	74	69	54	68	4	3	5	19	61	430
V	92	31	28	82	174	10	56	6	20	70	6	36	612
H	100	96	37	107	226	180	24	3	72	27	9	32	912
D	66	120	133	71	301	72	86	7	49	108	0	74	1 088
R	98	17	64	0	250	11	51	2	2	1	417	188	1 100
F	119	69	163	226	167	166	57	7	0	5	7	155	1 140
Q	52	17	42	137	518	80	12	5	113	21	0	158	1 154
E	154	29	369	215	20	21	1	10	3	6	310	179	1 317
B	104	57	159	262	20	100	8	4	5	6	0	655	1 379
P	25	30	229	208	629	127	51	1	0	9	5	78	1 392
O	130	11	139	224	188	302	274	1	0	6	118	95	1 488
M	133	177	54	325	471	249	5	14	109	1	1		1 541
S	63	12	35	99	681	80	360	10		8	33	177	1 557
J	68	17	141	116	455	49	51	25	19	3	611	122	1 678
K	183	35	39	373	194	190	231	12	97	0	293	102	1 749
C	68	194	100	338	463	181	132	8	75	23	17	157	1 755
Z	193	61	103	215	605	170	8	6	37	6	247	138	1 788
Å	0	0	222	337	775	263	5	0	33	26	0	139	1 801
N	92	170	224	129	365	419	107	21	14	28	101	166	1 836
T	82	45	61	85	89	229	1 553	1	24	10	16	41	2 237
L	190	47	49	215	577	242	135	7	17	20	659	88	2 248
W	139	50	95	152	400	289	171	26	32	21	842	32	2 250
Y	176	218	406	515	555	185	508	30	77	13	0	112	2 795
U	127	256	195	211	421	835	369	52	157	8	36	371	3 038
A	144	123	103	243	1 201	1 672	122	8	152	0	47	99	3 914
I	320	437	171	314	1 034	469	140	18	986	6	28	300	4 224

MIPS results (kg/person per year) for biotic resources of the goods and appliances in each household.

House-hold	Clot-hes	Fabrics	Furni-ture	Large house-hold applian-ces	Electri-cal applian-ces	Books and magazi-nes	Jewel-lery	Dishes and cutlery	Tools	Toys and leisure time equip-ment	Miscel-laneous goods	Daily con-sumer goods	In total
G	48	1	7	0	0	22	0	0	0	0	43	13	134
V	141	5	76	0	0	3	0	0	0	5	0	5	235
H	126	222	25	0	0	83	0	0	0	4	1	5	466
R	177	3	37	0	0	3	0	0	0	0	11	45	276
Q	72	3	53	0	0	46	0	0	0	2	0	35	211
D	86	246	67	0	0	42	0	0	0	8	0	15	464
S	86	2	9	0	0	30	0	0	0	1	1	51	179
E	256	5	70	0	0	6	0	0	0	1	24	39	401
P	30	4	64	0	0	46	0	0	0	1	0	12	158
B	189	8	43	0	0	32	0	0	0	2	0	68	343
F	235	35	287	0	0	46	0	0	0	1	0	17	621
O	184	2	66	0	0	84	0	0	0	0	2	17	356
J	78	3	162	0	0	33	0	0	0	2	108	21	406
K	295	6	16	0	0	53	0	0	0	0	33	35	438
Z	200	11	42	0	0	133	0	0	0	1	18	25	430
T	127	75	38	0	0	76	0	0	0	2	1	5	324
Å	0	0	396	0	0	139	0	0	0	3	0	32	570
N	148	451	154	0	0	138	0	0	0	1	102	36	1 030
W	165	75	75	0	0	122	0	0	0	5	224	2	669
C	110	511	156	0	0	122	0	0	0	1	1	39	940
L	235	32	103	0	0	149	0	0	0	2	76	17	613
M	216	373	32	0	0	243	0	0	0	1	0		865
U	239	606	95	0	0	294	0	0	0	4	1	54	1 293
Y	283	382	185	0	0	173	0	0	0	3	0	26	1 052
A	234	204	75	0	0	570	0	0	0	0	27	16	1 125
I	300	935	218	0	0	131	0	0	0	1	2	42	1 628

MIPS results (kg/person per year) for water consumption of the goods and appliances in each household.

House-hold	Clothes	Fabrics	Furni-ture	Large house-hold applian-ces	Electri-cal applian-ces	Books and magazi-nes	Jewel-lery	Dishes and cutlery	Tools	Toys and leisure time equip-ment	Miscel-laneous goods	Daily con-sumer goods	In total
G	3 351	2 159	1 081	1 184	415	701	0	27	11	251	554	1 946	11 681
T	14 250	5 738	3 252	1 076	1 913	7 220	0	12	69	226	597	812	35 165
Q	12 320	7 077	3 455	1 727	4 649	1 417	0	14	300	676	0	3 889	35 523
R	18 170	6 879	2 476	0	3 092	348	0	21	4	42	1 549	5 595	38 177
P	5 281	10 309	8 314	2 927	5 785	4 079	4	33	3	312	12	1 689	38 748
V	18 540	12 712	1 896	1 199	1 685	162	1	90	68	1 699	247	581	38 880
Å	0	0	16 093	4 752	7 726	6 656	0	0	92	1 214	0	4 078	40 611
S	16 049	3 910	1 896	1 121	5 830	2 158	1	12	0	342	74	10 565	41 957
H	26 041	11 035	2 247	1 553	2 283	4 880	175	41	459	879	271	655	50 519
J	23 378	7 612	7 431	1 586	4 704	631	0	22	48	222	1 945	3 140	50 719
D	15 412	19 113	6 318	977	3 285	1 562	7	38	129	3 437	0	1 729	52 008
C	12 334	13 918	5 143	4 240	7 419	3 866	5	75	520	521	744	4 457	53 242
N	16 526	11 002	9 377	1 806	3 571	12 427	43	15	47	797	4 131	4 351	64 095
B	22 974	19 785	5 472	3 330	81	2 432	0	49	46	227	0	11 154	65 549
O	30 255	5 717	6 018	2 605	1 979	9 484	20	7	0	474	8 640	2 221	67 421
M	27 420	22 671	5 181	3 992	4 897	6 356	0	31	276	46	30		70 900
F	25 450	26 823	11 111	2 660	2 225	5 513	3	90	2	405	14	2 669	76 965
K	44 064	14 189	2 224	5 617	2 788	3 825	261	72	243	29	2 287	3 000	78 600
E	35 265	11 750	11 221	2 473	116	628	10	136	29	537	14 177	5 128	81 470
W	36 299	12 349	3 620	2 239	5 590	8 137	255	180	167	1 246	15 069	568	85 720
U	18 623	31 218	9 032	3 223	4 334	23 083	0	64	691	205	1 159	7 205	98 839
L	54 038	17 807	3 900	3 130	7 121	5 704	37	56	111	1 183	8 506	2 270	103 863
Z	53 147	27 405	4 811	2 759	9 656	4 677	0	21	165	427	7 859	3 264	114 190
Y	31 601	42 803	21 499	8 061	7 644	3 725	0	45	294	293	0	3 224	119 188
A	24 314	25 284	6 650	3 209	12 741	51 781	1	45	422	4	390	2 073	126 913
I	112 791	49 833	10 956	4 019	10 139	9 797	0	71	2 490	150	55	5 592	205 895

MIPS results (kg/person per year) for air consumption of the goods and appliances in each household.

House-hold	Clot-hes	Fabrics	Furni-ture	Large house-hold applian-ces	Electri-cal applian-ces	Books and magazi-nes	Jewel-lery	Dishes and cutlery	Tools	Toys and leisure time equip-ment	Miscel-laneous goods	Daily con-sumer goods	In total
G	15	3	11	11	4	8	0	0	0	2	3	13	72
S	37	6	10	11	34	11	0	0	0	1	3	80	193
V	47	14	7	11	22	1	0	1	1	10	2	13	130
T	53	15	17	11	3	32	0	0	1	4	2	16	155
Q	36	8	13	16	45	12	0	0	4	7	0	68	208
H	72	24	10	14	17	26	1	1	5	10	1	10	190
R	74	8	26	0	39	1	0	0	0	0	36	43	227
F	54	32	43	25	7	23	0	1	0	1	0	48	234
P	16	15	71	26	42	18	0	1	0	2	0	25	215
D	41	34	42	8	47	11	0	1	2	17	0	17	219
Å	0	0	62	45	56	39	0	0	1	8	0	32	243
B	106	26	49	32	1	14	0	1	0	3	0	198	430
J	76	8	40	15	28	7	0	0	1	1	68	39	283
C	40	43	32	40	71	27	0	1	6	1	5	32	297
K	131	15	13	53	5	26	1	1	3	0	31	33	314
M	87	48	20	37	50	40	0	0	4	1	0		287
E	54	13	112	23	1	3	0	2	0	2	82	69	362
N	69	36	61	16	20	59	0	0	1	12	21	77	372
O	88	5	42	25	70	42	0	0	0	4	72	19	366
L	141	21	16	29	51	36	0	1	1	9	56	21	383
W	111	16	30	21	34	41	1	3	2	7	122	11	399
Y	84	66	127	78	28	29	0	1	3	6	0	27	450
U	86	66	61	30	52	118	0	1	9	4	10	105	544
Z	197	27	33	26	83	26	0	0	2	2	76	23	497
A	100	39	35	30	113	236	0	1	6	0	6	17	582
I	242	121	45	37	75	65	0	1	34	3	2	99	724

Appendix 7

MI factors used for the calculations and MIPS results for the natural resource consumption of leisure time activities

Some figures presented here differ from the figures in the Finnish report. The figures given here are consistent to each other in terms of system boundaries and should be used preferably.

	Abiotic kg per h	Biotic kg per h	Water kg per h	Air kg per h	Reference
Golf	47,29				3
Walking on walking path	1,40		33,00		3
Fitness centre	6,10	0,04	609,00	1,80	3
Sports track	0,90	0,00	126,00	0,20	3
Down hill skiing	2,45		57,57	0,03	1
Sports hall	5,60	0,00	621,00	2,10	3
Gym	6,10	0,05	609,00	1,80	3
Motorcycling	61,43		29,68	10,69	1
Motocross	40,58	0,00	20,61	7,08	1
Listening to music	1,00	0,00	0,00	0,00	4
Music school	4,13	0,00	200,64	1,30	4
Sailing1	35,00	0,00	261,00	8,00	4
Going to restaurant	3,00	0,00	0,00	0,00	5
Theatre	12,00		622,00	3,00	4
Sports field, artificial turf	5,70	0,00	39,00	0,40	3
Using computer	1,00				6
Watching TV	1,00	0,00	0,00	0,00	4
Swimming hall	10,80	0,04	1 114,00	4,50	3
Outdoor swim hall	9,19	0,01	428,73	2,08	7
Boating with small boat and motor[2]	2,00	0,00	20,00	2,00	4
Rowing a boat[2]	0,6	0,01	11	0,23	4

[1] without driving to marina
[2] small boat without marina

	Abiotic kg per visit	Biotic kg per visit	Water kg per visit	Air kg per visit	Reference
Going to movies	1,94	0,00	240,82	0,39	1
Down hill skiing	12,25		287,84	0,16	1
Going to the theatre	37,76	0,00	1 868,12	8,42	4
	Abiotic kg per passenger-km	Biotic kg per passenger-km	Water kg per passenger-km	Air kg per passenger-km	Reference
Bicycling	0,38		12,10	0,02	2
Passeger car	2,02		20,33	0,19	2
Passeger car	1,44		14,50	0,14	2
Bus	0,32		3,20	0,06	2
Metro	0,29		29,40	0,04	2
Bicycling	0,38		12,10	0,02	2
Consumption of the bicycle	0,05	0,00	6,56	0,02	2
Tram	0,36		48,10	0,07	2
Train	1,20		29,00	0,04	2

1 = own estimation
2 = Lähteenoja et al. 2006a
3 = Luoto et al. 2008
4 = Veuro et al. 2008
5 = Juric & Vogel 2005
6 = Moisio et al. 2008
7 = own estimation after Luoto et al. 2008

MIPS results of each household for leisure time activities (kg/person per year).

Household	Abiotic kg per person per year	Biotic kg per person per year	Water kg per person per year	Air kg per person per year	Tmr kg per person per year
E	593	0	18876	31	593
C	721	1	1540	32	722
G	874	0	22556	113	874
Y	974	0	13586	42	974
B	988	0	0	0	988
V	999	1	39346	187	1000
U	1119	0	30773	193	1119
Q	1156	0	20470	103	1156
S	1399	0	25175	108	1399
H	1880	0	61104	186	1880
I	1897	0	12867	261	1897
P	1982	3	61738	356	1985
D	1992	0	53641	282	1992
L	2144	1	70432	311	2145
O	2550	0	32003	136	2550
M	2590	0	44961	196	2590
Å	2643	0	105218	498	2643
W	2876	0	35153	490	2876
T	2897	0	11086	58	2897
A	2944	0	76111	407	2944
Z	3743	2	90923	463	3745
J	4090	1	81937	533	4091
N	4299	0	99625	562	4299
R	4451	6	134703	611	4457
K	4619	7	147645	647	4626
F	6016	0	156948	656	6016
X	15990	0	98845	2029	15990

Appendix 8

Question framework for the focus group interviews

Participation in study

- Personal introduction and reply to the question regarding how the interviewee feels about his or her participation in the study.
- What did your family members, friends, relatives or acquaintances think about the study?
- How well did participating in the study meet your own expectations?
- Did participating in the study affect your concept of environmentally responsible actions?

Significance of the MIPS results

- What do you think about the information provided by the MIPS calculations?
- Was there anything surprising? Was anything already familiar?
- Did the MIPS data help you to visualise the environmental impact of consumption?
- Where have you previously obtained information about the environmental impact of consumption?
- How does the information provided by MIPS compare with other sources of information?
- What effect will this new information have on your own daily life in the future?

Reducing material consumption

- What things are important when making consumption decisions? What things do you take into account?
- What components of consumption offer the most scope for making environmentally friendly choices?
- What offer the least?
- What factors prevent the making of environmentally friendly choices?
- How could these barriers be dismantled?
- What could be more effective ways of reducing the ecological backpack? What about the easiest?
- What could the other parties (companies, the government) do to reduce the environmental impacts of consumption?

DOCUMENTATION PAGE

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<tr><td>Abstract</td><td colspan="3">In this study the natural resource consumption of 27 Finnish households was calculated using the MIPS (material input per service unit) method. The households monitored their consumption over a 6-week period for seven components – housing, mobility, tourism, foodstuffs, household goods and appliances, leisure time activities, and packaging and household wastes. In the consumption monitoring only the households' direct consumption was taken into account and not consumption due to, e.g. public services. MIPS figures were calculated for five natural resource categories: abiotic natural resources, biotic natural resources, water, air and erosion. Service performance was expressed as kilograms per person per year. The calculation of natural resource consumption was based to a large extent on previously carried out sub-studies under the main FIN-MIPS study on households. The sub-studies focused on foodstuffs, leisure time activities, tourism, household goods and appliances, and construction.
All the people participating in the study were interested in environmental issues to a greater extent than the average Finn. Nevertheless, the difference between the household consuming the most, and the one consuming the least, natural resources was approximately 10-fold. Especially for mobility and tourism there were appreciable differences between the households.
The most material-intensive consumption components with reference to the households studied are housing, mobility and tourism. The TMR (total material requirement, i.e. abiotic and biotic natural resources and erosion combined) is approximately 10,000 kg per person per year. In the case of foodstuffs the average TMR per person per year is around 4,000 kg, in relation to household goods and appliances, about 2,000 kg, and in the packaging and waste sector approximately 200 kg. The precise definition of each component in the study has an influence on the results. The ranking of the different consumption components is the same in terms of air consumption, which is correlated with CO2 emissions, but housing consumes around twice as much air as do tourism and mobility. Home heating accounts for the highest proportion of air consumption by housing.
After the consumption monitoring, the households participated in focus group interviews in which the opportunities available for reducing natural resource consumption were debated. The conclusion to the report is based on the consumption monitoring results and focus group interviews. In it the authors ask what consumption components might offer consumers potential for reducing their natural resource consumption and what the barriers to modifying consumption practices are. It is the opinion of the households that in relation to housing the easiest way to reduce natural resource consumption is to change over to eco-electricity and in the case of foodstuffs to cut down on the amount of meat and cheese consumed. Incentives and guidelines are necessary for increasing consumers' willingness to change their habits in their daily mobility and particularly in tourism, and for creating opportunities for this. In addition to changes in consumer choices and practices, and for the support of such changes, novel technical solutions, e.g. low-energy dwellings, are required for conserving natural resources. The business sector and the government have a significant role to play in increasing the demand for solutions of this kind and in offering them to the public.</td></tr>
<tr><td>Keywords</td><td colspan="3">Households, natural resources, consumption, sustainable consumption, resource efficiency, eco-efficiency, MIPS, TMR, ecological backpack, housing, mobility, food, tourism, hobbies, goods and appliances, consumer behavior</td></tr>
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KUVAILULEHTI

Julkaisija	Ympäristöministeriö Ympäristönsuojeluosasto			*Julkaisuaika* Lokakuu 2008
Tekijä(t)	Elli Kotakorpi, Satu Lähteenoja, Michael Lettenmeier			
Julkaisun nimi	**Household MIPS – Natural resource consumption of Finnish households and its reduction** (KotiMIPS – Kotitalouksien luonnonvarojen kulutus ja sen pienentäminen)			
Julkaisusarjan nimi ja numero	Suomen ympäristö 43en/2008			
Julkaisun teema	Ympäristönsuojelu			
Julkaisun osat/ muut saman projektin tuottamat julkaisut	FIN-MIPS Kotitalous -hankkeen osatutkimuksia on julkaistu viisi. MatkailuMIPS on julkaistu TEM:n sarjassa (8/2008), KTK:n sarjassa on julkaistu LiikuntaMIPS (4/2008), HarrastusMIPS (5/2008) ja TavaraMIPS (6/2008). ElintarvikeMIPS on julkaistu MTTn sarjassa (met 130).			
Tiivistelmä	Tutkimuksessa laskettiin 27 suomalaisen kotitalouden luonnonvarojen kulutus MIPS-menetelmän (material input per service unit) avulla. Kotitaloudet seurasivat kulutustaan kuuden viikon ajan seitsemällä osa-alueella, jotka olivat asuminen, liikenne, matkailu, elintarvikkeet, kodin tavarat, harrastukset sekä pakkaukset ja kotitalousjätteet. Kulutusseurannassa otettiin huomioon vain kotitalouksien suora kulutus, ei esimerkiksi julkisten palvelujen aiheuttamaa kulutusta. MIPS-luvut laskettiin viidessä luonnonvaraluokassa: abioottiset luonnonvarat, bioottiset luonnonvarat, vesi, ilma ja eroosio. Palvelusuoritteena käytettiin kg/henkilö/vuosi. Luonnonvarojen kulutuksen laskeminen perustui suurelta osin FIN-MIPS Kotitalous -tutkimushankkeen aikaisempiin osatutkimuksiin, joissa selvitettiin elintarvikkeiden, harrastusten, matkailun, tavaroiden ja rakentamisen luonnonvarojen kulutusta. Vaikka kaikki tutkimukseen osallistuneet ihmiset olivat kiinnostuneempia ympäristöasioista kuin suomalaiset keskimäärin, oli eniten ja vähiten luonnonvaroja kuluttavan kotitalouden ero noin kymmenkertainen. Varsinkin liikenteessä ja matkailussa kotitalouksen erot olivat huomattavia. Tutkittujen kotitalouksien kulutuksen materiaali-intensiivisimmät osa-alueet ovat asuminen, liikenne ja matkailu. Näiden osa-alueiden TMR (total material requirement, abioottisten ja bioottisten luonnonvarojen kulutus sekä eroosio yhteenlaskettuna) on noin 10 000 kg henkilöä kohden vuodessa. Elintarvikkeissa keskimääräinen TMR henkilöä kohden vuodessa on noin 4 000 kg, kodin tavaroissa noin 2 000 kg ja pakkauksissa ja jätteissä noin 200 kg. Tutkimuksessa tehdyt kulutuksen osa-alueiden rajaukset vaikuttavat tuloksiin. Ilman kulutuksessa, joka kytkeytyy hiilidioksidipäästöihin, eri kulutussektoreiden järjestys on samanlainen, mutta asuminen kuluttaa ilmaa noin kaksinkertaisesti verrattuna matkailuun ja liikenteeseen. Asunnon lämmitys muodostaa suurimman osan asumisen ilman kulutuksesta. Kulutusseurannan jälkeen kotitaloudet osallistuivat ryhmähaastatteluihin, joissa keskusteltiin luonnonvarojen kulutuksen pienentämismahdollisuuksista. Raportin johtopäätöksissä pohditaan kulutusseurannan tulosten ja ryhmähaastattelujen perusteella, millä kulutuksen osa-alueilla olisi potentiaalia luonnonvarojen kulutuksen vähentämiseen ja mitä esteitä kulutustapojen muutokselle on. Asumisessa kotitalouksien näkökulmasta helpoin keino vähentää luonnonvarojen kulutusta on ekosähköön vaihtaminen ja elintarvikkeissa lihan ja juuston kulutuksen vähentäminen. Arkiliikenteessä ja erityisesti matkailussa tarvitaan kannustimia ja yhteiskunnan ohjauskeinoja lisäämään kuluttajien valmiutta ja mahdollisuuksia muuttaa liikkumistottumuksiaan. Kuluttajien valintojen ja käyttäytymisen muutosten lisäksi ja niitä tukemaan tarvitaan uusia teknisiä ratkaisuja luonnonvarojen säästämiseen, esimerkiksi matalaenergiataloja. Tällaisten ratkaisujen tarjonnan ja kysynnän lisäämisessä elinkeinoelämällä ja viranomaisilla on merkittävä rooli.			
Asiasanat	Kotitalous, luonnonvarat, kulutus, kestävä kulutus, materiaalitehokkuus, ekotehokkuus, MIPS, TMR, ekologinen selkäreppu, asuminen, liikenne, ruoka, matkailu, harrastukset, tavarat, kuluttajakäyttäytyminen			
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<tr><td>Publikationens tema</td><td colspan="3">Miljövård</td></tr>
<tr><td>Publikationens delar/ andra publikationer inom samma projekt</td><td colspan="3">FIN-MIPS Privathushåll – Fem delundersökningar av projektet har publicerats. TurismMIPS har publicerats i serien TEM (8/2008), i serien KTK har MotionMIPS (4/2008) , HobbyMIPS (5/2008) och VarorMIPS (6/2008). LivsmedelMIPS har publicerats i serien MTT (met 130).</td></tr>
<tr><td>Sammandrag</td><td colspan="3">Undersökningen omfattade en beräkning av förbrukningen av naturresurser i 27 finländska privathushåll med hjälp av MIPS-metoden (material input per service unit). Privathushållen observerade sin förbrukning på sju delområden under sex veckor. Delområdena bestod av boende, trafik, turism, livsmedel, varor i hemmet, intressen samt förpackningar och avfallshantering. Förbrukningskontrollen beaktade endast privathushållens direkta förbrukning, inte till exempel förbrukningen genom offentliga tjänster. MIPS-talen beräknades i fem naturresursklasser: abiotiska naturresurser, biotiska naturresurser, vatten, luft och erosion. Som serviceprestation användes kg/person/år. Beräkningen av naturresursförbrukningen byggde till stor del på forskningsprojektet FIN-MIPS Privathushålls tidigare delundersökningar, där naturresursförbrukningen av livsmedel, intressen, turism, varor och byggande beskrevs.

Även om alla personer som deltog i undersökningen var mer intresserade av miljöfrågor än finländarna i snitt, var skillnaden tiofaldig mellan det privathushåll som förbrukade mest naturresurser och det som förbrukade minst. I synnerhet i fråga om trafiken och turismen var skillnaderna mellan hushållen betydande.

De materialintensivaste delområdena bland de undersökta privathushållen var boende, trafik och turism. Delområdenas TMR (total material requirement, förbrukningen av abiotiska och biotiska naturresurser samt erosionen sammanräknat) uppgick till ca 10 000 kg per person per år. Den genomsnittliga TMR per person per år var ungefär 4 000 kg för livsmedel, ca 2 000 kg för varor i hemmet och ca 200 kg för förpackningar och avfallshantering. Förbrukningens begränsningar till delområden i undersökningen inverkade på resultatet. För förbrukningen av luft, som hänför sig till koldioxidutsläpp, är rangordningen den samma för de olika förbrukningssektorerna, men boendet förbrukar ca 2 gånger mer luft än turism och trafik. Uppvärmningen av bostaden utgör den största delen av boendets luftförbrukning.

Efter förbrukningsobservationerna deltog hushållen i gruppintervjuer där man diskuterade möjligheterna att minska förbrukningen av naturresurser. Utgående från konsumtionsobservationernas resultat och gruppintervjuerna diskuteras i rapportens slutledningar på vilka delområden av förbrukningen det kunde finnas potential att minska naturresursförbrukningen och vilka hinder som föreligger för att åstadkomma en förändring av förbrukningsvanorna. Ur privathushållens synvinkel är det lättaste sättet att minska naturresursförbrukningen när det gäller boendet att byta till eko-el och när det gäller livsmedel att minska på konsumtionen av kött och ost. När det gäller vardagstrafiken och i synnerhet turismen behövs det sporrar och samhälleliga styrmetoder för att öka konsumenternas beredskap och möjligheter att ändra på sina resvanor. Utöver konsumenternas val och beteenden, och som stöd för dem, behövs det nya tekniska lösningar för att spara på naturresurserna, till exempel lågenergihus. Näringslivet och myndigheterna spelar en viktig roll för att man ska kunna öka utbudet och efterfrågan på sådana lösningar.</td></tr>
<tr><td>Nyckelord</td><td colspan="3">Privathushåll, naturresurser, förbrukning, hållbar förbrukning, materialeffektivitet, ekoeffektivitet, MIPS, TMR, ekologisk ryggsäck, boende, trafik, mat, turism, intressen, varor, konsumentbeteende</td></tr>
<tr><td>Finansiär/ uppdragsgivare</td><td colspan="3">Finlands naturskyddsförbund, miljöministeriet, arbets- och näringsministeriet, Kesko Oy, Päijät-Hämeen Jätehuolto, Lahden seudun ympäristöpalvelut, Ekokumppanit Oy, Helsingfors stad, Kansalaisjärjestöjen kierrätysliike</td></tr>
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How much natural resources do Finnish households consume? What does resource consumption consist of? How can the resource consumption be reduced? This report answers these and other questions. In the research project the natural resource consumption of 27 Finnish households was calculated with the MIPS method (material input per service unit). The consumption components studied were housing, mobility, foodstuffs, tourism, leisure time activities and household goods and appliances.

Differences of even ten-fold were found in the resource consumption of the households studied. The components that consumed the most were mobility, tourism and housing. Besides the research results, the report presents the calculation methods used and the consumption and MIPS data. The report also includes the results of the focus group interviews with the households that participated in the study. On the basis of the interviews the action space of the consumers, that is the social and structural factors influencing sustainable consumption, is shown. In addition to interested consumers, the research can be utilised by consumer and environmental NGOs, governments and politicians, researchers and students from different disciplines and other people interested in resource efficiency. The appendices of the report present a comprehensive summary of the MIPS figures calculated in Finland.

The research project FIN-MIPS Household – Promoting Sustainable Consumption, which the Finnish Association for Nature Conservation carried out during 2006 to 2008, was part of the fourth environmental cluster programme "Eco-efficient society" of the Finnish Ministry of the Environment.

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