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**Substitute or addition to hypermobile lifestyles?
Second home mobility and Finnish CO₂ emissions**

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Substitute or addition to hypermobile lifestyles? Second home mobility and Finnish CO₂ emissions

Abstract

Tourism produces an increasing share in global greenhouse gas (GHG) emissions. These are mostly derived from transport emissions, and long-haul air travel in particular. Short-haul domestic tourism is believed by some to be a potential substitute for long-haul tourism. Using the example of Finland this paper examines the extent to which domestic second home tourism can substitute for other leisure trips and therefore contribute to reductions of travel-generated GHG emissions. Survey data are used to evaluate the CO₂ emissions caused by travel to domestic second homes, and to create statistical models that verify if the owners of domestic second homes travel to other leisure destinations less frequently than others, and if they cause less emissions by their leisure mobility than others with comparable economic and demographic background. We find that although the owners and users of domestic second homes travel for other leisure purposes less frequently than others, this does not mean their leisure mobility generates less emissions. Overall, owners of second homes produce significantly more CO₂ by their leisure mobility than non-owners. The use of second homes does not seem to be a substitute for high emission long-haul travels, but rather a part of an overall highly mobile leisure lifestyle. It is therefore necessary to better understand and influence the entire range of individual mobility behaviours in order to reduce travel-related GHG emissions.

Keywords

second homes, leisure mobility, greenhouse gas emissions, CO₂ emissions, substitution, travel behaviour, Finland

Introduction

The contribution of tourism to global greenhouse gas (GHG) emissions is increasing (Gossling, Scott, & Hall, 2013). Transport and long-distance air travel in particular have been recognised as being extremely problematic with respect to the impact of tourism on emissions (Gossling et al., 2013; Scott, Gossling, & Hall, 2012a, 2012b; Scott, Hall, & Gossling, 2016). Therefore, changing travel behaviours has become a significant focus in reducing emissions (Gossling, Hall, Peeters, & Scott, 2010; Gossling, Scott, Hall, Ceron, & Dubois, 2012; Kaján & Saarinen, 2013; Scott, Gossling, Hall, & Peeters, 2016). Emphasis has been placed on a number of actions including encouraging greater use of public transport (Le-Klähn & Hall, 2015) and 'slow' tourism (Fullagar, Markwell, & Wilson, 2012). However, a major focus is the encouragement of short-haul and domestic travel especially as a substitute for long-haul international tourism (Dolnicar, Laesser, & Matus, 2010; Peeters & Landré, 2011).

Second homes are a major part of domestic tourism in many countries and are popularly considered as an environmentally friendly form of tourism, although their environmental impact has become increasingly debated (Hall, 2014; Long & Hoogendoorn, 2013). Nevertheless, it has been argued that if people would not travel to their domestic second homes they would potentially travel abroad which would be even worse for the environment. For example, Gallent, Mace, and Tewdwr-Jones (2005) speculate that although second homes are a 'luxury good', 'if we take a practical view, that people with surplus income will spend that income in one way or another, then it could be argued that discouraging second home ownership in Britain could lead to alternatives that are even more detrimental to the environment' (p. 62). Nevertheless, there is relatively little knowledge of the extent of GHG

emissions arising from domestic second home travel and its relative contributions to tourism emissions.

Therefore, this study examines travel to second homes in Finland, a country with one of the highest levels of second home access and ownership in the world (Hiltunen, Pitkänen, Vepsäläinen, & Hall, 2013). It uses carbon dioxide (CO₂) emissions as proxy for overall GHG emissions. The aim of the study is twofold: First, it investigates the impacts of second home tourism on climate change through the generation of CO₂ emissions. Then, it explores if short-haul trips to second homes replace long-haul tourism mobility and thus reduces overall tourism/leisure related CO₂ emissions. These two aims translate into three specific research questions: First, how much CO₂ is produced by trips to second homes in Finland? Second, excluding visits to second homes, do owners and users of domestic second homes travel for leisure purposes less frequently than others, including international journeys? And third, do owners and users of domestic second homes cause less CO₂ emission by their overall leisure mobility than others with comparable economic and demographic characteristics? Before answering these questions the paper provides an account of previous research on second homes and emissions before detailing the study's methods.

Literature

Although there is a rapidly growing international literature on the potential impacts of climate change on second homes (Hall, 2014), there is only a limited account of emissions arising from second home mobility (Scott et al., 2012b). Kelly and Williams (2007) examined the energy consumption and GHG emissions of a major second home resort area, Whistler in Canada, and Walz et al. (2008) Davos in Switzerland, but neither study separated out second home travel in their analysis.

In the French context Dubois and Ceron (2006) noted the extent to which second homes had a substantial effect on mobility patterns encouraging frequent departures from the main home, and suggested that in 2000 second home related mobility (which they termed bi-residentiality) contributed 3% of all tourism and leisure GHG emissions by type of mobility. In comparison very long distance and long distance mobility contributed 55% and 22% of GHG emissions, respectively. However, the specific emissions arising from second home travel appear rarely reported in national assessments of tourism emissions. This arguably may be because of the difficulties associated with defining second homes and including them in national tourism and travel surveys, as well as a possible perception that their contribution is limited.

Numerous studies suggest that second homes are an important part of leisure mobility in many countries and that second home ownership and use influences other types of mobility (leisure/work/everyday life) (Hall & Müller, 2004). Significantly, second homes are not just a domestic phenomenon (Müller, 2002). Growth in international second homes has been identified as being interrelated to the development of budget airline routes (Hares, Dickinson, & Wilkes, 2010; Hepburn & Müller, 2010). Most second home owners tend to have their declared permanent home close to the second home (Müller, 2006), although the frequency of visitation may lead to a significant annual travel distance.

In their study on second homes in Germany and the Netherlands Dijst, Lanzendorf, Barendregt, and Smit (2005) found that Germans travelled annually approximately 5300 km and Dutch 4259 km to visit their second homes. Private cars were the primary means of transport (95% of Dutch second home owners and 85% of German). Interestingly, the study

found that second home owners used cars more often and travelled longer distances for all leisure activities. The study concluded that second homes induced more car travel over longer distances and that it is important to include the ownership of recreational dwellings in models explaining travel behaviours.

Second home ownership, as a cultural and geographical phenomenon, is extensive in the Nordic countries (Lithander, Tynelius, Malmsten, Råbock, & Fransson, 2012; Müller, 2007). In Finland second home ownership and tourism is among the most popular forms of domestic tourism. At the end of 2014 there were half a million (500,400) registered second homes and approximately 3000 new ones are built annually (Statistics Finland, 2015a). In addition, there are around 170,000 rural vacant detached houses, of which over 70% are used as second homes (Sikiö, Pitkänen, & Rehunen, 2014). Almost 800,000 citizens belong to a household which owns a second home; however, it has been estimated that every second family, i.e. around three million Finns, have access to second homes since they are also used by friends and relatives of the owners (Nieminen, 2010). Second homes locate predominantly along shorelines accessible from urban areas, and are visited mostly during the summer season (Hiltunen & Rehunen, 2014). An increasing proportion of households have access to more than one second home. Finnish second homes are largely a domestic phenomenon and only about 1% of second homes owned by Finns are located abroad (survey results). These are mostly in Mediterranean counties, which make mobility related to them distinct from that associated with domestic second homes.

Second homes in Finnish travel surveys

There are four national surveys that provide regular information on trips and mobility to second homes in Finland. These are

- 1) The Finnish Travel Survey (Statistics Finland, 2001, 2012),
- 2) The Free-time Residence Barometer (Nieminen, 2004, 2010),
- 3) The National Outdoor Recreation Demand Inventory LVVI (Sievänen & Neuvonen, 2011), and
- 4) The National Travel Survey HLT (Finnish Transport Agency, 2012a, 2012b).

These national surveys are not fully comparable because of methodical differences. Nevertheless, three of the four surveys indicate that the travel volume to second homes has been increasing since 2000 (Table 1).

<INSERT Table 1. Travels to second homes in Finland according to previous travel surveys ABOUT HERE>

Finnish Travel Survey

The Finnish Travel Survey is a telephone survey conducted by Statistics Finland. It provides statistics of 15–74-year-old citizens' trips with overnight stays and until 2012 has distinguished trips made to own second home. In 2011 (monthly sample size 2200, response rate 65%) Finns made 31.2 million domestic free time trips with at least one overnight stay (Statistics Finland, 2012). The amount of trips to own second homes was 5.9 million (19% of total), which was slightly higher than overnights in paid accommodation (5.8 million, 18.5%). Visits to friends and relatives accounted for 62% of all domestic free time trips. The total amount of trips made to own second homes has also doubled since 2000 with short weekend

trips rising considerably whereas long trips with four or more overnights have shown less increase (Hiltunen & Rehunen, 2014).

Free-time Residence Barometer

The Free-time Residence Barometer is a monitoring system describing the development of second home tourism in Finland. It is ordered by the Ministry of Employment and the Economy, and delivered by Statistics Finland. The Barometer is conducted approximately every five years and is based on a postal survey of second home owners. Comparison of the results from 2003 (N = 3200, response rate 64%) (Nieminen, 2004) and 2008 (N = 2629, response rate 55%) (Nieminen, 2010) indicates that the average number of nights spent at second homes increased along with average distance and travelling time.

National Outdoor Recreation Demand Inventory LVVI

The National Outdoor Recreation Demand Inventory LVVI is a survey that examines the recreational use of the natural environment. According to the latest LVVI 2010 Study (N = 8895, response rate 37%) nearly 41% of Finns can use a summer cottage (*kesämökki*) on a regular basis and 65% have access to a cottage. From 2000 to 2010 the use of summer cottages increased, especially among the retired age group of 65–74 year olds but also among 15–24 year olds (Sievänen, 2001; Sievänen & Neuvonen, 2011). The rising building standards of second homes likely influence their increasing use as well. The LVVI 2010 Study indicates that 45% of second homes are traditional summer cottages without modern facilities, 39% are modern cottages or villas fitted for year round use and 16% are detached houses or old farmhouses. The younger generations have greater access to modern second homes than the older ones who are more likely to adjust to traditional modest summer cottages (Sievänen & Neuvonen, 2011; see also Pitkänen, Puhakka, Semi & Hall, 2014).

National Travel Survey HLT

The National Travel Survey HLT is a large telephone survey conducted by the Finnish Transport Agency providing an overall picture of Finnish passenger mobility. The HLT Survey includes daily trips made by Finns over six years old every day during one year (Pastinen, Rantala, Lehto, & Nurmela, 2012). The most recent HLT Survey 2010–2011 (N = 12,318, response rate 56%) shows that the number of all daily leisure trips including visits to friends and relatives has decreased while the number of daily shopping and personal business trips has increased. According to this survey 34% of Finns have access to a cottage. Trips to the cottages account for 5.3% of all domestic daily trips and 11% of daily leisure trips in person kilometres (pkm). Cottage owners and users drive private cars more often and also travel more kilometres for other leisure purposes than other Finns. Most active travellers are those who own more than one second home (Kalenoja, Kiiskilä, & Heikkilä, 2009). The average travel distance to the cottage is 55 km. The group that travels most person kilometres to cottages are women between 55 and 64 years old (4.5 pkm/day). For men the highest frequency of cottage travels appears in the 65–74 years age group (3.8 pkm/day) (Finnish Transport Agency, 2012a).

Contrary to the three surveys discussed earlier, comparison of the results of HLT surveys 1998–1999, 2004–2005 and 2010–2011 indicates a decrease in the number of cottage trips and related total person kilometres travelled. The number of cottage trips decreased especially among the people in working age (35–64 years old). However, among the active retirees

(aged 65–74) the number of cottage trips remained the same (29 trips a year). The HLT survey does not measure overnight trips; however, the numbers of cottage trips made on Fridays suggest that the number of weekend stays has remained the same. The share of cottage trips over 100 km grew slightly from 10.0% to 11.4% (Finnish Transport Agency, 2012b).

These national surveys provide measurements on second home trips and travel patterns in different ways and with different variables, thus giving only a limited overview of second home tourism in Finland. For example, the first two surveys address only second home owners and do not include other regular users. The LVVI and HLT studies in turn ask about the use of summer cottages which does not necessarily include all forms of second housing. Nevertheless, despite the methodical differences, three surveys give a similar general image of increasing frequency and length of travels to second homes, reinforcing their importance for leisure mobility in the Finnish context.

Previous studies of second homes and CO₂ in Finland

A small number of studies have looked into the energy consumption and/or GHG emissions related to second homes in Finland. In her examination of the environmental impacts of rural second home tourism in the Finnish Lakeland, Hiltunen (2007) estimated that the yearly emission of CO₂ was on average 1264 kg/year per car and 599 kg/year per person. This calculation was based on average annual visits and travel distances of a limited sample of second home owners living permanently in Helsinki capital region and travelling to their second homes in the Finnish Lakeland.

The Leisure Living and Eco-efficiency (VAPES) project has looked into eco-efficient technical and social innovations and practices related to second homes (Rytkönen & Kirkkari, 2010; Ahlqvist, Santavuori, Mustonen, Massa, & Rytkönen, 2008; Perrels & Kangas, 2007). Although emissions related to second home mobility were not a specific focus, the project concludes that traffic is a significant source of emissions. Ahlqvist et al. (2008) estimated that trips to second homes resulted in 0.4 million tons of CO₂ in 1999 and trips to second homes comprise 7% of all distance travelled by private cars. Based on Finnish national travel survey (HLT 2004–2005), the project estimated that the annual energy consumption of mobility related to second homes is approximately 1070 GWh, equivalent to about 0.26 million tons of CO₂. This estimation is based on Finns daily mobility of which on average 2.6 km (6.3%, 950 km annually) is related to second homes. In comparison, energy consumption of the use of electricity at second homes reaches only to 500–900 GWh a year.

Based on different methods, these studies provide a very rough estimation of CO₂ emissions of Finnish second home mobility. Neither study scrutinises differences between second home owners and other groups, nor takes into account how distance affects second home mobility. Nevertheless, all studies indicate that the private car is the predominant mode of transport in traveling to second homes, while private mobility and the growing winterization of cottages may also contribute to increased commuting between primary and secondary residences and parallel consumption (Heinonen, Jalas, Juntunen, Ala-Mantila, & Junnila, 2013a, 2013b). Other studies have suggested that second homes can also be considered eco-efficient in certain terms. According to Perrels and Kangas (2007), even though second home owners travel relatively long daily distances when travelling to and from second homes, they travel less kilometres a day than the national average during their stays at second homes. This may

be interpreted as suggesting that second homes can be a relatively eco-efficient alternative for leisure time if the duration of the trip is long enough.

Data and methods

This study is based on the results of a nation-wide mail survey on leisure travel and second home use conducted in 2012. Questionnaires were sent to a random sample of 4000 Finnish inhabitants aged 15–85. After one reminder 1189 questionnaires were returned (response rate 29.7%) and 1107 cases were used in the analysis after excluding incomplete responses.

The survey attempted to gather information on respondent's entire leisure travel behaviour, which incurred two methodological issues. First, due to the multitude of possible forms, destinations and time patterns of trips (length of trips and recurrence of visits) it would be impossible to ask closed-ended question without losing a large part of information. Second, the respondents might have problems with recalling all their trips, particularly in case of regular but short travels to second homes or friends and relatives, so questions were not asked about too long a time period (Frei, Kuhnimhof, & Axhausen, 2010). Having considered those reservations, an open-ended questionnaire was constructed that asked respondents to enumerate five places they visited for leisure purposes for at least one overnight during the preceding year. The survey asked about the location of those places, type of accommodation used, if the respondents owned the place they visited, if they visited the place recurrently and, if so, how many times per year. Twelve per cent of respondents filled all five spaces, which means that possibly a few percent may have filled more spaces if they had been provided.

The questionnaires were filled in personally, but on the basis of previous Finnish travel surveys (discussed earlier) it was assumed that most leisure travel is made by households, so households were used as units of the further analysis (though other groups, e.g. groups of friends, are also potentially important). The following categories of accommodation were defined as domestic second homes: purpose-built summer cottages (Finnish *mökki*), farms and previous permanent houses converted into second homes, urban second homes, time-shares, allotment cottages (if they were used for overnight stays) and caravans or trailers (if permanently located). Second homes located outside Finland were not regarded as second homes in the analysis, but instead were treated as foreign destinations. Respondents that owned and visited one or more domestic second home at least once a year were classified as second home owners. Those who visited a domestic second home at least once a year, but do not own any, were classified as second home users. These two categories are disjoint, so when mentioning second home users we refer only to those who visit, but do not own a second home. A third category used in the analysis is non-users consisting of respondents who do not use or own a domestic second home.

Second home owners and users were asked additional questions about kilometres covered and means of transport used when travelling to second homes. Based on the answers we estimated yearly distances covered by households by four means of transport: car, bus, train and flight due to travels between place of permanent residence and second home. All other mobility related to second home construction and use is excluded from the analysis. Other frequently mentioned means of transport – motorboats and ferries – are excluded from the analysis, because they are usually used only for very short parts of trips, mostly to access cottages located on islands. If the respondent selected several means of transport, the frequency of use of each of them was considered to be equal. In the case of car transport it was assumed that

one household uses one car to go to second home and in case of public transport the distance was multiplied by the number of household members.

For the trips to destinations other than second homes distances were calculated based on the information on the place of residence and destination only. Assumptions as to which means of transport were used for domestic travel were based on information provided by Statistics Finland (2012): 79% of all domestic leisure trips are made by cars, and among public means of transport more energy-efficient trains and buses are balanced by less energy-efficient flights (the difference between total emission estimations assuming only car use and using real proportions of means of transport is less than 5%). Therefore, it was assumed that only cars are used for all domestic leisure trips other than to second homes. For international leisure trips, based on data on destinations and means of transport used for foreign travels (Statistics Finland, 2012; Finnish Transport Agency, 2012a), it was assumed that trips to Estonia, Sweden, Norway and Russia are made by car, or consist of a travel chain of a car and ferry, and beyond these countries all international trips are made by flight. Distances for air traffic were calculated as the shortest connections between the regional airport closest to the respondents' place of residence and destination airport.

LIPASTO, a calculation system and inventory tool for traffic exhaust emissions and energy consumption in Finland developed by the Technical Research Centre of Finland in 2009–2012 (VTT, 2012), was used to estimate GHG emissions caused by travels to second homes and other forms of leisure mobility. Only CO₂ emissions, which are proportional to other widely used mobility-related GHG emission measures as CO₂ equivalent or energy consumption, were used. The average emission estimations for 2011 were: for cars, 165 g of CO₂ per vehicle km; for buses, 48 g per pkm (person kilometre); for trains, 34 g per pkm; for domestic flights, 217 g per pkm; for international flights, 131 g per pkm; and for ferries, 232 g per pkm. These estimations are approximate, but reflect the average mobility emissions in the Finnish case. More exact estimation would require precise information such as class and age of vehicle, type of fuel and road in case of car transport, type of aircraft, seat classes and length of flights in case of air transport (see, e.g. Statistics Netherlands, 2014).

To answer the research question about the difference between second home owners, users and non-users in their leisure mobility, the three groups were compared in terms of the mean frequencies of three categories of leisure trips: to domestic second homes, other domestic trips and trips abroad. Next, the three groups were compared in terms of the CO₂ emitted from the three categories of leisure trips. The average leisure mobility and related CO₂ emission of socio-demographic subgroups of the sample divided by household size, respondents' age, education, socioeconomic position, household income and type of area of permanent residence were also examined.

The impact of ownership or use of second homes on mobility may interfere with the effects of socio-demographic factors, e.g. couples in older age and higher income are more often owners of second homes, so simple comparison of means will not confirm that higher or lower mobility of the second home owners group results from the access to a second home rather than from underlying socio-demographic factors. To measure the independent effect of ownership or use of second homes on the numbers of trips and generated emission, we developed multifactor ANOVA models. The models assess the independent impacts of each of the explaining variables by the *F*-statistics. Estimated marginal means inform about the values of dependent variables (numbers of trips and CO₂ emission) for each category of households assuming that the influence of all other variables is removed. Among the

explaining variables in the models, apart from the ownership/use of second home, four controlling variables were included: household size, respondents' age, household income and type of area of permanent residence. Socioeconomic position of a household (which proved to be highly correlated with the age variable) and respondents' education (which, after testing the models, had no significant independent effect in any of them) were excluded.

Results

Sample description

Half of the respondents represent two-person households and the rest is divided equally between single persons and families of three and more (Table 2). The study sample is not fully representative for the Finnish population in terms of demographic and socio-economic profile. Most of the respondents are of middle and older age. Only 28.0% respondents are 15-45 years old, although they constitute 45.2% of the Finnish population between 15 and 85 years old. People with elementary education answered the survey less frequently than others and respondents with secondary education prevail in the sample (55.4%, but only 39.5% in whole population). Pensioners are overrepresented in the sample (36.3%, compared to 27.8% in total population), and those in relatively lower income ranges answered more frequently than more affluent ones. The sample is representative of the Finnish population in terms of distribution of places of residence both regionally and across different levels of the urban-rural hierarchy, and in terms of language (Finnish or Swedish speaking population), although only represents a small proportion of foreign-born residents (5.7% of Finnish population, but only 1.1% of the sample).

<INSERT Table 2. Background characteristics of the study sample ABOUT HERE>

One-third of the respondents (33.2%) owned at least one second home that they visited during the year prior to the study, so they were classified as second home owners. 23.5% visited at least one second home owned by someone from their family or friends and they were named second home users. The remaining 43.4% did not visit any second home during the preceding year (non-users). Second home mobility is often related to more than one second home, 26.7% of second home owners and 29.2% of second home users used at least two different second homes. Due to a possible sample bias towards those interested in the topic of second homes, the proportions of their owners and users are possibly higher than in the wider population, although this does not affect the result of the study which primarily aims to compare these three groups in terms of leisure mobility and related CO₂ emission. In comparison to other groups, second home owners are more often older employed or retired people, with secondary or higher education, living in Helsinki or other large urban areas in a two-person household with higher than average income. Second home users also tend to live in large cities, be well educated, but in contrast to the owners are typically younger, have larger households, and are more often employed (Table 2).

CO₂ emissions from trips to second homes

Second home owners visit second homes on average 25.9 times a year and users 10.3 times a year. The mean distance between the place of permanent residence and second home is 167 km in case of second home owners and 229 km for second home users (Table 3). These values are higher than results of other Finnish surveys (Nieminen, 2010), which may be caused by differences in survey methodology, question and definition of second home.

Second homes located close to the permanent residence are generally visited more frequently than more distant ones. Second home owners cover on average 3882 km, and second home users 1708 km yearly during their trips to second homes.

<INSERT Table 3. Estimated yearly CO₂ emission caused by trips to domestic second homes ABOUT HERE>

Individual car transport is the dominant means of transport used in trips to second homes. 91.7% owners and users do not use any public means of transport. 96.8% of trips to second homes accounting for 94.7% of travelled kilometers are done by car. Public transport is mostly used for longer distances. Train and bus shares in the number of trips are 2.0% and 1.1% respectively, and in travelled distance 2.7% and 1.9%. Air transport is only used for trips to second homes located in ski resorts of northern Finland from the Helsinki region (0.1% of trips and 0.8% of kilometres are covered by flights). Individual car transport is also dominant in the structure of CO₂ emissions from the trips to second homes, producing 95.1% of the total of CO₂ emission related to second home mobility. Although air transport has a very low trip share, it has a larger emission effect (2.5% of total) than trains and buses (1.7% and 1.0%, respectively).

Trips to second homes by one second home owner or user household cause an average emission of 495.9 kg CO₂ per year (Table 3). This is broadly equivalent to one person's round trip flight from Finland to Central Europe. Based on the total number of second homes in Finland according to Statistics Finland and survey results we can estimate the number of households that own or use a second home at approximately 800,000. Thus the total CO₂ emission from trips to second homes amounts to 400,000 tons a year, which is significantly above Rytkönen and Kirkkari's (2010) estimated energy consumption equivalent of 260,000 tons CO₂. However, this is still not a large share of the total emissions as it accounts for 0.8% of total 51 million tons of CO₂ emitted in Finland in 2012 and 3.3% of emissions from transport (Statistics Finland, 2015b).

Because of their frequency of visits second home owners produce on average twice as much emissions as the users from their trips to second homes. The distribution of CO₂ emissions caused by mobility to second homes is skewed towards higher values (Figure 1): the highest emitting quarter of relatively frequent visitors to their rather distant second homes produce almost two-thirds of the total emission, while the lowest emitting quarter of infrequent visitors to closely located second home is responsible for only 3% of the emissions.

<INSERT Figure 1. Distribution of yearly CO₂ emission caused by trips to domestic second homes ABOUT HERE>

Comparing leisure mobility of second home owners, users and non-users

The majority of all respondents (87.9%) had at least one overnight leisure trip during the past year. On average, they visited 2.5 places, and frequently their visits to one place were recurrent, hence every respondent travelled on average 15.2 times during the year (Table 4). Second homes were the most frequently visited places accounting for 38.7% of destinations and 72.2% of trips (11.0 trips per year on average). The respondents also made on average 3.4 trips to other domestic destinations: they were mostly visits to relatives and friends (17.6% places and 16.4% visits), hotels and motels were popular for single trips (29.0% places, 5.1% visits) and the remaining domestic trips were made to other kinds of commercial

accommodation. 37.5% of the respondents travelled abroad, foreign destinations accounted for 28.6% of the places visited, but only 5.3% of the total number of trips as they were usually non-recurrent. Couples and families travel more often than single respondents, older age people are less mobile than others. Respondents belonging to higher economic strata are more mobile than others, particularly when international trips are compared. Urban dwellers travel more than rural dwellers. Residents of the capital urban region travel relatively less frequently than inhabitants of other urban areas, but choose foreign destinations more often.

<INSERT Table 4. Number of leisure trips per year ABOUT HERE>

Comparing the mobility of second home owners, users and non-users it is evident that the owners and the users are the most frequent travellers: with 28.6 and 14.5 leisure trips a year respectively, while non-users did only 5.4. Those who do not use second homes undertake more frequent travels to other domestic destinations (4.6 trips per year compared to 1.9 for owners and 3.4 for users). Domestic destinations other than second homes are relatively more distant from permanent places of residence than second homes (mean distance 275 km). All three groups travelled abroad with similar frequency: on average 0.8 times a year. Single comparison shows no difference in the most energy-consuming international trips between those who use and do not use domestic second homes which seems to refute the argument that second home trips potentially replace more energy-consuming forms of mobility. However, it is probable that the owners and users of second homes are more mobile overall due to their socio-demographic profile. For example, higher household affluence increases the chance of both owning a second home and undertaking international trips. The impact of the use of second homes on leisure mobility can be verified by controlling for the impact of socio-demographic characteristics of households using multifactor ANOVA and presenting estimated marginal means of numbers of trips (Table 5).

<INSERT Table 5. Number of leisure trips per year: multifactor ANOVA ABOUT HERE>

Ownership or use of a second home appears to be the strongest factor affecting the frequency of total leisure trips. With other variables held constant, owners are expected to travel for leisure purposes 29.0 times a year, users 13.1 times, and non-users 5.2 times. The frequency of travels is also significantly affected by the age of respondents: members of the youngest age group (up to 44 years old) travel more than other respondents. The impacts of other factors: size of a household, its income and area of permanent residence, do not reach statistical significance threshold. Trips to second homes are obviously performed only by their owners and users (the estimated marginal mean for non-owners is not zero due to estimation error), and are also significantly affected by the place of permanent residence: residents of the Helsinki region tend to visit their second homes much less frequently than residents of other urban areas, mainly due to longer distances to their second homes. The trips to domestic destinations other than second homes are much more common among younger than older respondents. It partially explains the lower frequency of travels among owners of second homes (which are usually older), but even when controlling for age and other variables, the non-users of second homes travel to other domestic destinations more frequently than owners and users, which confirms that trips to second homes replace other domestic travels. Similarly in the case of foreign trips: non-users of second homes travel more than two other groups after controlling for other variables, particularly the incomes that determine it the most. Here however, the difference between groups in terms of second home use is not statistically significant. The residents of Helsinki area travel abroad more frequently than other Finns, which compensates for their lower propensity to travel to domestic destinations (see Heinonen

& Junnila, 2011). The ANOVA analysis partially corroborates the hypothesis that second home ownership and use is related to lower frequency of travels to other destinations: it is evident in the case of domestic trips, but we cannot state definitely that second home owners and users travel abroad less frequently than the non-users. The possibility that reductions in other forms of mobility or lifestyle offsets trips to second homes in terms of CO₂ emission effect will be examined in the next section.

Comparing CO₂ emissions from leisure mobility of second home owners, users and non-users

According to the analysis the annual leisure mobility of an average household caused emissions of 1557.7 kg of CO₂ (Table 6). Only 17.8% of this amount was produced by mobility to second homes and 11.9% by remaining domestic leisure mobility whereas 70.3% of total emissions was caused by international leisure trips. The dominance of international mobility in the emission structure results from extensive use of air transport and relatively long distances travelled by Finns to foreign destinations, not only compared to domestic trips, but also with other European nations. For example, transport emissions from a single international trip of a surveyed Finnish household (1369 kg of CO₂) is double the estimated total emissions (of which only 56% is caused by transport) from an international trip of a Dutch tourist (Pels, Eijgelaar, Peeters, Bruijn, & Dirven, 2014). Based on the survey results, the total CO₂ emission from leisure mobility in Finland can be roughly estimated at 4 million tons, which is 7.8% of 51 million tons of CO₂ emissions from the country in 2012 (which however does not include international aviation) and is close to the emissions from industrial processes and product use or 1/5 of emissions from energy industries (Statistics Finland, 2015b).

<INSERT Table 6. Estimated yearly CO₂ emission from leisure mobility (kg) ABOUT HERE>

The dominance of infrequent international travel in the structure of emissions leads to its highly skewed distribution across the study sample (Figure 2). A quarter of the most mobile respondents caused 78% of total emissions, and 35% of emissions can be attributed to only 5% of respondents, while the bottom quarter of respondents are responsible for only 0.1% of total emissions. Such results are consistent with earlier studies on mobility-induced emissions that highlight the responsibility of a small number of hypermobile travelers for a large share of emissions (Gössling, Ceron, Dubios, & Hall, 2009).

<INSERT Figure 2. Distribution of yearly CO₂ emission caused by leisure mobility ABOUT HERE>

The total CO₂ emissions caused by second home owners' and users' mobility were much higher than for the non-users of second homes (2.2, 1.5 and 1.1 t respectively). Only a part of that surplus results from trips to second homes (0.6 and 0.3 t, respectively). It is also a result of emissions from trips abroad, higher in the case of second home owners (1.4 t) and users (1.1 t) than non-users (0.9 t). Total emissions were also higher for larger and more affluent households, and residents of Helsinki region. They were lower for older respondents. Further multifactor ANOVA models were elaborated to check how second home ownership or use affects the total emissions independently from the socio-economic characteristics of a household (Table 7).

<INSERT Table 7. Estimated yearly CO₂ emission from leisure mobility (kg): multifactor ANOVA ABOUT HERE>

The controlling variables play significant roles in the models: income, place of residence and household size appear to affect CO₂ emissions to a substantial degree (see also Strandell & Hall, 2015). Second home ownership does influence the total emissions caused by leisure mobility as well. There are significant differences between second home owners and the other two groups. Marginal means of CO₂ emissions are estimated to be 2.1 t for second home owners, and 1.5 t for both second home users and non-users. Only a minor part of emissions from second home owners and users is caused by trips to second homes (about 29% for second home owners and about 18% for second home users). Emissions from other domestic mobility are higher for non-users, but the largest component, the emissions from international mobility, does not differ significantly between the three groups after controlling for other variables. Thus, we can conclude that second home ownership and use do not contribute to a decrease in CO₂ emission from overall leisure mobility. On the contrary, trips to second homes appear to cause additional emissions, which are not compensated by decreased emissions from other forms of leisure mobility.

There is seemingly a contradiction between the results of models in Tables 5 and 7. Second home owners and users travel a bit less frequently than non-users to other destinations, but the emission effect of those travels does not differ between groups. This may be explained by the distance structure of travels whereby second home use replaces other short trips in Finland or neighbouring countries. Also previous research has indicated that second home owners travel equally or more often to long-haul destinations (Perrels & Kangas, 2007; Kalanoja et al. 2009). Moreover, second home as well as other short leisure trips tend to be marked by different motives than more distant travel (Hall, 2014), and thus second home use in fact does not act as a replacement for the majority of medium and long-haul travel.

Discussion and conclusions

The results enable us to estimate the per household CO₂ emission caused by mobility to second homes at 495.9 kg per year, and a corresponding estimate of a total of 400,000 tons a year arising from all travel to second homes in Finland. The results confirm that excluding visits to second homes, owners and users of domestic second homes travel for leisure purposes less frequently than others. This can potentially be explained by the limited time budgets that people have for travel and time taken for second home visits excludes its use for other travel (Hall, 2005). However, this replacement effect mostly affects domestic trips, and not long-haul international trips, which cause the largest share of travel-related GHG emissions. As a result, when looking at the amount of CO₂ emissions, we find that second home owners produce significantly more CO₂ by their overall leisure mobility than others (users or non-users). This finding reflects that of Gössling et al. (2009) who suggested that hypermobile travellers own more second homes than the French population on average (+25%). Although second home ownership seems to have a negative effect on the frequency of other leisure trips, second home owners still travel more overall than non-owners and thereby also produce more emissions. Rather than be a substitute for high emission travel, for the majority of second home owners the second home is instead part of an overall highly mobile leisure lifestyle.

The results of this research highlight the importance of understanding overall individual travel behaviour rather than focusing on different forms or factors of leisure mobility in isolation.

Neither second homes (Gallent et al., 2005), nor short-haul city travel (Dolnicar et al., 2010), nor denser urban development (Strandell & Hall, 2015; Heinonen et al., 2013b) are solutions by themselves to encourage more sustainable forms of mobility. Indeed, an important future research question may be the extent to which second home ownership only serves to reinforce and normalise high levels of leisure mobility. The capacity to substitute domestic second home tourism for long-haul travel is restricted by different travel motivations as well as lifestyles. However, better understandings of travel behaviour in relation to perceptions of personal contributions to climate change (Gössling et al., 2012), may provide some basis for the development of social marketing interventions that persuade individuals to travel to the second home *instead of* travelling internationally, especially for longer stays (Hall, 2013). To be effective it however probably requires the support of direct regulatory policies, e.g. effective taxation and/or offsetting of transport emissions, especially of aviation (Scott, Gössling, Hall, & Peeters, 2016).

Although the share of second homes of the total energy consumption of Finland is small, recent changes in Finnish second home culture suggest a growing trend of increased energy consumption (Hiltunen et al., 2013). Second homes are increasingly winterised and used year round, also of concern with respect to mobility patterns are that second homes are acquired further away from home than ever before, including abroad. In addition, people are acquiring not only a second home but increasingly also a third home. Although such purchases may also be related to retirement strategies (Hall, 2014), they nevertheless have implications for mobility as well. In general, there are no signs of decreasing popularity of second homes yet the maintenance and use of two or more residences considerably decreases not only the eco-efficiency of housing due to mobility, but also resource and energy use, emissions, waste and overall consumption. The owners of second homes are relatively little concerned about the harmful environmental impacts of the ever increasing second home consumption, as their environmental perceptions are mediated by place-based experiences and values of second home environments and nature. Therefore, reducing environmental impacts of multiple residence consumption requires the enhancement of the second home owners' awareness by appealing directly to their personal experiences and values (Hiltunen, Pitkänen, & Halseth, 2015).

Despite shedding considerable light on the GHG emissions of second home tourism in Finland this study has a number of limitations. The inconsistencies of outcomes of previous mobility surveys and our results illustrate manifold difficulties in using surveys to measure leisure mobility, including that related to second homes. It is difficult to control for the impact of socio-economic factors, especially wealth. There is a need therefore to look at the intersections between wealth, ownership and overall mobility behaviour. The application of the results beyond the Finnish experience may be debatable. The study design was appropriate to the Finnish case with relatively high access to mostly domestic second homes and the geographic location and structure of tourist trips justifying the distinction between short-haul domestic and long-haul international tourism. Such an approach would be inappropriate in the case of small countries where even short trips may often cross international borders, or for large countries such as the USA or Australia where domestic trips may vary very much in travel distances. Nevertheless, the results of the study appear to resonate elsewhere in Europe at least (Gössling et al., 2009). International second homes are not examined in this study, but are growing in popularity. In addition to Finns travelling abroad, the overall CO₂ load of second home tourism is also contributed by foreigners, particularly Norwegians and Russians, with properties in Finland (Honkanen, Pitkänen & Hall, 2015).

Moreover, it cannot readily be derived from the study if second home use replaces day-trips, which were not included in the analysis. Available Finnish data suggest that this may not necessarily be the case. According to the results of the National Travel Survey, second home owners and users in all age groups make more leisure trips than others, including trips for shopping, culture, sports or restaurants, which are typically day-trips ((Finnish Transport Agency, 2012a; Kalenoja, Kiiskilä & Heikkilä, 2009). However, these results were not controlled for wealth or other variables. Therefore, more detailed methods such as mobility diaries or mobile positioning and tracking are needed to study whether and to what extent different forms and lengths of domestic and international leisure mobility compensate each other.

There are a number of other topics related to second homes and emissions that warrant future study, these include a more detailed analysis of mobility at the second home (Perrels & Kangas, 2007); and a life-cycle analysis of energy and emission cost at second homes versus other tourism accommodation. Finally, individual mobility behaviour is a dynamic process which cannot be fully understood using static cross-sectional study. Instead, longitudinal analyses are necessary to track changes in lifestyles over the lifecourse, e.g. after acquiring a second home. Also, research should be targeted at new second home developments as the number of marginal trips 'generated' by a new development depends fundamentally on how individuals adjust to the location and how travel behaviour adjusts to new housing choices and destinations. In such a case individuals may be reshuffling existing trips in response to the new location, rather than generating new ones (Millard-Ball, 2015).

As almost all consumption, be it services or products, involves GHG emissions, looking at the emissions from transport and housing may not in themselves be sufficient to define whether one form would be more desirable than another (Heinonen et al., 2013a). However, what this paper highlights is the need to take a much closer look at the assumptions that are often made about tourism and leisure choices and their implications for emissions. In particular, the research emphasises the importance of examining the relationship between mobility and emissions within the context of the total mobility of the individual rather than a tourism activity per se. As the paper suggests, while second home trips may be lower in emissions than international flights the households who undertake the most trips to second homes do not appear to substitute second home travel for long distant travel, instead they are highly mobile individuals. The challenge of lowering the emissions from tourism may therefore reside more in understanding and influencing the mobility lifestyles of people than in simply suggesting that second home development compensates for international travel.

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Table 1. Travels to second homes in Finland according to previous travel surveys

Finnish Travel Survey	2000	2011	
Trips total	2.95 million	5.94 million	
Short trips (1–3 overnights)	2.27 million	4.44 million	
Long trips (4 and more overnights)	0.68 million	1.50 million	
Free-time Residence Barometer	2003	2008	
Mean/median number of day trips per year	no data	21/10	
Mean/median number of days spent per year	72/no data	75/65	
Mean/median distance from permanent residence	107 km/50 km	118 km/60 km	
Mean/median travel time from permanent residence	90 minutes/50 minutes	99 minutes/60 minutes	
Outdoor Recreation Demand Inventory LVVI	2000	2010	
Mean/median number of visits per year	31/16	38/17	
Mean/median number of days spent per year	31/no data	43/30	
National Travel Survey HLT	1998–1999	2004–2005	2010–2011
Number of trips per day	0.048	0.046	0.039
Number of trips per year	17.5	16.8	14.2
Travel distance per trip (km)	52.62	58.75	55.45
Total person kilometers travelled per day	2.526	2.726	2.185
Total person kilometers travelled per year	922.0	995.0	797.5

Sources: Statistics Finland (2001, 2012); Nieminen (2004, 2010); Sievänen (2001); Sievänen and Neuvonen (2011); Finnish Transport Agency (2012b).

Table 2. Background characteristics of the study sample

Variable name and values	Share in:				
	Total sample (%)	Second home owners (%)	Second home users (%)	Non-users (%)	Total Finnish population ¹ (%)
Number of household members					
1	24.9	17.7	22.7	31.7	no data
2	50.3	61.0	45.8	44.6	
3 and more	24.8	21.3	31.5	23.8	
Age of respondent					
15–44 years	28.0	14.2	45.8	29.0	45.2
45–64 years	41.5	51.5	41.2	34.0	34.1
65–85 years	30.5	34.3	13.1	37.1	20.7
Education level of respondent					
Elementary	17.8	12.3	10.8	25.8	32.3
Secondary	55.4	58.3	54.2	53.8	39.5
Higher	26.8	29.4	35.0	20.4	28.2
Socioeconomic position of respondent					
Employed	51.2	53.7	61.9	43.5	52.2
Pensioner	36.3	40.9	18.1	42.7	27.8
Other	12.5	5.4	20.0	13.8	20.0
Household yearly income					
<20k €	19.7	10.6	16.9	28.1	12.5 ²
20–39k €	27.3	23.4	26.5	30.6	22.9 ²
40–89k €	42.6	49.3	46.5	35.4	44.8 ²
≥90k €	10.4	16.6	10.0	5.8	19.8 ²
Permanent residence urban area					
Helsinki area	22.3	25.9	28.5	16.3	No data
More than 80k inhabitants	24.5	27.0	27.3	21.0	
25–79k inhabitants	18.8	18.0	18.1	19.8	
Outside urban areas	34.4	29.2	26.2	42.9	

Number of cases: 1107.

¹ Share in total Finnish population aged 15–85 in 2012 according to Statistics Finland.

² Data for 2010.

Table 3. Estimated annual CO₂ emission caused by trips to domestic second homes

	Distance to second home	Number of visits per year	Distance covered yearly by:				Estimated emission (kg CO ₂)
			Car (km)	Bus (pkm)	Train (pkm)	Flight (pkm)	
Second home owners	167.4	25.92	3679	126	265	63	643.3
Second home users	229.3	10.33	1615	61	63	60	287.8
Owners and users	193.0	19.46	2823	99	181	62	495.9

Note: Number of cases: 627.

Table 4. Number of leisure trips per year

	Total leisure trips	Trips to domestic second homes	Trips to other domestic destinations	Trips abroad
Mean	15.24	11.02	3.42	0.80
Ownership/use of second home				
Owners	28.60	25.92	1.88	0.80
Users	14.49	10.33	3.45	0.72
Non-users	5.44	0.00	4.59	0.85
Number of household members				
1	10.63	7.12	2.72	0.79
2	16.29	12.96	2.50	0.84
3 and more	17.76	11.01	5.99	0.76
Age of respondent				
15–44 years	17.42	8.63	8.06	0.73
45–64 years	15.59	12.55	2.13	0.91
65–85 years	12.78	11.13	0.92	0.73
Education level of respondent				
Elementary	11.70	7.93	3.40	0.37
Secondary	15.59	11.62	3.17	0.80
Higher	16.88	11.84	3.95	1.10
Socioeconomic position of respondent				
Employed	16.66	11.79	3.94	0.93
Pensioner	12.64	10.89	1.01	0.73
Other	17.01	8.22	8.29	0.49
Household yearly income				
<20k €	7.76	5.36	2.10	0.30
20–39k €	14.22	10.02	3.41	0.79
40–89k €	18.81	13.69	4.23	0.88
≥90k €	17.50	13.42	2.63	1.46
Permanent residence area				
Helsinki urban area	12.90	8.90	2.71	1.28
Urban area >80k inhabitants	18.34	14.56	3.10	0.67
Urban area 25–79k inhabitants	16.79	12.43	3.67	0.68
Outside urban areas	13.72	9.10	3.97	0.65

Note: Number of cases: 1107.

Table 5. Number of leisure trips per year: multifactor ANOVA

	Total leisure trips	Trips to domestic second homes	Trips to other domestic destinations	Trips abroad
Dependent variable characteristics				
Mean value	15.24	11.02	3.42	0.80
Standard deviation	32.25	30.00	12.91	2.38
ANOVA <i>F</i> -statistics:				
Total model	11.85**	15.97**	6.14**	2.99**
Access to a second home	56.75**	80.80**	3.61*	1.90
Number of household members	0.05	0.05	0.13	1.43
Age of respondent	3.66*	0.17	22.38**	0.14
Household yearly income	1.21	0.56	0.84	6.30**
Permanent residence area	2.16	2.63*	0.52	2.78*
Intercept	189.44**	124.64**	48.28**	87.43**
Estimated marginal means:				
Ownership/use of second home				
Owners	28.97	25.44	2.81	0.72
Users	13.10	10.06	2.30	0.74
Non-users	5.18	-0.55	4.71	1.02
Number of household members				
1	15.38	11.19	3.15	1.04
2	15.59	11.72	3.06	0.81
3 and more	16.27	12.04	3.60	0.63
Age of respondent				
15–44 years	19.90	11.57	7.56	0.76
45–64 years	13.71	11.06	1.79	0.86
65–85 years	13.63	12.31	0.47	0.85
Household yearly income				
<20k €	12.96	10.58	2.23	0.15
20–39k €	16.93	12.27	3.94	0.73
40–89k €	18.03	13.28	3.79	0.95
≥90k €	15.06	10.46	3.13	1.47
Permanent residence area				
Helsinki urban area	11.51	7.58	2.72	1.21
Urban area >80k inhabitants	17.63	14.03	2.89	0.71
Urban area 25–79k inhabitants	17.76	13.45	3.64	0.68
Outside urban areas	16.09	11.54	3.85	0.70

Notes: Number of cases: 1107. Main effects model. * $p < 0.05$, ** $p < 0.001$.

Table 6. Estimated yearly CO₂ emission from leisure mobility (kg)

	Total leisure trips	Trips to domestic second homes	Trips to other domestic destinations	Trips abroad
Mean	1557.7	277.7	185.1	1095.0
Ownership/use of second home				
Owners	2174.7	635.9	136.6	1402.1
Users	1539.2	284.5	197.1	1057.6
Non-users	1096.1	0.0	215.7	880.4
Number of household members				
1	684.4	183.0	146.25	355.2
2	1586.9	343.4	165.3	1077.2
3 and more	2378.2	239.4	262.6	1876.2
Age of respondent				
15–44 years	1765.6	238.3	351.1	1176.2
45–64 years	1916.1	321.9	164.8	1429.3
65–85 years	880.5	253.6	60.5	566.4
Education level of respondent				
Elementary	1116.6	150.5	135.5	830.6
Secondary	1382.6	295.8	158.2	928.6
Higher	2211.8	324.5	273.7	1613.6
Socioeconomic position of respondent				
Employed	2116.1	323.9	229.4	1562.8
Pensioner	855.8	245.5	70.0	540.3
Other	1308.3	181.5	338.4	788.4
Household yearly income				
<20k €	446.0	111.2	106.8	228.0
20–39k €	990.0	223.8	155.5	610.7
40–89k €	1982.3	344.6	231.2	1406.5
≥90k €	3413.7	460.0	222.4	2731.2
Permanent residence area				
Helsinki urban area	2312.7	429.9	191.5	1691.2
Urban area >80k inhabitants	1472.0	285.4	162.5	1024.0
Urban area 25–79k inhabitants	1501.3	307.1	222.7	971.5
Outside urban areas	1160.1	157.3	176.5	826.2

Note: Number of cases: 1107.

Table 7. Estimated yearly CO₂ emission from leisure mobility (kg): multifactor ANOVA

	Total leisure trips	Trips to domestic second homes	Trips to other domestic destinations	Trips abroad
Dependent variable characteristics				
Mean value	1557.7	277.7	185.1	1095.0
Standard deviation	3372.6	502.9	472.6	3244.32
ANOVA <i>F</i> -statistics:				
Total model	9.13**	44.50**	6.85**	6.46**
Access to a second home	3.98*	192.58**	3.71*	0.48
Number of household members	3.78*	3.31*	0.48	4.89*
Age of respondent	1.67	1.17	25.80**	1.37
Household yearly income	7.76**	2.06	1.79	6.57**
Permanent residence area	3.43*	8.17**	0.83	2.36
Intercept	202.26**	384.57**	111.32	109.69**
Estimated marginal means:				
Ownership/use of second home				
Owners	2137.4	621.4	159.7	1356.2
Users	1512.8	269.8	149.6	1093.4
Non-users	1523.2	23.5	234.6	1265.1
Number of household members				
1	1285.8	308.3	189.7	787.9
2	1688.0	346.5	195.9	1145.7
3 and more	2199.5	259.8	158.4	1781.2
Age of respondent				
15–44 years	1836.6	336.2	345.6	1154.8
45–64 years	1892.5	287.3	148.3	1456.8
65–85 years	1444.3	291.1	50.1	1103.2
Household yearly income				
<20k €	956.3	252.1	114.2	590.0
20–39k €	1225.0	277.4	169.4	778.3
40–89k €	1810.3	339.7	213.4	1257.2
≥90k €	2906.3	350.3	228.3	2327.6
Permanent residence area				
Helsinki urban area	2247.6	389.3	178.8	1679.5
Urban area >80k inhabitants	1585.4	273.6	152.9	1158.8
Urban area 25–79k inhabitants	1688.6	332.9	219.0	1136.7
Outside urban areas	1376.3	223.7	174.6	879.0

Notes: Number of cases: 1107. Main effects model. * $p < 0.05$, ** $p < 0.001$.

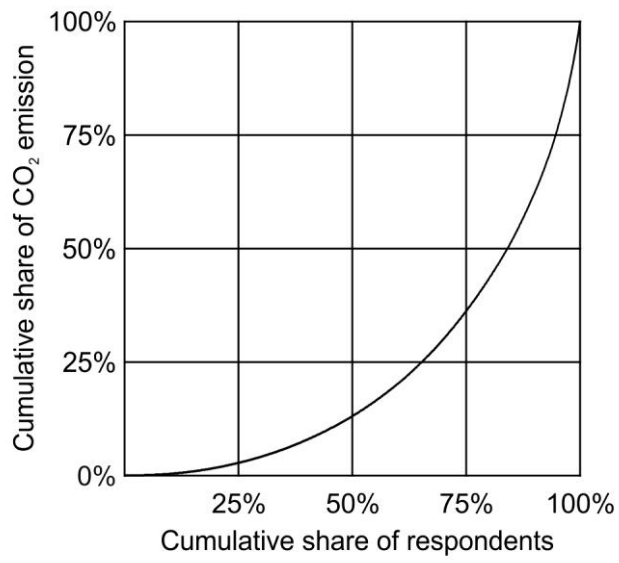


Figure 1. Distribution of yearly CO₂ emission caused by trips to domestic second homes

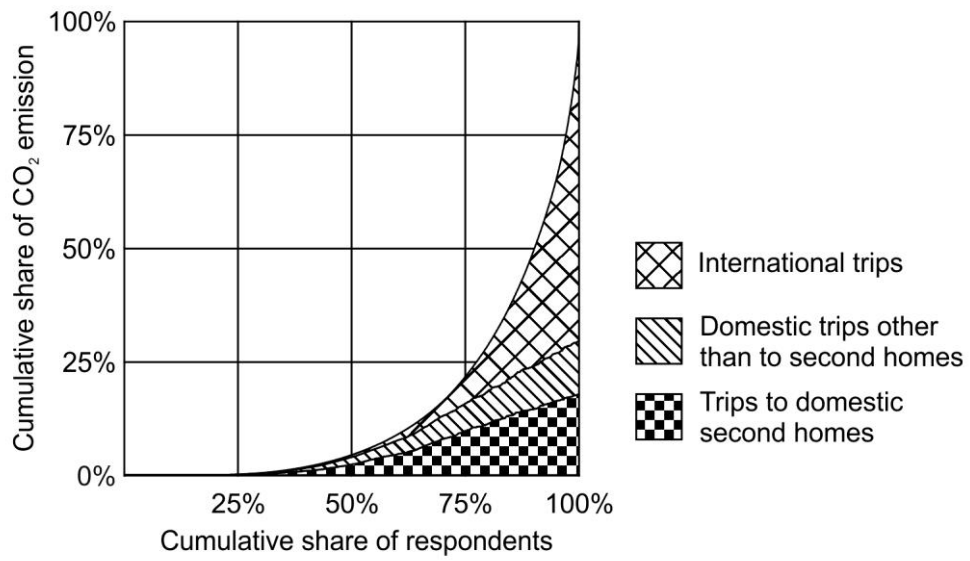


Figure 2. Distribution of yearly CO₂ emission caused by leisure mobility