

June 2008

SIZE MATTERS

Canada's Ecological Footprint, By Income

By Hugh Mackenzie, Hans Messinger, Rick Smith

Growing Gap  **.ca**

CANADIAN CENTRE FOR POLICY ALTERNATIVES

ISBN 978-1-897569-02-3

Canadian Centre for Policy Alternatives

2 Carlton Street, Suite 1001

Toronto, Ontario

(416) 263-9896

www.GrowingGap.ca

This study is based on path-breaking research into the relationship between household income and environmental impact by Hans Messinger, former Director and current senior advisor and consultant at Statistics Canada. This innovative research was funded by the Atkinson Charitable Foundation as part of the development of the Canadian Index of Wellbeing (CIW). For more information about the CIW, visit www.ciw.ca.

Executive summary

WE KNOW FROM international studies that, far from the clean and green image we have of ourselves, Canada has among the highest ecological impacts in the world. At 7.6 hectares per capita, Canada's ecological footprint is the third largest in the world — tied with Finland and following the United States and the United Arab Emirates as the worst offenders.

There have been a number of studies in Canada that look at the relative environmental impact of various sectors of the economy but none that show the fairly direct intersection between climate change and income inequality. This study breaks new ground on this front: it is the first study to look at the size of Canadians' ecological footprint by income categories, and it finds that the ecological footprint of high-income Canadian households is substantially greater than that of everyone else. Canadians at every income level are contributing to global warming. Even low-income Canadians have a greater impact on the environment than most of the world's population. Yet, this study provides conclusive evidence that because higher income households consume more and travel more, they have a greater impact on the environment. The study finds:

- The size of Canadian households' ecological footprint grows systematically according to their income;
- With the notable exception of food, the ecological footprint associated with Canadians' consumption in every category increases steadily as their incomes increase;

- In housing and transportation in particular, the ecological footprint of the richest 10 percent of Canadian households is several times the size of the footprint of lower- and lower-middle-income Canadians and significantly greater than that of the next highest-income 10% of households.

In one of those classic conclusions that seems obvious as soon as it is stated, it turns out that Canadians' ecological impact is not a function of their existence on the planet, but rather is a function of their consumption. Not surprisingly, the more one consumes, the greater one's impact on the planet; and the greater one's income, the greater one's consumption.

This study is based on pathbreaking research into the relationship between household income and environmental impact by former Statistics Canada economist and statistician Hans Messinger. In the first section, economist Hugh Mackenzie and environmentalist Rick Smith summarize Messinger's technical findings and put those findings into a social, economic, and political context. The second section presents Hans Messinger's technical analysis and conclusions.

This study raises new and important questions for policy makers considering ways to reduce Canada's ecological footprint and contribute to the fight against global warming. We now recognize that global warming is directly linked to human behaviour. As data comparing Canada and other nations demonstrate, wealthier nations tend to have a greater impact than poorer nations. This study demonstrates that, within Canada, the consumption decisions of higher-income households have a substantially greater impact than those of lower-income households.

While it is evident that all Canadians must make significant efforts to reduce our ecological footprint, it would be a mistake to base policy decisions on the assumption that the underlying drivers of our excessively large ecological footprint are democratically distributed. A strategy that ignores the underlying relationship between ecological impact and income threatens to achieve the worst of all policy worlds: an ineffective strategy that has a substantial negative distributional impact. In short, if we fail to incorporate differences in environmental impact that are systematically related to income, we risk creating an ineffective policy that has the side effect of imposing disproportionate costs on the low- and moderate-income Canadians who have contributed the least to the problems we are trying to address.

Whose ecological footprint is biggest?

By Hugh Mackenzie and Rick Smith

IN A WORLD where size really does matter, the technical findings in this study open the vault on who Canada's biggest household polluters are — and why. The technical part of this study looks at Canadians' households, and breaks these households into deciles (slices of 10%) to see if there is a difference between high-, middle- and low-income households' consumption patterns and their corresponding ecological footprint. The findings reveal that the consumption of high-income Canadians is having a very real and damaging effect on the environment. The richest 10% of Canadian households are leaving behind an ecological footprint of 12.4 hectares per capita. To put that finding in context, their per capita ecological footprint is 66% higher than the national average.

The Canadian national average ecological footprint is 7.5 hectares per capita. The bottom 60% of Canadian households are leaving behind an ecological footprint that is below this national average. There is a wide gap between the richest and poorest 10% of Canadian households. The ecological footprint of the richest 10% of Canadians is nearly two-and-a-half times that of the poorest 10%.

FOOTPRINTS AND CONSUMPTION: ALL CONSUMPTION IS NOT THE SAME

This study breaks down the ecological footprint of Canadian households into five consumption categories: food, housing, mobility, goods, and services. The results show that the ecological footprint of high-income Canadian households is substantially larger than that of the rest of Canadians in every category except food. In ecological footprint terms, it turns out that food is the great equalizer. In every other consumption category, the ecological footprint associated with consumption increases as income increases. For about 70% of Canadians, food is the most significant contributor to their household's ecological footprint. It is only for the highest-income 30% of Canadian households that the housing footprint exceeds the food footprint. And indeed, it is only for the richest 10% of households that housing rises to a level significantly above that of food.

Through most of the income range, the housing footprint has the second-weakest relationship to income. The exception is for the richest 10%, where the housing footprint is nearly 50% greater than the next highest income 10% (the 9th decile).

For mobility and goods and services, the size of the ecological footprint increases steadily throughout the income range, although even with that steady rise, there is still a jump in the neighbourhood of 50% in the size of the ecological footprint between the 9th and 10th income deciles.

For lower-income households — the households in which the poorest 20% of Canadians live — food and housing account for more than 70% of the ecological footprint. Even at median income levels (middle incomes), these two consumption categories account for nearly 60% of the households' total footprint. In the richest 10% of households — even accounting for the large jump in the size of the housing footprint between the 9th decile and the 10th decile — food and housing account for only 45% of the total footprint. For low-and-moderate-income Canadians, much of their ecological footprint is associated with the consumption of basic necessities.

The biggest gaps between the poorest 10% and the richest 10% are in: mobility, where the richest 10% has a footprint nearly nine times the size of the footprint of the poorest 10%; goods, where the ratio is 3.75 times; and services, where the ratio is 2.7 times.

Mobility — all forms of travel — has the most powerful relationship to income throughout the income scale.

BREAKING IT DOWN EVEN FURTHER

As the chart below confirms, Canadians' ecological footprint associated with food consumption demonstrates very little variability by income class. In every other consumption category, however, there is a significant degree of variation between the poorest 10% and the richest 10%. There is also, notably, a big difference within the

TABLE 1 **Canadian household consumption and ecological footprint** (GHA/CAP)

	Poorest 10%	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6
Food	2.06	2.15	2.14	2.14	2.14	2.16
Housing	1.51	1.82	1.79	1.73	1.88	1.98
Mobility	0.36	0.62	0.88	1.04	1.20	1.43
Goods	0.56	0.74	0.82	0.85	0.93	1.00
Services	0.55	0.68	0.71	0.74	0.79	0.82
Size of ecological footprint	5.03	5.66	6.34	6.48	6.93	7.36
	Decile 7	Decile 8	Decile 9	Richest 10%	Total consumption	
Food	2.15	2.16	2.13	2.24	2.13	
Housing	2.06	2.19	2.31	3.40	2.16	
Mobility	1.55	1.74	2.17	3.23	1.43	
Goods	1.09	1.16	1.33	2.11	0.97	
Services	0.83	0.89	0.95	1.48	0.74	
Size of ecological footprint	7.67	8.12	8.87	12.42	7.49	

richest 20% of Canadian households (the difference between the 9th income decile and the 10th income decile).

In housing, mobility, and consumption of goods and services, the richest 10% of Canadian households is responsible for an ecological footprint between 1.75 times and 2.5 times the average footprint of middle-income households (the middle 20%).

MAKING SENSE OF THE FINDINGS

It would be a mistake to interpret these findings as rationale for exempting low- and middle-income Canadian households from measures intended to support Canada's climate change objectives. The average ecological footprint of the poorest 10% of Canadian households is 5.0 hectares. That is three times the average ecological footprint in China and more than seven times the average ecological footprint in India. Indeed, the gap between the lowest-income households in Canada and the average ecological footprint in China is roughly 3:1. That is greater than the gap between the richest 10% and poorest 10% of households in Canada (2.5:1).¹

So what does all this mean? Ten years after Canada signed onto the Kyoto Accord, the question of how this nation should respond to global environmental change has finally moved to political centre stage. With what passes in politics for breathtaking speed, the middle ground in the debate has shifted dramatically. At the start of 2006, the semi-official policy of a newly-elected federal government was to deny global warming science and push it to the political fringe.² Much has changed in a

very short period of time. Global warming as a phenomenon is no longer credibly in dispute. Nor is the contention that substantial changes will be required in Canadian society — and in the Canadian economy — if Canada is to make serious inroads into reducing greenhouse gas emissions.

The link between consumption and global impact is also accepted without question. Part of the political consensus that has emerged on the issue involves an acceptance that as citizens of a wealthy, consumer-oriented society, Canadians contribute disproportionately to the global warming phenomenon and must expect to contribute disproportionately to the solution. And yet little attention has been paid to this aspect of Canadian households' collective responsibility for global warming.

Indeed, the implicit message in the One Tonne Challenge — the former federal government's advertising attempt to get Canadians involved in greenhouse gas reduction — was that all Canadians are equally responsible for global warming. The findings in this study indicate the burden of proof lies heavily at the feet of the richest Canadians among us and public policy should reflect that imbalance.

POLICY, HOUSEHOLD INCOMES, AND THE ECOLOGICAL FOOTPRINT

These findings are significant for the design of Canadian policy. They suggest that policies aimed at cleaning up Canadians' environmental act should take explicit account of the differences in environmental impact by income class. Policies that ignore this reality are likely to have the unintended effect of exacerbating income inequality and hampering Canada's efforts to reduce its ecological footprint. Policies that fail to account for differences in ecological footprint by income class will undoubtedly be less successful in meeting environmental objectives than policies that reflect this reality.

The findings in this study on housing and household income should also influence Canadian policy makers. Low- and lower-middle income Canadian households are far more likely to rent rather than own their housing.³ As tenants, they are generally not in a position to make decisions with respect to the energy efficiency of their homes because they are not responsible for the capital investments required to give effect to those decisions. In many cases, tenants are not even in a position to control the temperature in their rented homes. Since renters lack such controls over their energy consumption, purely market-based measures will have little impact in the rental housing sector. Because energy costs are generally incurred by landlords and passed through to tenants, whatever economic incentives are created by market measures in the rental housing market will generally be created at the wrong place. And to the extent that landlords are forced to make environmental improvements, they will simply pass the cost on to their tenants by raising their rents — a practice that would exacerbate income inequality in Canada and unfairly penalize lower-income households.

Mobility is another area in which differences in footprints by household income will be significant for policymaking. The gap in the size of the ecological footprint between the poorest and richest 10% of Canadian households is far greater — nearly nine times — than it is for any other consumption category. This is largely attributable to higher-income households' use of private cars, vans and trucks (their footprint here is 12 times greater than the poorest 10%) and passenger air travel (four times more). Policies to influence the impact of mobility on Canada's ecological footprint will fail unless they address the consumption patterns of higher-income Canadians.

The practical problems associated with the use of market measures are particularly acute for air travel, which is generally either exempted from or given special treatment under fuel tax regimes on the grounds that airlines will simply avoid the taxes by purchasing their fuel supplies at foreign destination airports. In the absence of international actions to create market incentives for conservation in the airline industry, it is difficult to see how government could use economic instruments to bring about change in that industry.

SUMMARY OF CONSIDERATIONS

There are significant differences in environmental impact among Canadian families with different income levels. Just as higher-income nations tend to impose a greater burden on the environment than lower-income nations, higher-income households in Canada impose a greater burden on the environment than lower-income households. A policy response to global warming cannot be effective if it ignores this reality. Not only will a response that ignores significant differences in environmental impact by income class be less effective, it will serve to exacerbate income inequality in Canada.

Technical findings

By Hans Messinger⁴

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WHAT IS AN ECOLOGICAL FOOTPRINT?

The ecological footprint measures the biologically productive space in per capita global hectares needed to provide the resources for a nation's total consumption and to absorb the waste that it generates. A recent document (May 2005) on methodology produced by the Global Footprint Network describes the Ecological Footprint as follows:

“The accounts presented in this paper focus on those human activities that either depend on life-supporting services of natural capital or that compromise natural capital's ability to provide these services. Since both renewal and absorption depend on the health and integrity of ecosystems, regenerative capacity is a reliable proxy for the life-supporting capacity of natural capital. To track human demand on these services, we have developed accounts that measure how much of the biosphere's regenerative capacity is used by the human economy. These Ecological Footprint accounts document how much of the annual regenerative capacity of the biosphere, expressed in mutually exclusive hectares⁵ of biologically productive land or sea area, is required to renew the resource throughput of a defined population in a given year—with the prevailing technology and resource management of that year. For example, renewable resources like timber and crops need space to grow. Non-renewable resources are included in the Footprint insofar as they put a demand on

the regenerative capacity of the planet, such as the energy needed to concentrate and process them and to absorb the waste from processing and using them.”

CANADA’S ECOLOGICAL FOOTPRINT

Canadians enjoy one of the highest living standards in the world, which requires abundant natural resources and a large biomass capacity. The ecological footprint for Canada in 2002 stood at 7.5 global hectares per capita (gha/cap) — near the top of the international scale. Basic necessities, food and housing, account for 57% of the total ecological footprint. Canada, with an abundance of renewable resources and a sparse population density, has a biomass capacity of 15.1 — double its ecological footprint. The only highly industrialized nation surpassing Canada is our southern neighbour and major trading partner, the United States. The U.S. footprint was 9.7gha/cap in 2002 — more than double its biomass capacity.

The purpose of this paper is to examine how differences in Canadians’ personal income impact on the nation’s ecological consumption footprint. The analysis focuses on consumption patterns of Canadians by personal disposable income deciles. In this report, the ecological footprint is summarized in 5 consumption categories (food, housing, mobility, goods and services) and 6 types of land use (energy land, cropland, pasture land, forest land, built area and fishing grounds)

OVERVIEW OF RESULTS

The income of the highest income Canadians — those in the top 10% — is nearly five times that of Canadians in the bottom 10% and 73% above those in the 9th decile. The next largest jump in income is between the bottom and 2nd income decile. The inequality between deciles at the two ends of the income spectrum is largely a function of pre-tax market income (Table 1). Personal consumption is highly correlated to disposable income, but varies across the deciles due to differences in demographic composition of households and decisions regarding financial savings and borrowing.

The household income deciles analysis of the ecological footprint clearly shows the consumer extravagance of high income Canadians. The overall national footprint of 7.5 global hectares per capita is only surpassed in the 7th decile and increases moderately in the 8th and 9th deciles. However, the ecological footprint of Canadians in the top decile, at 12.4 global hectares per capita, is 66% above the national average and surpasses the 9th decile by 40%. A sharply higher footprint is evident in every consumption category except food.

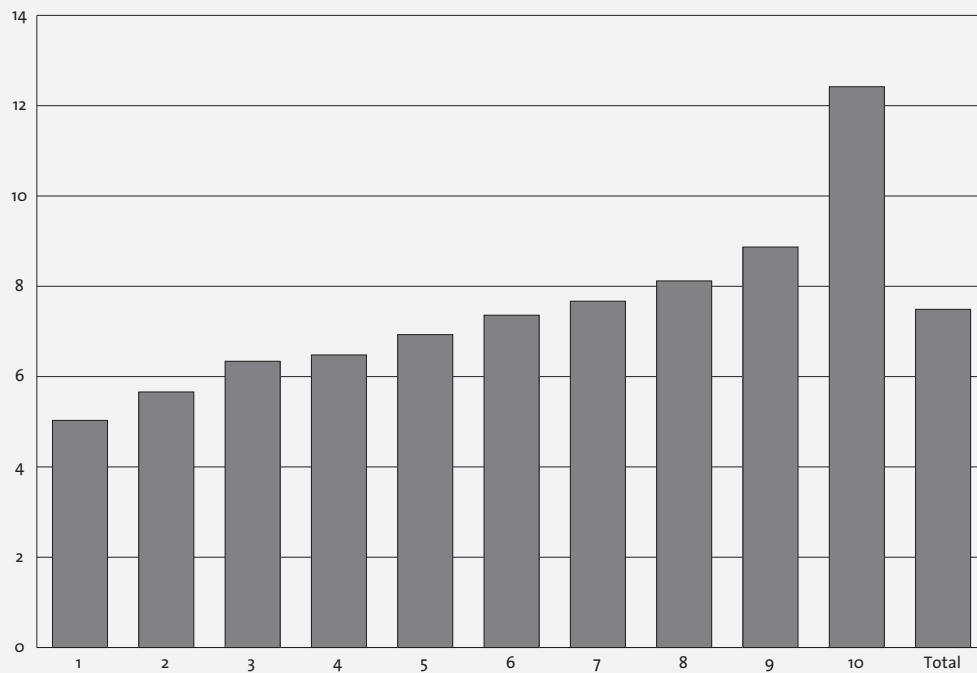
The footprint for high income Canadians is nearly two-and-a-half times greater than the 5 global hectares for individuals in the bottom 10% of the income scale

TABLE 2 Change in footprint size, decile to decile

	2 nd decile compared with 1 st	3 rd compared with 2 nd	4 th compared with 3 rd	5 th compared with 4 th	6 th compared with 5 th	7 th compared with 6 th
Food	4% higher	0% lower	0% higher	0% higher	1% higher	0% lower
Housing	21% higher	-2% lower	-3% lower	9% higher	5% higher	4% higher
Mobility	72% higher	42% higher	18% higher	15% higher	19% higher	8% higher
Goods	32% higher	11% higher	4% higher	9% higher	8% higher	9% higher
Services	24% higher	4% higher	4% higher	7% higher	4% higher	1% higher
Total	13% higher	12% higher	2% higher	7% higher	6% higher	4% higher

	8 th compared with 7 th	9 th compared with 8 th	10 th compared with 9 th	Ratio 10 th to 1 st	Ratio 10 th to middle 20%
Food	0% higher	-1% lower	5% higher	1.1	1.0
Housing	6% higher	5% higher	47% higher	2.3	1.8
Mobility	12% higher	25% higher	49% higher	9.0	2.5
Goods	6% higher	15% higher	59% higher	3.8	2.2
Services	7% higher	7% higher	56% higher	2.7	1.8
Total	6% higher	9% higher	40% higher	2.5	1.7

CHART 1 Total Ecological Footprint by Income Deciles (GHA/CAP)



(Chart 1). Sharp increases in consumption in the 2nd and 3rd deciles resulted in double digit ecological footprint increases. In the 2nd decile the larger footprint stems from all consumption categories except food, like those at the top. For individuals in the 3rd income decile, the heavier footprint is concentrated in mobility and consumer goods.

Chart 2 shows decile variation in the ecological footprint by consumption category. There is a big footprint range for every consumption category except food, mostly at the far ends of the income scale. Much of the footprint increase across the deciles occurs between the 9th and top level. The most extreme range is in mobility, which also shows the largest increase between deciles. This is largely associated with motor vehicle use. Consumption category details will be discussed in section 3.

In the lower income deciles the ecological footprint associated with basic necessities of food and shelter make up a much larger part of their footprint than in the higher income ranges. As income increases, consumer goods and services as well as mobility become an increasing share of the footprint. Chart 3 shows a comparison of the footprint composition for the bottom and top income deciles. Over 70 % of the footprint for those living in households in the bottom income decile is related to food and housing, but only 45% for individuals at the top of income the scale. Mobility shows the largest footprint inequality varying nine-fold between the income decile extremes. The footprint for food declines in relative importance across all deciles, ranging from 41% of the footprint at the bottom to 18% at top (Table 2). The relative share of footprint for housing and services remains virtually stable across all deciles. The ecological footprint associated with mobility and consumer goods increases across all deciles ranging from 7% to 26% and 11% to 17% respectively.

The ecological footprint was estimated by consumption category by type of land use. Income deciles distribution of the footprint by type of land use is summarized in Chart 4. The use of energy accounts for over 61% of the total footprint. This not only represents direct consumption of energy Canadians use to fuel our vehicles and heat and light our homes, but also the energy required to produce the goods and services that we consume — the major source GHG emissions. Agriculture (cropland and pasture land) and Forestry equally share most of the balance of the footprint. Chart 4 clearly shows a spike at the top income decile. The relative importance of land use, however, only shows modest variation across income deciles (Table 3). The use of energy land ranges from 56% of the footprint in the bottom decile to 64% in the 9th decile. Forest land is stable across all deciles. The only significant variation is for land associated with food consumption (cropland, pasture land and fishing grounds) where the relative importance of land use declines through each decile, ranging from 26% to 18%.

CHART 2 Ecological Footprint by Income Deciles and Consumption Categories (GHA/CAP)

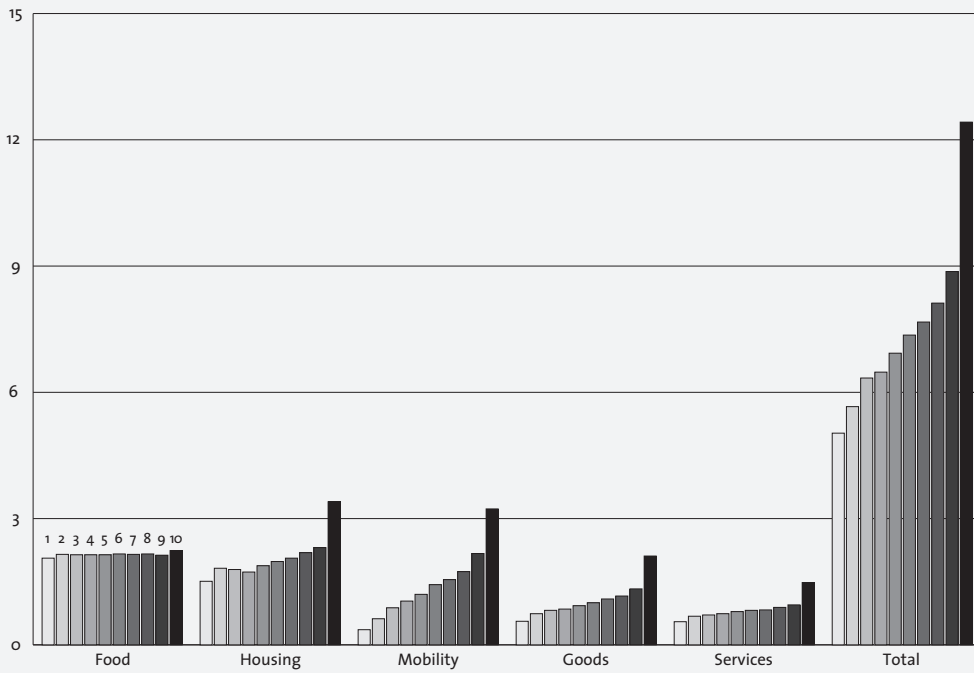
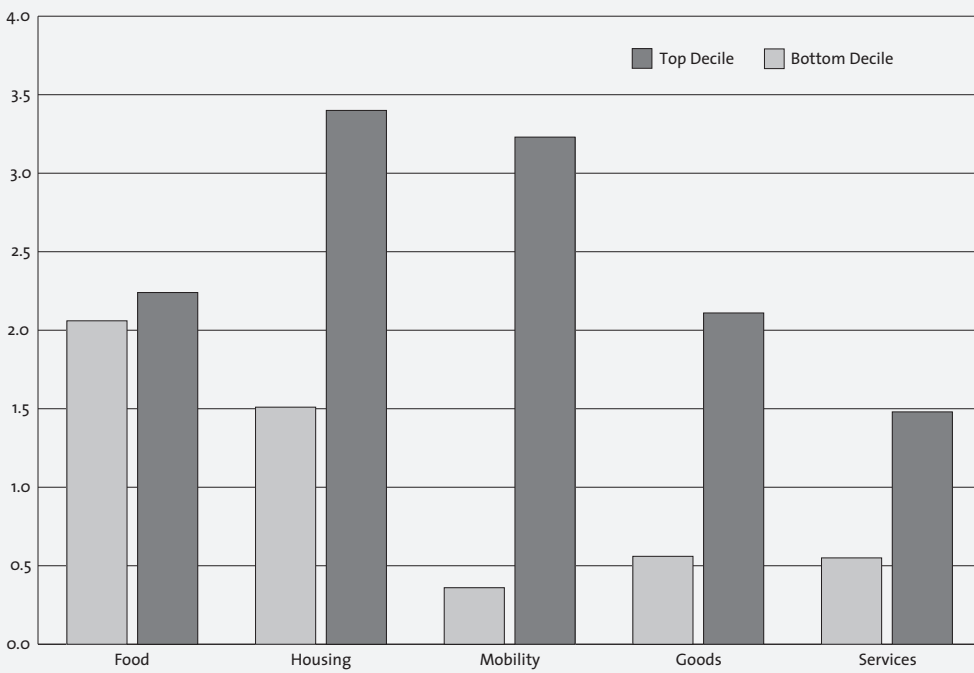


CHART 3 Footprint Comparison of the Bottom and Top Deciles (GHA/CAP)



DETAILS OF THE ECOLOGICAL CONSUMPTION FOOTPRINT

This section of the report looks at the five major consumption categories: food, housing, mobility, goods and services.

FOOD FOOTPRINT

The food ecological footprint for all Canadians is 2.1 global hectares per capita. Food consumption (Chart 5) is more evenly distributed over the income deciles than other consumption categories.

The relative stability in the footprint across income deciles is rationalized by the limited variance in the quantity of per capita food consumption, on average. Food consumption is generally lower for young children and elderly persons who are less active, and tends to be higher for teens and active adults. The combination of household income and demographic composition affects the per capita footprint estimates. The largest changes were found between the bottom and 2nd deciles, and the 9th and top deciles.

The lower food footprint for the bottom income decile reflects a higher incidence of single elderly and young single parents. At the top of the income scale, households tend to be more concentrated with middle-age parents who have teenage children. Per capita personal spending on food and non-alcoholic beverages in the top income decile is 44% above that of the 9th decile. Spending on alcoholic beverages, also part of the food footprint, is 64% higher. These higher expenditures translated into a footprint increase of 5.1% between the top two deciles. This represents the additional land used to grow crops, pasture land used to raise livestock and energy requirements to produce, transport and market food and beverages.

The divergence between the increase in food and beverage expenditure and the food footprint in the top income decile is largely associated with the consumption of higher priced “quality” products such as pre-prepared foods, choice meat cuts, exotic fruits and vegetables and vintage wines that demand only marginally higher land use than lower priced products.

HOUSING FOOTPRINT

The ecological footprint for housing is 2.2 global hectares per capita (29% of the total footprint). The footprint for housing includes: new construction, maintenance and residential energy use. The ecological footprint for housing varies from 1.5 to 3.4 between the bottom and top income deciles, as shown in Chart 6.

There are pronounced jumps in the housing footprint in the 2nd and 10th deciles, with a steady progression from the 5th income decile. The relative share of the eco-

CHART 4 Footprint by Income Deciles and Type of Land Use (GHA/CAP)

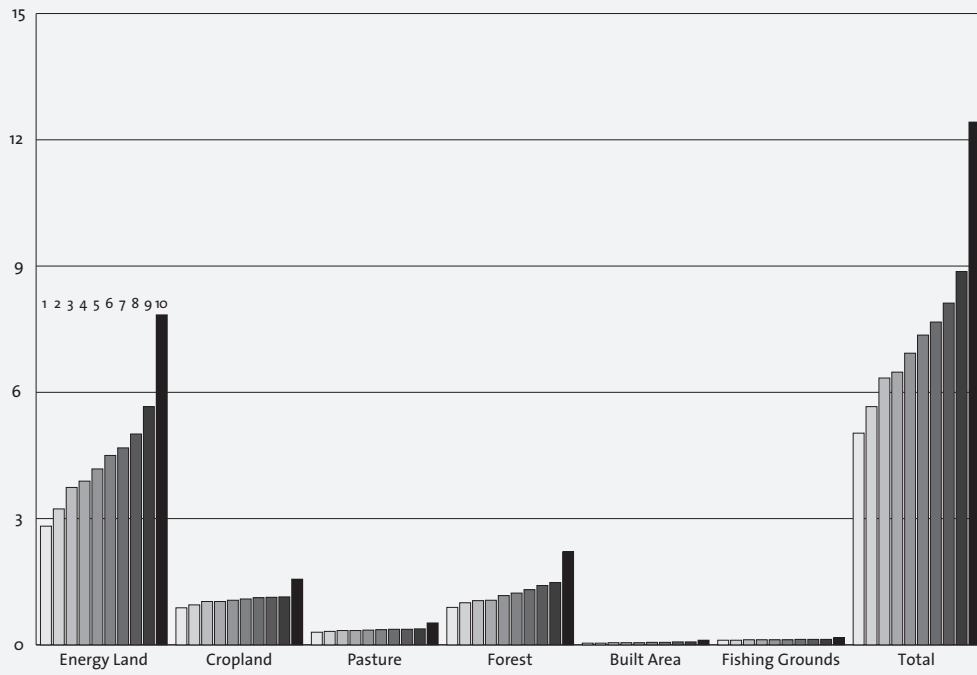
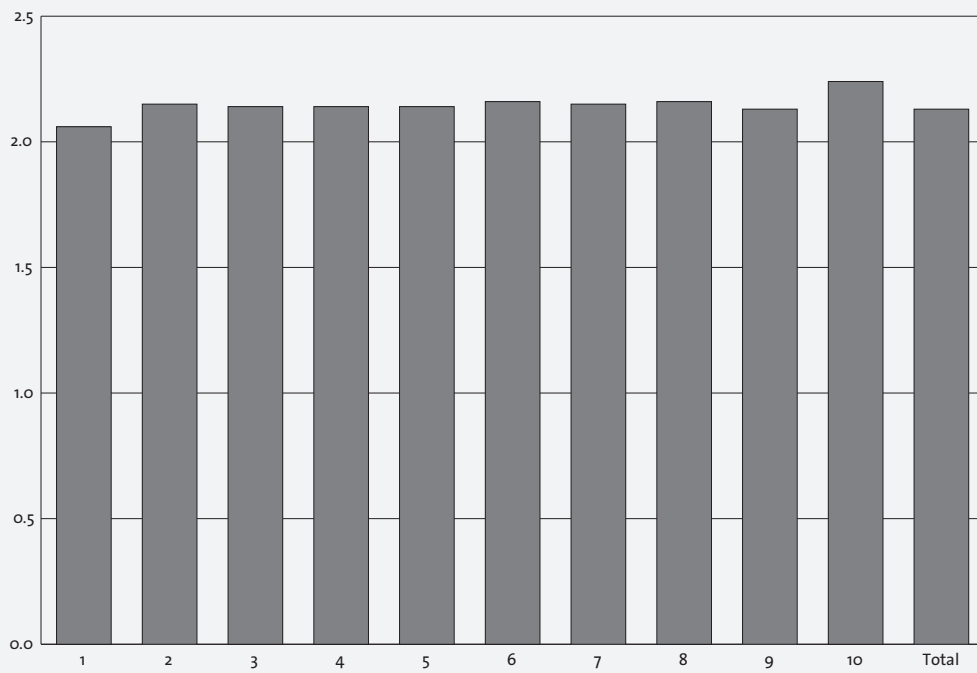


CHART 5 Ecological Footprint Food (GHA/CAP)



logical footprint for housing in each decile, however, is remarkably stable (Table 2). This is, in part, explained by the increase in the number of persons per household, ranging from 1.2 to 3.4 from bottom to top income decile. There is an economy of scale of two or more persons sharing a common dwelling. In other words, housing expenditures clearly rise with income, but, for most income deciles, balance out on a per capita basis.

Nevertheless, despite the largest number of persons per household, high income Canadians leave a housing footprint of 3.4 global hectares per capita, which is 47% higher than members of households in the 9th decile. New housing construction is predominantly demanding on forest land. High income Canadians tend to purchase larger single detached dwellings that require more global hectares to construct, maintain in terms of upkeep and energy requirements for heating, cooling, lighting and operating household equipment.

MOBILITY FOOTPRINT

The mobility footprint is composed of motor vehicles use and purchased transportation services (air, rail, bus and water). The mobility footprint has the largest variance across the income deciles. The mobility footprint at 1.4 global hectares per capita is about two-thirds that of food and housing, but shows the largest incremental steps across income deciles, as shown in Chart 7.

Motor vehicle use accounts for 80% of the mobility footprint. This component of the mobility footprint nearly doubles (93%) from the 1st to 2nd deciles with a further 61% rise in the 3rd level. Percentage increases from the 4th to 7th deciles are all double digit, averaging 16%. For higher income Canadians, the motor vehicle use footprint leaps an additional 24% and 42% in the 9th and top deciles respectively.

At the low end of the income scale, motor vehicles are either not needed, not affordable or used sparingly. At the high end of the income spectrum, there are not only more motor vehicles per capita, but also more expensive vehicles that require a larger footprint to produce, maintain and operate. The Statistics Canada Household and Environment Survey (2006) showed that over 75% of households use their personal vehicle to commute to work and about 80% travel alone. The number only varies about 10–12% between colder and warmer months of the year.

The remaining 20% of the mobility footprint is accounted for by purchased transportation services. Air travel is the most demanding on our ecosystem accounting for more than two-thirds of this component of the mobility footprint. The ecological footprint for purchased transportation by Canadians in the highest income decile is 4.4 times that of the lowest income decile. The largest jump is at the top, where the transportation service footprint is 85% above the 9th decile. This is mainly attributed to air travel.

CHART 6 Ecological Footprint Housing (GHA/CAP)

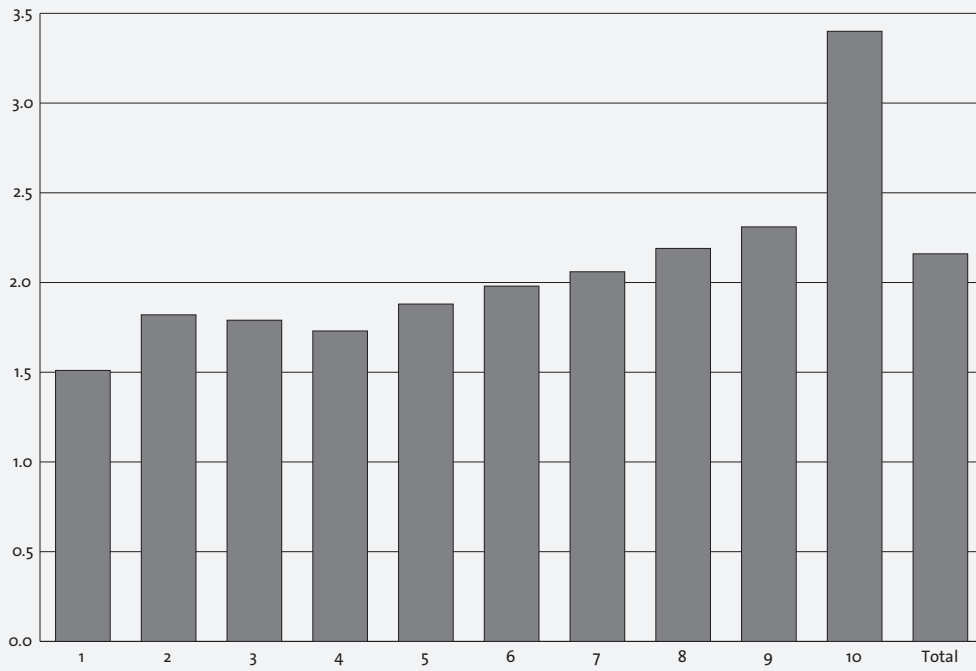
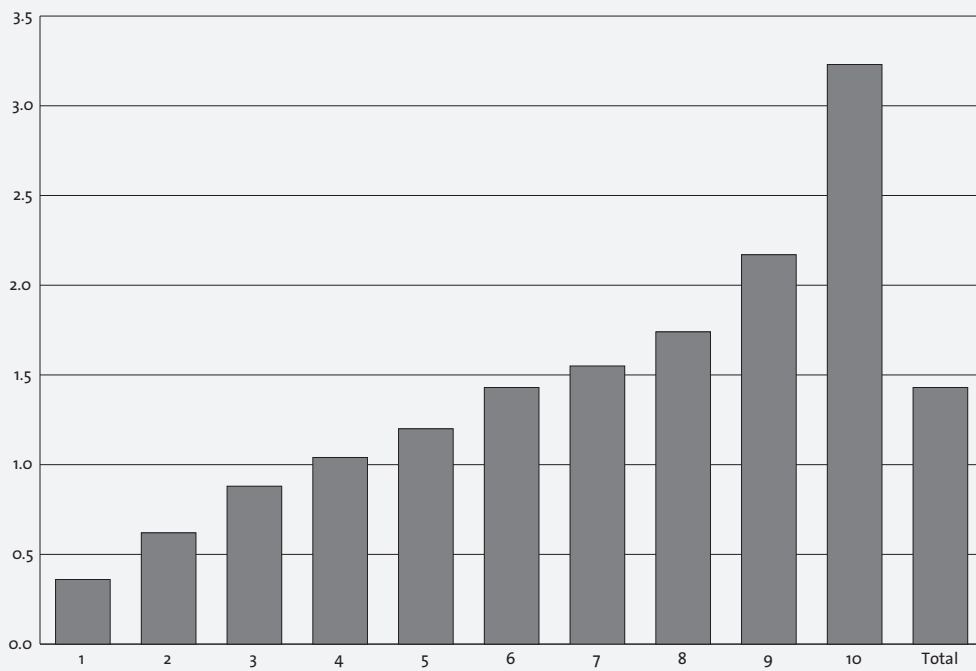


CHART 7 Ecological Footprint Mobility (GHA/CAP)



GOODS FOOTPRINT

The ecological footprint for consumer goods is 1.0 global hectare per capita. This consumption group includes clothing and footwear, home furnishing and appliances, electronic and electrical equipment, cleaning and paper products, and tobacco. The consumption of goods shows the second largest variance after mobility (Chart 8).

The largest jump in the ecological footprint for consumer goods occurs at the opposite ends of the income spectrum — 33% between the 1st and 2nd deciles and 59% from the 9th to 10th deciles. The goods footprint is highly polarized at the two ends of the income spectrum for types of goods, particularly clothing, home furnishing and electronic equipment. The footprint associated with the use of tobacco products is fairly stable over most income deciles. It drops in the 8th and 9th deciles and then jumps over 70% for the top income households. This may be related to the demographic structure of households. High income households tend to have more middle-aged adults and older children — teenage smoking may be part of the explanation, but needs further investigation.

SERVICES FOOTPRINT

Consumer services, as expected, leave the smallest ecological footprint (0.7 global hectares per capita) of all consumption categories. Like housing, mobility and goods, the footprint increase is heavily polarized at the two ends of the income spectrum, increasing 23% from the 1st to 2nd deciles and 55% between the 9th and 10th deciles (Chart 9).

The public sector factors prominently in the production and delivery of services, including health care, water, sewage and waste disposal, military, and a variety of non-military services. Medical and health services and products account for 45% of the services footprint. Canada's universal health care represents the majority of expenditure and is spread evenly across the income deciles. The remaining share of the medical footprint lies in private spending on health and medical care products and services which spike at the extremes, resulting in a medical footprint that increases 16% between the bottom and 2nd deciles and 27 % from the 9th to the top decile. The ecological footprint for real estate rental and lodging, water, sewage and waste disposal closely follows the pattern of the housing. The footprint for entertainment services is highly polarized.

CONCLUSION

The analyses have shown, as expected, a strong positive correlation between disposable household income, consumption and the ecological footprint. The increase in

CHART 8 Ecological Footprint Goods (GHA/CAP)

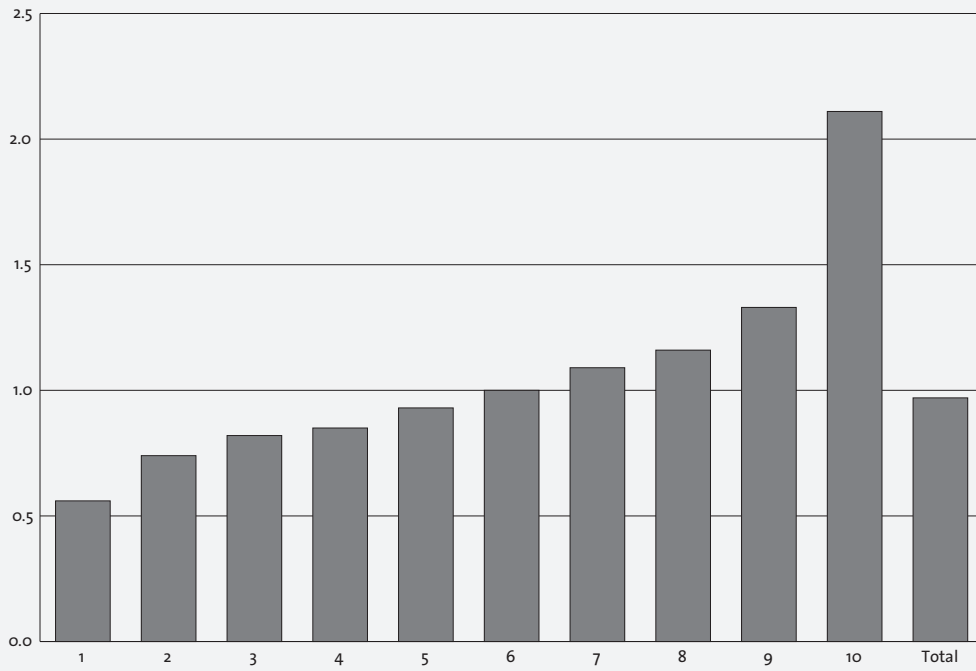
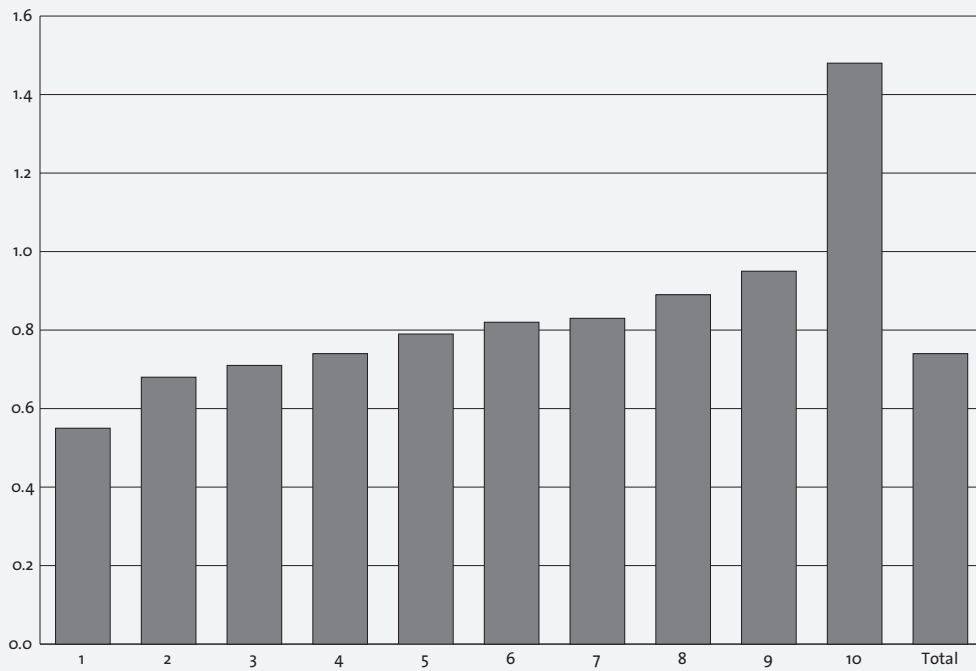


CHART 9 Ecological Footprint Services (GHA/CAP)



consumption and ecological footprint at the top and the bottom of the income scale are primarily related to presence of market income. At the bottom, it's securing a job, in the middle, it's a function of stable employment, dual income households and career development. At the top, the leap in market income is related to successful careers and successful businesses.

At the lower end of the income scale, increased income has a close relationship to the ecological footprint in all consumption categories. This implies that increased consumption in terms of quantity of goods and services is in line with income and the footprint. At the higher end of the income spectrum, however, the ecological footprint increases at less than the rate of disposable income and consumption for the following reasons:

- Consumption grows more slowly than income due to savings. Savings provide a means to future consumption and hence, deferred ecological demands for later in life, or to be inherited by future generations.
- The purchase of higher priced consumer goods and services that go with lavish lifestyles, do not necessarily result in a linear relationship with the ecological footprint. For example, a luxury car, at double the price of a modest vehicle, requires more — but not double — the land use to produce. Similarly, expensive furniture and gourmet dining require more land use, but not in proportion to their nominal cost.

The focus of this report was on the inequality of income, consumption and the ecological footprint. High income Canadians leave a footprint 2.5 times that of individuals in the lowest income decile. Perhaps the leading authority on measurement and assessment of inequality is 1998 economics Nobel Prize laureate Amartya Sen in his works, "Freedom of Choice" (1987) and "Inequality Reexamined" (1995). He concluded that individuals with given resources have opportunities to make informed choices. Inequality as articulated in Sen's work refers to several dimensions, including income and wealth resources that provide a capacity for consumption choices and an ecological footprint. Consumer awareness of environmental issues is certainly an important element in making responsible choices, but classical theories by Jean-Baptiste Say and John Stuart Mill on market forces remain relevant in our society in ensuring that supply creates its own demand.

APPENDIX A

Statistical Tables

TABLE A1 **Ecological Footprint by Consumption and Land Use** (GHA/CAP)

	Energy Land	Cropland	Pasture Land	Forest Land	Built area	Fishing Grounds	Total
Food	0.60	1.04	0.34	0.02	0.00	0.12	2.13
..plant-based	0.30	0.41	0.00	0.01	0.00	0.00	0.72
..animal-based	0.30	0.64	0.34	0.01	0.00	0.12	1.41
Housing	1.35	0.00	0.00	0.81	0.01	0.00	2.18
..new construction	0.06	0.00	0.00	0.47	0.00	0.00	0.53
..maintenance	0.04	0.00	0.00	0.34	0.00	0.00	0.38
..residential energy use	1.25	0.00	0.00	0.00	0.00	0.00	1.25
...electricity	0.64	0.00	0.00	0.00	0.00	0.00	0.64
...natural gas	0.50	0.00	0.00	0.00	0.00	0.00	0.50
...fuelwood	0.02	0.00	0.00	0.00	0.00	0.00	0.02
...fuel oil, kerosene, LPG, coal	0.09	0.00	0.00	0.00	0.00	0.00	0.09
Mobility	1.42	0.01	0.00	0.00	0.01	0.00	1.45
..passenger cars and trucks	1.16	0.01	0.00	0.00	0.00	0.00	1.16
..motorcycles	0.01	0.00	0.00	0.00	0.00	0.00	0.01
..buses	0.05	0.00	0.00	0.00	0.00	0.00	0.05
..passenger rail transport	0.02	0.00	0.00	0.00	0.00	0.00	0.02
..passenger air transport	0.18	0.00	0.00	0.00	0.00	0.00	0.18
..passenger boats	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Goods	0.54	0.01	0.02	0.40	0.01	0.00	0.99
..appliances	0.05	0.00	0.00	0.01	0.00	0.00	0.06
..furnishing	0.04	0.00	0.00	0.04	0.00	0.00	0.08
..computers and electronics	0.01	0.00	0.00	0.00	0.00	0.00	0.01
..clothing and shoes	0.15	0.01	0.02	0.01	0.00	0.00	0.18
..cleaning products	0.06	0.00	0.00	0.03	0.00	0.00	0.09
..paper products	0.06	0.00	0.00	0.20	0.00	0.00	0.27
..tobacco	0.02	0.01	0.00	0.00	0.00	0.00	0.03
..other misc. goods	0.14	0.00	0.00	0.11	0.00	0.00	0.26
Services	0.68	0.00	0.00	0.04	0.01	0.00	0.73
..water and sewage	0.02	0.00	0.00	0.00	0.00	0.00	0.02
..telephone and cable service	0.01	0.00	0.00	0.00	0.00	0.00	0.01
..solid waste	0.04	0.00	0.00	0.00	0.00	0.00	0.04
..financial and legal	0.07	0.00	0.00	0.01	0.00	0.00	0.08
..medical	0.32	0.00	0.00	0.01	0.00	0.00	0.33
..real estate and rental lodging	0.12	0.00	0.00	0.00	0.00	0.00	0.12
..entertainment	0.06	0.00	0.00	0.02	0.00	0.00	0.08
..Government	0.03	0.00	0.00	0.00	0.00	0.00	0.03
...non-military, non-road	0.01	0.00	0.00	0.00	0.00	0.00	0.01
...military	0.03	0.00	0.00	0.00	0.00	0.00	0.03
..other misc. services	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unidentified	0.00	0.00	0.00	0.02	0.00	0.00	0.02
Total	4.59	1.07	0.36	1.29	0.06	0.12	7.49

TABLE A2 **Ecological Footprint by Consumption by Income** (GHA/CAP)

	Final Adjusted Model										Total
	1	2	3	4	5	6	7	8	9	10	
Food	2.06	2.15	2.14	2.14	2.14	2.16	2.15	2.16	2.13	2.24	2.13
..plant-based	0.69	0.72	0.73	0.73	0.73	0.73	0.73	0.74	0.72	0.76	0.72
..animal-based	1.37	1.42	1.42	1.41	1.41	1.42	1.42	1.42	1.41	1.48	1.41
Housing	1.51	1.82	1.79	1.73	1.88	1.98	2.06	2.19	2.31	3.40	2.16
..new construction	0.35	0.43	0.40	0.39	0.44	0.46	0.51	0.55	0.57	0.90	0.53
..maintenance	0.25	0.31	0.29	0.28	0.32	0.33	0.37	0.39	0.41	0.65	0.38
..residential energy use	0.90	1.07	1.10	1.05	1.11	1.16	1.17	1.24	1.31	1.83	1.25
...electricity	0.50	0.59	0.62	0.58	0.62	0.62	0.60	0.59	0.66	0.87	0.64
...natural gas	0.30	0.36	0.37	0.38	0.40	0.43	0.47	0.54	0.55	0.82	0.50
...fuelwood	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
...fuel oil, kerosene, LPG, coal	0.08	0.10	0.09	0.08	0.08	0.09	0.08	0.09	0.09	0.12	0.09
Mobility	0.36	0.62	0.88	1.04	1.20	1.43	1.55	1.74	2.17	3.23	1.43
..passenger cars and trucks	0.23	0.44	0.70	0.83	1.01	1.17	1.31	1.48	1.84	2.62	1.16
..motorcycles	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.01
..buses	0.03	0.04	0.03	0.04	0.04	0.05	0.04	0.05	0.06	0.11	0.05
..passenger rail transport	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.04	0.02
..passenger air transport	0.09	0.11	0.11	0.13	0.12	0.16	0.14	0.16	0.20	0.37	0.18
..passenger boats	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01
Goods	0.56	0.74	0.82	0.85	0.93	1.00	1.09	1.16	1.33	2.11	0.97
..appliances	0.04	0.06	0.06	0.06	0.07	0.07	0.08	0.07	0.09	0.13	0.06
..furnishing	0.06	0.08	0.09	0.09	0.09	0.11	0.12	0.12	0.15	0.23	0.08
..computers and electronics	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.01
..clothing and shoes	0.11	0.17	0.19	0.21	0.23	0.25	0.27	0.30	0.31	0.51	0.18
..cleaning products	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.09	0.10	0.15	0.09
..paper products	0.17	0.20	0.21	0.21	0.22	0.23	0.24	0.26	0.29	0.46	0.27
..tobacco	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.04	0.03
..other misc. goods	0.08	0.12	0.15	0.16	0.19	0.21	0.24	0.26	0.33	0.52	0.26
Services	0.55	0.68	0.71	0.74	0.79	0.82	0.83	0.89	0.95	1.48	0.74
..water and sewage	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.05	0.02
..telephone and cable service	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01
..solid waste	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.09	0.04
..financial and legal	0.04	0.07	0.08	0.09	0.11	0.13	0.13	0.15	0.16	0.34	0.08
..medical	0.26	0.31	0.31	0.32	0.33	0.32	0.32	0.32	0.33	0.43	0.33
..real estate and rental lodging	0.11	0.12	0.12	0.12	0.14	0.14	0.15	0.16	0.18	0.29	0.12
..entertainment	0.04	0.07	0.08	0.09	0.10	0.10	0.10	0.12	0.13	0.21	0.08
..Government	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
...non-military, non-road	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
...military	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
..other misc. services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unidentified	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.04	0.02
Total	5.03	5.66	6.34	6.48	6.93	7.36	7.67	8.12	8.87	12.42	7.49

TABLE A3 Footprint by Income by Consumption Summary (GHA/CAP)

	1	2	3	4	5	6	7	8	9	10	Total
Food	2.06	2.15	2.14	2.14	2.14	2.16	2.15	2.16	2.13	2.24	2.13
Housing	1.51	1.82	1.79	1.73	1.88	1.98	2.06	2.19	2.31	3.40	2.16
Mobility	0.36	0.62	0.88	1.04	1.20	1.43	1.55	1.74	2.17	3.23	1.43
Goods	0.56	0.74	0.82	0.85	0.93	1.00	1.09	1.16	1.33	2.11	0.97
Services	0.55	0.68	0.71	0.74	0.79	0.82	0.83	0.89	0.95	1.48	0.74
Total	5.03	5.66	6.34	6.48	6.93	7.36	7.67	8.12	8.87	12.42	7.49

TABLE A4 Footprint by Income by Type of Land Use (GHA/CAP)

	1	2	3	4	5	6	7	8	9	10	Total
Energy Land	2.82	3.23	3.74	3.89	4.18	4.50	4.68	5.01	5.66	7.84	4.59
Cropland	0.88	0.95	1.03	1.03	1.06	1.09	1.12	1.13	1.14	1.56	1.07
Pasture	0.30	0.32	0.34	0.34	0.35	0.36	0.37	0.37	0.38	0.52	0.36
Forest	0.89	1.00	1.05	1.06	1.17	1.23	1.31	1.41	1.48	2.21	1.29
Built area	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.11	0.06
Fishing Grounds	0.11	0.11	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.17	0.12
Total	5.03	5.66	6.34	6.48	6.93	7.36	7.67	8.12	8.87	12.42	7.49

TABLE A5 Household Summary Characteristics

	1	2	3	4	5	6	7	8	9	10	Total
Disposable											
Household Income \$	11531	19710	26901	33867	41113	48810	57732	68804	85533	155845	54978
Pre-tax Market											
Household Income \$	3259	10057	17992	26467	35948	46076	59218	72785	93377	176400	54150
Number of Persons per Household											
	1.22	1.53	1.89	2.26	2.47	2.65	2.84	3.17	3.29	3.47	2.48
Per Capita											
Disposable Income \$	9470	12861	14199	14981	16627	18436	20322	21719	25964	44967	22174
Per Capita Market Income \$											
	2677	6562	9496	11707	14539	17403	20845	22976	28346	50898	21840

Data Sources

IISD and Global Footprint Network

Canada's Ecological Footprint Matrix

Global Footprint Network

CIW Ecological Footprint Fact Sheet

Statistics Canada

1. Survey of Household Spending, Income Statistics Division
2. Public Institutions FM statistics, System of National Accounts
3. Social Policy Simulation Database, Analytical Studies
4. Input-Output Accounts, System of National Accounts

References

UNSD and Global Footprint Network: “*Canadian Index of Wellbeing: Ecological Footprint Calculations*”, December 2005

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Notes

1 Ecological Footprint and Biocapacity (2006 edition), 2006 National Footprint Accounts, Global Footprint Network, 2007, http://www.footprintnetwork.org/gfn_sub.php?content=national_footprints

2 Independent Summary for Policymakers, Fraser Institute, 1 February 2007, a handbook for Canadian climate change deniers.

3 According to a Statistics Canada, 60% of families in the lowest-income fifth of the population rented their accommodation, compared with 27% in the middle fifth and only 15% in the highest-income fifth. Sophie Lefebvre, Housing: An Income Issue, Perspectives On Labour and Income, Statistics Canada, June 2002 vol. 3 no. 6

4 This work is an extension of ecological footprint allocation estimates developed with funding from the Atkinson Charitable Foundation as part of the Canadian Index of Wellbeing project. The results in this report contain estimation refinements from the earlier work.

5 'Mutually exclusive hectares' means that for ecological services provided by the same hectare, this hectare would be counted only once. Otherwise, areas would be double counted, and Footprint result would exaggerate the area demand for ecological services.