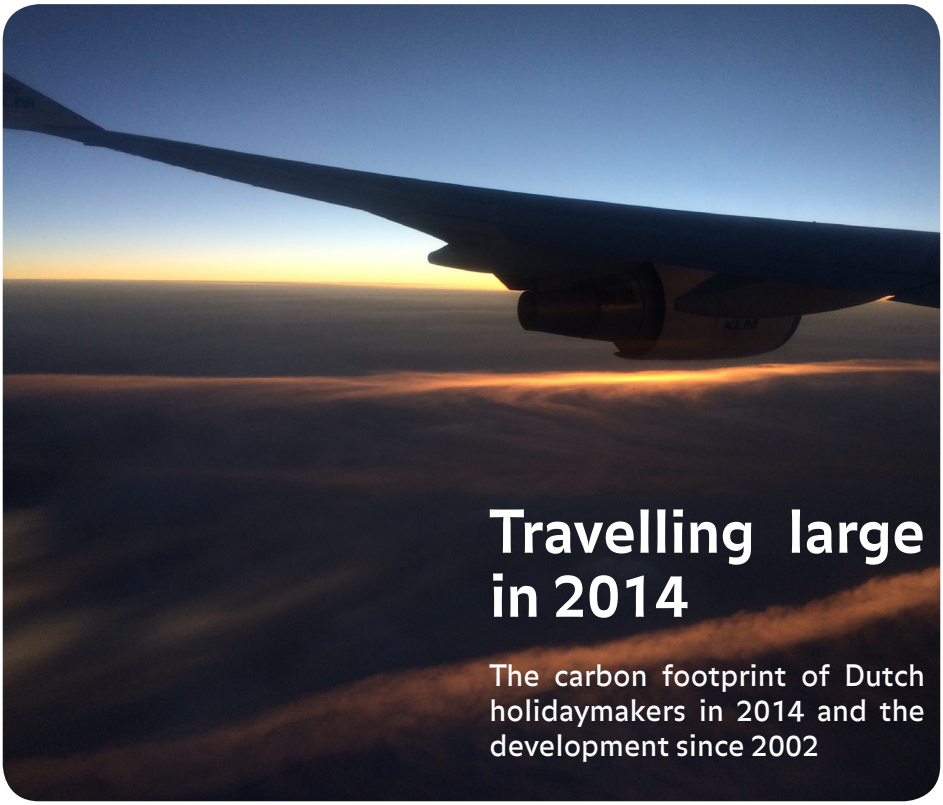

Travelling large in 2014

The carbon footprint of Dutch holidaymakers in 2014 and the development since 2002

NHTV Breda University of Applied Sciences

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A project of NHTV Centre for Sustainable Tourism and Transport in collaboration with NRIT Research and NBTC-NIPO Research

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1 Introduction

1 Introduction

This is the eighth volume in the series on the carbon footprint (CF, the emissions of the greenhouse gas CO_2) of Dutch holidaymakers (see de Bruijn et al. 2008, de Bruijn et al. 2009a, de Bruijn et al. 2009b, de Bruijn et al. 2010, de Bruijn et al. 2012, de Bruijn et al. 2013a, de Bruijn et al. 2013b, Pels et al. 2014)1. All reports were written by the Centre for Sustainable Tourism & Transport of NHTV Breda University of Applied Sciences and NRIT Research, in collaboration with NBTC-NIPO. The current volume presents figures for 2014, and shows developments over 2002, 2005, 2008, 2009, 2010, 2011, 2012 and 2013. The range of figures over a twelve-year period not only allows for a presentation of trends, but also for insight on possible impacts of the economic recession on tourism emissions.

Despite a shift of media attention from issues like climate change towards the (volatile) global economy, the impact of industrial sectors – including tourism – on the environment is still discussed by these respective industries, for example as part of evolving Corporate Social Responsibility (CSR) strategies and/or newly introduced climate policies. Several Dutch tour operators and the Dutch Association of Travel Agents and Tour Operators (ANVR), amongst others, have recognised their responsibility, and have started to engage in carbon management. For these tour operators, some of the most important factors for taking action are increasing energy costs, international aviation policy, pressure from society to become greener, increasing demand for green trips, and the wish to obtain a green image and become a frontrunner among consumers and colleagues in doing so.
For tourism, the 2008 World Tourism Organisation (UNWTO) report on the effects of climate change on tourism as well as the effects of tourism on greenhouse gas emissions (UNWTO-UNEP-WMO 2008) is still a work of reference. Other industry associations have also started to handle the theme more seriously (e.g. WTTC 2009). The UNWTO report estimates the contribution of tourism to carbon dioxide emissions at approximately 5% in 2005 (UNWTO-UNEP-WMO 2008). Moreover, UNWTO expects these emissions to increase by a factor 2.6 (or 160%) between 2005 and 2035. Information on the share of tourism of all environmental impacts and eco-efficiency (kg CO_2 per Euro spent by tourists) of the Netherlands is important for the sector's continued implementation of CSR.

The aim of this research consists of two parts. Firstly, it provides a complete overview of the effects of Dutch holidaymakers on climate and eco-efficiency in 2014. Secondly, it shows some of the changes that have occurred throughout the period 2002-2005-2008-2009-2010-2011-2012-2013-2014.

This understanding requires answers to the following questions:

- What is the total carbon footprint of Dutch holidaymakers and what are the developments of this carbon footprint?
- How does the holiday carbon footprint relate to the total carbon footprint of the Netherlands?
- What factors determine the development of the carbon footprint?
- What type of holidays and which parts of tourism are the least/most damaging to the environment?
- What is the eco-efficiency of different types of holidays?

Chapter two of this report briefly describes the method used to calculate the carbon footprint and the eco-efficiency, followed by an overview of Dutch holiday behaviour in the seven survey years. Chapter 3 describes the results for 2013. Section 3.1 starts with a number of reference values for the CF in the Netherlands. Section 3.2 provides an overview of the calculated CF for holidays, split for several holiday types and a number of destinations. The chapter continues with a detailed breakdown of the CF by destination, duration, accommodation type, transport mode, and form of organisation, both for domestic holidays (section 3.3) and outbound holidays (section 3.4). Section 3.5 examines the distribution of emissions over the different components of holidays (accommodation, transport and activities). Section 3.6 looks at the eco-efficiency and compares the results with the eco-efficiency of the Dutch economy. Chapter 4 then shows the main changes of the CF during the period 2002-2014. Finally, in chapter 5, the research questions are answered, the results are reflected upon and some conclusions are drawn.

2 Methodology

Data on Dutch travel behaviour from the ContinuVakantieOnderzoek (Continuous Holiday Survey, CVO), the annual holiday survey in the Netherlands, form the basis of this report. Specifically for this analysis, as an indicator for the environmental effect of tourism, the carbon footprint (CF, expressed in kg CO_2 emissions) was used and added to the CVO. The CF has been accepted as a legitimate indicator for calculating the environmental impact by a continuously increasing group of stakeholders, both inside and outside the tourism industry. Carbon dioxide (CO_2) currently receives much societal and political attention, and policy is already developed for it. CO_2 is also one of the biggest environmental problems for tourism (see e.g. Peeters et al. 2007a, UNWTO-UNEP-WMO 2008). The CF is calculated by multiplying emission factors for CO_2 (in kg CO_2 per night, per kilometre, etc.) by the number of nights, distance travelled, et cetera. These calculations are performed on data on the accommodation type, number of nights, transport mode, destination, and type of holiday, per trip featured in the CVO database. Note that for the CF, this report uses metric units throughout.

2.1 Carbon footprint

The carbon footprint is a measure of the contribution of an activity, country, industry, person, et cetera, to climate change (global warming). The CF is caused by the combustion of fossil fuels for generating electricity, heat, transport, and so on. CO_2 emissions cause a rise in the concentration of CO_2 in the atmosphere. Since the industrial revolution the CO_2 concentration has increased from 280 ppm to 399 ppm in 2014 (parts per million; see Tans 2015), which causes the atmosphere to retain more heat. The atmosphere's ability to retain heat is called "radiative forcing", expressed in W/m2. However, besides CO_2 emissions, other emissions also play a role in global warming. These include gases like nitrogen oxides, CFCs and methane. A common way to add the effects of these other greenhouse gases (GHG) to CO_2 is by converting them into carbon dioxide equivalents (CO_2-eq). To do this, "global warming potential" (GWP) is used as a conversion factor. These factors vary significantly per type of gas. For instance, the GWP of methane is 25 (see IPCC 2007: 33). This means that in one hundred years the emission of 1 kg methane has the same effect on the temperature as the emission of 25 kg of CO_2 over the same period. A conversion factor can also be determined for an industry or sector, which obviously depends on the exact mix of emissions. For nearly all tourism components this factor is relatively small (1.05, see Peeters et al. 2007a). However, for air travel this is not the case. Airplanes cause additional impacts on climate, as they not only produce additional GHGs like nitrogen oxides, but also because these substances appear in the upper atmosphere, where they cause chemical reactions, and in some cases contrails (condensation trails) and sometimes even high altitude 'contrail-induced' cirrus clouds. This produces a significant net contribution to "radiative forcing". In 2005, the total contribution of aviation to radiative forcing accumulated since

1940 was 2.0 (excluding cirrus clouds) to 2.8 times (including cirrus) as large as the effect of all airplane CO_2 emissions (best estimates from Lee et al. 2009). However, the uncertainty is large: the total contribution of aviation to climate change lies somewhere between 1% and 14%. Unfortunately, as a result of various practical and theoretical objections, these percentages cannot be used as GWP (see Forster et al. 2006, Forster et al. 2007, Graßl et al. 2007, Peeters et al. 2007b). Thus it is not possible to provide a CO_2-equivalent for air travel. In this report, we therefore limit ourselves to the CF of CO_2 emissions only (see also Wiedmann et al. 2007).

The CF consists of two parts: the direct and indirect CF. The direct CF consists of CO_2 emissions caused by the operation of cars, airplanes, hotels, etc. The indirect CF measures the CO_2 emissions caused by the production of cars, airplanes, kerosene, et cetera, and thus considers the entire lifecycle, in addition to the user phase (see Wiedmann et al. 2007). This report addresses all primary CO_2 emissions, plus the emissions caused by the production of fuel and/or electricity, but ignores all other indirect emissions.

2.2 Calculation model

The CVO data have been processed with SPSS 22.0, which required the development of a syntax (a piece of SPSS code) for the CF. A CF has been calculated for each single holiday in the CVO. Firstly, the CVO was supplemented with a variable that indicates the amount of kilometres between origin and destination. This concerned the great circle distance, i.e. the shortest distance between origin and destination. Secondly, a diversion factor was added for each transport mode, which was used to multiply transport emissions with in the end. Thirdly, a CF per day for each holiday component (transport, activities, accommodation) was calculated through the use of an emission factor for CF and based on the number of nights, distance travelled and specific activities. By multiplying these with the duration of the holiday, the CF for each complete holiday was found. Then, by increasing the individual carbon footprints with a weight factor and summation, the total carbon footprint of all holidays was calculated. As weight factors, those provided by the CVO for calculating totals for the entire Dutch population were used. For a detailed description of the calculation method and the emission factors, we refer to the internal NHTV/CSTT-report 'Carbon footprint emission factors; version 2012 and trends 2002-2012' (Peeters 2013). For 2013 and 2014 park emissions for road transport were taken equal as 2012 due to unavailability at the time of calculating the data in this report.
This report contains some small corrections in comparison with the emission factor report used for the 2013 CF report (Pels et al. 2014). As a result, the aggregated CF for all previously years published upon differ (slightly) in this report from those published in Pels et al. 2014. The figures in the present report have to be considered the most reliable.

2.3 Key figures holidays

In table 2.1 the key figures for population and holidays are presented for the survey years 2002, 2005, 2008, 2010, 2011, 2012, 2013 and 2014.

Table 2.1 Key figures holidays 2002, 2005, 2008, 2010, 2011, 2012, 2013, 2014

	Unit	2002	2005	2008	2010	2011	2012	2013	2014
Dutch population on January 1	million	16.1	16.3	16.4	16.6	16.7	16.7	16.8	16.8
0-19 years	%	24.6	24.5	24.0	23.7	23.5	23.3	23.1	22.9
20-64 years	%	61.9	61.5	61.3	61.0	60.9	60.5	60.1	59.8
65 years and older	%	13.7	14.0	14.7	15.3	15.6	16.2	16.8	17.4
Holiday participation	%	81	81	82	81	82	81	81	80
Long holidays (5 or more days)	%	74	75	75	76	76	74	74	72
Short holidays (2-4 days)	%	41	40	40	42	42	43	41	41
Number of long holidays by the Dutch population	million	22.4	22.2	23.6	23.3	23.1	22.9	22.8	22.1
Number of short holidays by the Dutch population	million	13.1	12.2	12.3	12.9	13.2	13.9	12.8	13.0
Total number of holidays by the Dutch population	million	35.5	34.4	35.9	36.1	36.3	36.7	35.6	35.1
Average number of holidays per Dutch inhabitant									
For the whole population		2.21	2.11	2.18	2.18	2.17	2.20	2.12	2.1
For those that go on holidays		2.72	2.61	2.67	2.69	2.65	2.71	2.62	2.8
Domestic holidays	million	18.7	17.3	17.4	17.7	17.7	18.1	17.5	17.2
Outbound holidays of which in:	million	16.8	17.1	18.5	18.4	18.6	18.6	18.1	17.9
France	million	3.3	2.8	2.9	2.9	3.0	2.8	2.7	2.6
Germany	million	2.5	2.6	3.0	3.2	3.3	3.4	3.2	3.4
Belgium	million	2.2	2.0	2.0	2.0	2.0	1.8	1.8	1.4
Overnight stays by the Dutch	million	275.9	267.5	280.2	278.0	276.3	279.0	275.4	265.2
Domestic	million	108.9	95.7	91.8	94.0	91.8	92.3	93.0	86.4
Abroad	million	167.0	171.8	188.3	184.0	184.6	186.7	182.6	178.8
Expenditure by the Dutch on domestic holidays	billion Euro	2.9	2.5	2.7	2.8	2.8	2.9	2.9	2.8
Expenditure by the Dutch on outbound holidays	billion Euro	9.7	10.3	12.6	12.2	11.2	12.9	12.6	12.6
Total distance travelled on holidays by the Dutch*)	billion km	45.9	54.7	62.0	62.4	61.7	62.3	59.1	61.0

Source: CVO 2002, 2005, 2008, 2010, 2011, 2012, 2013, 2014

*) these are not the actual distances, but the great circle distance between home and destination; the real distances are between 5% and 15% longer

3 Carbon footprint 2014

3.1 Introduction

In this chapter, the results of the calculations and analyses of the survey year 2014 are presented (in kg CO_2). The values in table 3.1 are used for reference. Note that the 2014 value of total Dutch CO_2 emissions is preliminary (CBS 2015a); official values will likely be published in the course of 2015. The 157.9 Mt figure and the population size in 2014 were used to calculate the average CO_2 emissions per person and the CO_2 emissions per person per day in the Netherlands. Especially the last figure is used several times as a reference in this report, as emissions figure for 'staying at home'.

Table 3.1 Reference values carbon footprint, 2014

	2014
CO_2 emissions per average Dutch holiday	421 kg
CO_2 emissions per average Dutch holiday per day	49.0 kg
Total CO_2 emissions Dutch holidays	14.8 Mt
Average annual CO_2 emissions per person in the Netherlands	9.38 tonnes*)
Average CO_2 emissions per person per day in the Netherlands	25.7 kg*)
Total Dutch CO_2 emissions**)	157.9 Mt*)

Source: CBS 2015b; the holiday values have been calculated in this study
*) preliminary figure (CBS 2015b)
**) excluding LULUCF (forestry- and land use)

3.2 Total carbon footprint

The total carbon footprint of all Dutch tourists was around 14.8 Mt CO_2 in 2014. Tourism CO_2 emissions are not directly comparable with national CO_2 emissions, as transport and accommodation emissions were calculated using the nationality principle, thus including all tourism emissions of Dutch holidaymakers, i.e. also when they were produced abroad. However, measured as part of Dutch emissions (157.9 Mt CO_2 in total and just under 9.5 tonnes of CO_2 per person in 2014), the tourism emissions would amount to approximately 9.4% of the total Dutch carbon footprint. The carbon footprint per average holiday is 421 kg CO_2 and per day 49 kg CO_2. Because 20% of the Dutch population did not go on holiday

in 2014 (see table 2.1), the average number of holidays for those who did go is 2.8 holidays per year. As a result, each person that went on holiday produced average holiday emissions of 1179 kg CO_2, which is 12.6% of the average annual emissions of a Dutch citizen in 2014. Table 3.2 shows the (average) values of the carbon footprint of Dutch tourists, divided in short (2 to 4 days) and long holidays (5 days and longer), and in domestic and outbound holidays.

Table 3.2 Carbon footprint per day, per holiday and in total, by destination and length of stay, 2014

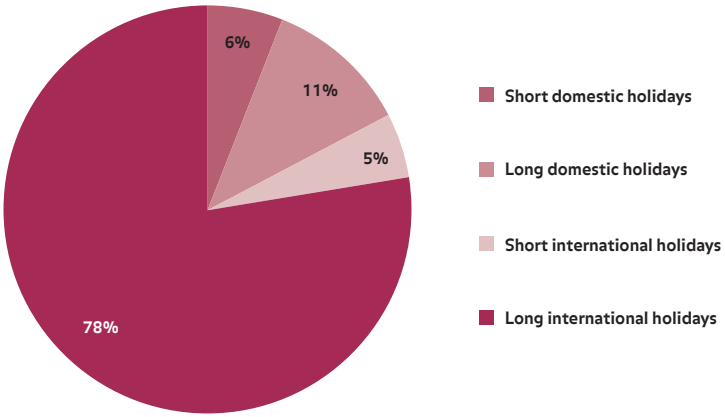
	Short holiday			Long holiday			All holidays		
Carbon footprint in kg CO_2	Per day	Per holiday	Total (Mt)	Per day	Per holiday	Total (Mt)	Per day	Per holiday	Total (Mt)
In the Netherlands	29	92	0.87	23	220	1.69	25	149	2.56
Abroad	64	213	0.75	62	795	11.46	62	681	12.21
Belgium	35	108	0.08	26	233	0.15	28	165	0.24
France	50	165	0.08	33	503	1.06	34	438	1.14
Germany	43	143	0.18	31	298	0.63	33	239	0.81
Average	39	124	1.62	51	595	13.15	49	421	14.77

Source: CVO, 2014 (calculation CSTT/NRIT Research)

Domestic holidays produced a total carbon footprint of 2.6 Mt CO_2, which is 149 kg per holiday and 25 kg per day. An average outbound holiday has a much larger footprint of 681 kg or 62 kg per day. All outbound holidays produced 12.2 Mt CO_2. Thus, 17% of all holiday emissions were produced by domestic and 83% by outbound holidays (see figure 3.1), whereas the number of domestic holidays (17.2 million) is close to that of outbound holidays (17.9 million). The average carbon footprint for all holidays is 49 kg per day; over 23 kg more than the Dutch average per day during the whole year (see table 3.1). This means that on average, the pressure on the environment is 91% higher during holidays than when staying at home. Moreover, this comparison does not take into account, for example, the emissions from people that leave their heating on in winter when taking a holiday, which would make their total footprint while on holiday a little larger still. Still, the per day emis-

sions of a domestic holiday are 1 kg below the average for staying at home, but only when there is no additional home energy-use. Per long holiday (5 days or longer) both the domestic and outbound carbon footprints are much higher than for short holidays. The differences are not as large on a per day basis. The carbon footprint per day of a long domestic holiday is actually smaller than for a short domestic holiday. The main reason for this is that the transport emissions are divided over a larger number of days. A long outbound holiday does have a larger carbon footprint per day than a short outbound holiday, although here too, the contrary would have perhaps seemed logical due to a higher transport footprint per day for short holidays. The main reason here is the considerably longer distance often noted for long outbound holidays. The emissions of long outbound holidays produced 78% of all holiday emissions (see figure 3.1).The carbon footprint of a holiday in Belgium is only slightly higher per holiday and day than for domestic holidays. Figures for France and Germany are much higher. Germany's lower total holiday footprint than France is due to a high number of short and fewer long Dutch holidays.

Figure 3.1 Distribution of all CO_2-emissions by domestic and outbound holidays and holiday length, 2014



Source: CVO, 2014 (calculation CSTT/NRIT Research)

3.3 Carbon footprint of domestic holidays

3.3.1 Length of domestic holidays

Table 3.3 shows that the carbon footprint per day decreases with an increase of the length of stay. The transport component weighs less heavily on the carbon footprint of a longer holiday, because the distance between home and the destination does not differ much

between longer and shorter holidays in the Netherlands. On average, CO_2 emissions per day are slightly lower for domestic holidays than for staying at home (24.6 vs. 25.7 kg/day).

Table 3.3 Carbon footprint per day, per holiday and in total, by length of stay for domestic holidays in 2014

	Carbon footprint in kg CO_2		
	Per day	Per holiday	Total (Mt)
2-4 days	29	92	0.87
5-8 days	25	162	0.86
9 days or more	21	348	0.83
Average	25	149	2.6

Source: CVO, 2014 (calculation CSTT/NRIT Research)

3.3.2 Accommodation type domestic holidays

The influence of touristic and season-dependent recreational accommodations on the holiday footprint can also be detected. Table 3.4 and 3.5 show the corresponding values per day, per holiday and in total. Please note that these are figures for the total holiday, based on the accommodation type used: besides the carbon footprint of the accommodation, those for transport and activities are also included.

One figure that stands out in table 3.4 is the high per day footprint of motel and hotel holidays. Holidays spent in tents and youth/group accommodation have the lowest carbon footprint per day. Per holiday the carbon footprint is highest for caravan/tent/trailer/campervan; this is the accommodation type with the longest average length of stay. Finally, the highest total carbon footprint is for holidays spent in second homes or bungalows, which is a result of the high number of holidays spent in this type.

Table 3.4 Carbon footprint per day, per holiday and in total, by touristic accommodation type in the Netherlands for domestic holidays, 2014

	Carbon footprint in kg CO_2		
	Per day	Per holiday	Total (Mt)
Private homes	16	110	0.168
Hotel/motel	37	124	0.457
Pension/B&B	23	89	0.030
Apartment	32	182	0.043
Second home, bungalow	28	175	0.830
Tent, Bungalow tent	14	86	0.065
Caravan, tent trailer, campervan	28	262	0.485
Boat: sailing boat/motor vessel	27	130	0.015
Youth hostel or other group accommodation	11	82	0.020
Other	19	85	0.025
Average	27	155	2.138

Source: CVO, 2014 (calculation CSTT/NRIT Research; note: due to missing values in accommodation data the totals differ from those given in other tables)

The carbon footprints of season-dependent recreational accommodation types do not vary much. Compared to touristic accommodation types, per day figures are generally lower. Probably season-dependent recreational holidays are taken closer to home. Table 3.5 clearly shows that these kinds of holidays are always better for the environment than staying at home, although it must be noted that the figure for staying at home is a daily average, whereas the accommodation types referred to here are often only used during weekends. A better comparison would therefore be based on the average carbon footprint at home during the weekend, but such a figure is not available.

Table 3.5 Carbon footprint per day, per holiday and in total, by recreational accommodation type (permanent pitch, private accommodation) in the Netherlands, 2014

	Carbon footprint in kg CO_2		
	Per day	Per holiday	Total (Mt)
Second home, bungalow	20	127	0.158
Caravan, tent trailer, campervan	19	143	0.243
Boat (with cabin for overnight stays)	7	50	0.015
Other	7	34	0.004
Average	18	125	0.421

Source: CVO, 2014 (calculation CSTT/NRIT Research)

3.3.3 Transport mode domestic holidays

As in the previous section, values presented in table 3.6 are for the complete holiday, and not just the transport mode used. The car is the most popular transport mode which also shows in the total carbon footprint of domestic trips by car. These holidays also have the highest carbon footprint per holiday and per day, and therefore largely determine the average figures. The difference in the carbon footprint per holiday between train and bus on the one hand and the car on the other is large considering the short distances in the Netherlands.

Table 3.6 Carbon footprint per day, per holiday and in total, by transport mode for domestic holidays in 2014

	Carbon footprint in kg CO_2		
	Per day	Per holiday	Total (Mt)
Car	25	156	2.417
Train	19	84	0.076
Touring car/shuttle bus	20	91	0.006
Bicycle	8	82	0.006
Boat: sailing boat/motor vessel	12	62	0.021
Other	20	109	0.033
Average	25	149	2.558

Source: CVO, 2014 (calculation CSTT/NRIT Research)

3.3.4 Organisation type domestic holidays

Regarding the organisation type, the carbon footprint per day for domestic holidays is highest for an organised holiday by car (see the list of terms for an explanation of organisation types). Specified by length of stay, non-organised holidays longer than nine days have the lowest per day footprint. A short, organised holiday by car shows the highest carbon footprint per day, surpassing the per day emissions value for staying at home considerably.

Table 3.7 Carbon footprint per day, per holiday and in total, by organisation type and length of stay in the Netherlands, 2014

	2-4 days			5-8 days			> 9 days			Total		
Carbon footprint in kg CO_2	Per day	Per holiday	Total (Mt)	Per day	Per holiday	Total (Mt)	Per day	Per holiday	Total (Mt)	Per day	Per holiday	Total (Mt)
Organised car	34	107	0.452	28	180	0.445	25	389	0.216	29	153	1.113
Organised other	25	72	0.041	20	128	0.023	19	209	0.008	23	92	0.072
Non-organised	26	80	0.375	23	147	0.391	20	338	0.607	22	150	1.373
Average	29	92	0.868	25	162	0.860	21	348	0.831	25	149	2.558

Source: CVO, 2014 (calculation CSTT/NRIT Research)

3.4 Carbon footprint of outbound holidays

3.4.1 Length of outbound holidays

Section 3.3.1 showed that for domestic holidays, the carbon footprint per day decreases as the length of stay increases. For outbound holidays, medium-length holidays (5-8 days) have the largest carbon footprint per day. An important factor here is the often considerably longer distance travelled on long(er) holidays, and the subsequent higher use of the airplane as transport mode, which increases the share of the transport component in the total carbon footprint. The far longer average length of holidays of over eight days (17 days) decreases the influence of this distance and transport mode factor.



Table 3.8 Carbon footprint per day, per holiday and in total, by length of stay for outbound holidays in 2014

	Carbon footprint in kg CO_2		
	Per day	Per holiday	Total (Mt)
2-4 days	64	213	0.748
5-8 days	66	450	2.505
9 days or more	61	1012	8.955
Average	62	681	12.208

Source: CVO, 2014 (calculation CSTT/NRIT Research)

3.4.2 Outbound destination

The carbon footprint strongly relates to the destination, as well as the distance travelled and transport mode used to get to each destination. Table 3.9 shows the carbon footprint of several outbound destinations, split in short and long holidays. It is obvious that more distant destinations have larger carbon footprints. In general, the carbon footprint per day is smaller with longer than with shorter outbound holidays for a given destination. However, a longer holiday is often one which is taken further away. The carbon footprint per day of, for instance, a holiday to the USA or Canada, does show that the transport component has a larger impact on the total footprint of a short holiday than a long holiday. Spain has the largest total carbon footprint of all single country destinations. Spain's popularity (large number of holidays), plus the relatively long distance and frequent use of air transport are the main reasons for this (both partly due to the Canary Islands being part of Spain). The apparent role of the airplane is even more visible in the carbon footprint per holiday for destinations like Greece, Turkey and other continents. Table 3.9 also shows that an average holiday to Australia or Oceania has a carbon footprint, per holiday, that exceeds that of a holiday to France by a factor 11. Per day the difference is 'only' a factor five, because holidays to Australia last much longer.

Table 3.9 Carbon footprint per day, per holiday and in total, by outbound destination, 2014

	Short holiday			Long holiday			Total holidays		
Carbon footprint in kg CO_2	Per day	Per holiday	Total (Mt)	Per day	Per holiday	Total (Mt)	Per day	Per holiday	Total (Mt)
Belgium	35	108	0.084	26	233	0.151	28	165	0.235
Luxembourg	42	146	0.012	29	290	0.024	32	219	0.036
France	50	165	0.083	33	503	1.058	34	438	1.140
Spain	136	509	0.069	66	818	1.407	68	795	1.476
Portugal	158	610	0.034	64	906	0.389	67	872	0.423
Austria	84	305	0.009	37	411	0.446	38	409	0.455
Switzerland	62	221	0.004	28	381	0.091	29	370	0.095
United Kingdom	83	287	0.100	38	376	0.195	47	340	0.296
Ireland	99	388	0.006	50	577	0.032	54	536	0.037
Norway	119	427	0.002	74	1148	0.139	74	1123	0.141
Sweden	129	422	0.007	45	829	0.104	47	781	0.111
Finland	114	455	0.002	60	622	0.020	62	604	0.021
Denmark	66	227	0.003	33	394	0.057	33	379	0.061
Germany	43	143	0.182	31	298	0.627	33	239	0.808
Italy	119	440	0.049	47	629	0.617	49	610	0.666
Greece	163	652	0.005	74	902	0.649	75	900	0.653
Turkey	192	767	0.006	89	955	0.727	89	953	0.734
Former Yugoslavia	91	363	0.001	40	664	0.165	41	660	0.166
Hungary	124	460	0.007	45	578	0.063	48	563	0.070
Czech Republic	81	284	0.008	37	379	0.060	40	364	0.069
Rest of Europe	134	534	0.016	67	801	0.198	69	772	0.215
Africa	169	576	0.005	110	1526	0.699	111	1507	0.704
Asia	556	1951	0.035	138	2572	1.365	140	2552	1.400
USA and Canada	512	2050	0.008	129	2496	1.092	130	2492	1.101
Rest of Americas	279	838	0.001	151	2607	0.775	151	2597	0.776
Australia, Oceania	1523	4569	0.009	168	4974	0.309	173	4961	0.319
Average outbound	64	213	0.748	62	795	11.460	62	681	12.208

Source: CVO, 2014 (calculation CSTT/NRIT Research)

3.4.3 Accommodation type outbound holidays

For outbound holidays it is also possible to measure the carbon footprint related to the accommodation used, both for touristic and season-dependent recreational (permanent) accommodation types. Table 3.10 and 3.11 show the values per day, holiday and in total. Again, these figures are for the total holiday footprint, depending on the accommodation used, i.e. including transport and activities.
As with domestic holidays, the carbon footprint per day is large for outbound holidays spent in a motel or hotel (see table 3.10). This accommodation type also causes the largest total carbon footprint. Holidays spent on a boat or cruise ship produce the largest footprint per day; those in a tent the lowest. The high level for the "Boat" category is entirely caused by the very high levels of emissions of cruise ships.

Table 3.10 Carbon footprint per day, per holiday and in total, by touristic accommodation type for outbound holidays in 2014

	Carbon footprint in kg CO_2		
	Per day	Per holiday	Total (Mt)
Private home of friends or relatives	62	639	0.740
Private home (other)	38	439	0.451
Hotel/motel	89	786	5.534
Pension/B&B	52	492	0.283
Apartment	63	715	1.464
Second home, holiday cottage	51	519	1.045
Tent, Bungalow tent	28	427	0.356
Caravan, tent trailer, campervan	42	757	1.368
Boat: sailing boat/motor vessel/cruise*)	157	1663	0.406
Youth hostel or other group accommodation	85	826	0.115
Other	66	663	0.064
Average	64	696	11.827

Source: CVO, 2014 (calculation CSTT/NRIT Research; note: due to missing values in accommodation data the totals differ from those given in other tables)
*) These values are high because cruises use large amounts of energy per day or night

Season-dependent recreational accommodations outside the Netherlands mainly concern second homes or bungalows, and caravans, tent trailers or campervans on permanent pitches. Per day, the carbon footprint for the latter type is lower than for the first. The total footprint is also larger for holidays spent in second homes and bungalows, because more outbound holidays are spent in this type. On average and for second homes and bungalows, the carbon footprint per day is higher than for staying at home in the Netherlands.

Table 3.11 Carbon footprint per day, per holiday and in total, for outbound holidays in season-dependent recreational accommodation types (on a permanent pitch), 2014

	Carbon footprint in kg CO_2		
	Per day	Per holiday	Total (Mt)
Second home, bungalows	35	446	0.308
Caravan, tent trailer, campervan	24	298	0.069
Boat (with cabin for overnight stays)		-	-
Other	12	128	0.003
Average	32	402	0.381

Source: CVO, 2014 (calculation CSTT/NRIT Research)

3.4.4 Transport mode outbound holidays

Per day, the largest carbon footprint was found for outbound holidays taken by airplane. The popularity of the airplane also gives these holidays the largest footprint per holiday and in total. The average holiday by plane produces over three times more emissions than that by car. Holidays by train, having the lowest carbon footprint per day based on the transport mode used, only produce a relatively small share of the total carbon footprint of outbound holidays. An explanation for the relatively high per day and per holiday values for the category "other" is the inclusion of cruise ships (as mode of transport).

Table 3.12 Carbon footprint per day, per holiday and in total, by transport mode for outbound holidays in 2014

	Carbon footprint in kg CO_2		
	Per day	Per holiday	Total (Mt)
Car	35	385	3.632
Airplane	98	1169	8.045
Train	27	172	0.084
Touring car/shuttle bus	30	229	0.148
Boat: sailing boat/motor vessel	32	610	0.012
Other	65	615	0.287
Average	62	681	12.208

Source: CVO, 2014 (calculation CSTT/NRIT Research)

3.4.5 Organisation type outbound holidays (longer than 4 days)

The strong influence of the transport mode used is also apparent in the carbon footprint of outbound holidays per organisation type: an organised holiday by plane has the largest carbon footprint per day and per holiday (see table 3.13; see the list of terms for an explanation of organisation types). Organised holidays by plane produce by far the highest share of the total carbon footprint of outbound holidays by organisation type. Organised holidays by car (e.g. including accommodation booked with a travel agency) have a slightly lower carbon footprint per holiday than non-organised outbound holidays.

Table 3.13 Carbon footprint per day, per holiday and in total, for outbound holidays (longer than 4 days) by organisation type in 2014

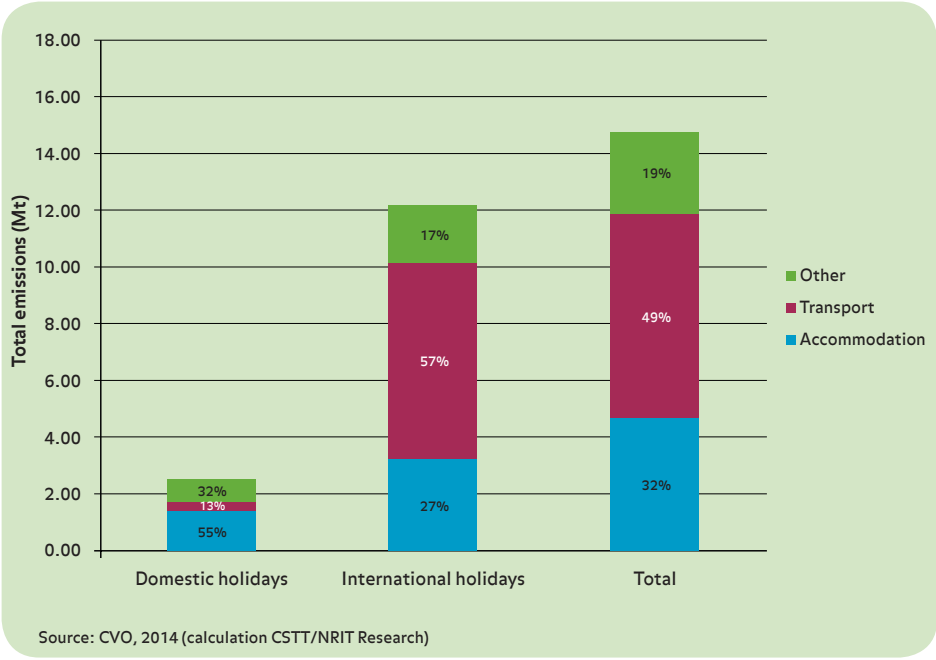
	Carbon footprint in kg CO_2		
	Per day	Per holiday	Total (Mt)
Organised car	38	434	1.388
Organised touring car	29	275	0.127
Organised airplane	98	1249	7.593
Organised other	51	519	0.289
Non-organised	33	500	2.064
Average	62	795	11.460

Source: CVO, 2014 (calculation CSTT/NRIT Research)

3.5 Carbon footprint per holiday component

The environmental impact of a holiday can be divided over the components transport, accommodation, and other aspects. These 'other aspects' are also called 'entertainment', and concern local activities (that also include local transport used for excursions et cetera). Figure 3.2 shows the division over these three categories. For all holidays, the transport used to and from the destination has the largest impact on the holiday carbon footprint (49%). Accommodation is responsible for just under a third of all holiday emissions (32%).

Figure 3.2 Carbon footprint per holiday component in 2014



Source: CVO, 2014 (calculation CSTT/NRIT Research)

Figure 3.2 also shows large differences between domestic and outbound holidays. For the carbon footprint of domestic holidays, accommodation is particularly relevant (55%), whereas transport is similarly important for outbound holidays (57%). All three components have a much larger absolute environmental impact with outbound holidays than with domestic holidays.

In table 3.14 the carbon footprint of the three components is shown for various destinations. One figure that stands out is the large share of transport in the holiday carbon footprint of more distant destinations. This is particularly valid for countries and regions that are mainly accessed by plane, where the transport share is typically at least around 50%, starting with e.g. Hungary, Spain and Finland, and reaching up to 83% for overseas destinations. Intercontinental holidays also have a relatively large carbon footprint for the category 'other', mainly caused by the longer duration of these holidays, but also because of round trips made at the destination (involving long distances and often local flights). For Australia this is particularly visible. In the right (percentage) column this share is not very large, because the transport component still weighs much heavier.

Table 3.14 Share of the components transport, accommodation and 'other' of the carbon footprint per destination, in kg per holiday and in percentage of total, 2014

	Carbon footprint per holiday in kg CO_2			Share of total carbon footprint in %*		
	transport	accommoda-tion	other	transport	accommoda-tion	other
Netherlands	19	82	47	13%	55%	32%
Belgium	30	80	55	18%	48%	33%
Luxembourg	55	93	71	25%	42%	32%
France	140	168	130	32%	38%	30%
Spain	483	208	104	61%	26%	13%
Portugal	536	204	132	61%	23%	15%
Austria	183	159	67	45%	39%	16%
Switzerland	131	155	85	35%	42%	23%
United Kingdom	128	131	81	38%	38%	24%
Ireland	266	128	142	50%	24%	26%
Norway	207	737	179	18%	66%	16%
Sweden	283	227	271	36%	29%	35%
Finland	394	139	71	65%	23%	12%
Denmark	115	148	116	30%	39%	31%
Germany	60	109	70	25%	45%	29%
Italy	249	230	131	41%	38%	21%
Greece	557	233	109	62%	26%	12%
Turkey	639	218	97	67%	23%	10%
Former Yugoslavia	242	225	193	37%	34%	29%
Hungary	304	146	113	54%	26%	20%
Czech Republic	144	137	83	40%	38%	23%
Rest of Europe	414	215	142	54%	28%	18%
Africa	1072	248	188	71%	16%	12%
Asia	1919	348	285	75%	14%	11%
USA and Canada	1833	370	289	74%	15%	12%
Rest of Americas	2090	307	201	80%	12%	8%
Australia, Oceania	4122	329	510	83%	7%	10%
Average	206	133	82	49%	32%	19%

Source: CVO, 2014 (calculation CSTT/NRIT Research)
*total share not always 100% because component figures are rounded off

Table 3.15 shows the shares of the components transport, accommodation and 'other' aspects per holiday by transport mode. Logically, the transport component of holidays taken by plane is the largest, whereas it is zero for holidays taken by bicycle and boat. The latter is because the carbon footprint of cruise ships and boats has been completely attributed to accommodation.

Table 3.15 Share of the components transport, accommodation and 'other' of the carbon footprint per transport mode, in kg per holiday and in percentage of total, 2014

	Carbon footprint per holiday in kg CO_2			Share of total carbon footprint in %*		
	transport	accommo-dation	other	transport	accommo-dation	other
Car	60	109	74	25%	45%	30%
Airplane	817	217	134	70%	19%	11%
Train	17	70	28	15%	61%	24%
Touring car/shuttle bus	35	140	40	16%	65%	19%
Boat**	0	135	59	0%	70%	30%
Bicycle	0	46	17	0%	73%	27%
Other	76	293	47	18%	70%	11%
Average	206	133	82	49%	32%	19%

Source: CVO, 2014 (calculation CSTT/NRIT Research)

* total share not always 100% because component figures are rounded off

** The transport emissions for 'boat' are zero as these trips do not require (significant) transport to the boat and we have assigned all emissions from the boat itself to accommodation as these are difficult to separate.

The next table (3.16) shows the shares of transport, accommodation and 'other' aspects of the holiday footprint and total footprint by accommodation type. Hotel holidays have the largest impact on the environment. However, the share of accommodation of the total carbon footprint of hotel holidays is relatively low (25%), because they are often taken by plane, which weighs heavier on the total carbon footprint.

Table 3.16 Share of the components transport, accommodation and 'other' of the carbon footprint per accommodation type, in kg per holiday and in percentage of total, 2014

	Carbon footprint per holiday in kg CO_2			Share of total carbon footprint in %		
	transport	accommo-dation	other	transport	accommo-dation	other
Hotel	326	136	80	60%	25%	15%
Bungalow	88	121	59	33%	45%	22%
Camping	104	141	113	29%	39%	32%
Other	255	132	81	54%	28%	17%
Average	206	133	82	49%	32%	19%

Source: CVO, 2014 (calculation CSTT/NRIT Research)

Finally, table 3.17 shows the division of the three components per organisation type (see the list of terms for an explanation of organisation types). The share of transport of the total carbon footprint is largest for holidays for which only the transport is booked in advance. To a lesser degree, this is also valid for combined trips and package holidays. In all three cases the airplane plays a major role.

Table 3.17 Share of the components transport, accommodation and 'other' of the carbon footprint per organisation type, in kg per holiday and in percentage of total, 2014

	Carbon footprint per holiday in kg CO_2			Share of total carbon footprint in %		
	transport	accommo-dation	other	transport	accommo-dation	other
Package trip	635	250	110	64%	25%	11%
Combined trip	649	198	125	67%	20%	13%
Only transport organised	741	148	136	72%	14%	13%
Only accommodation organised via booking agency	47	100	68	22%	46%	32%
Only accommodation directly booked	63	120	88	23%	44%	33%
Non-organised	72	108	60	30%	45%	25%
Average	206	133	82	49%	32%	19%

Source: CVO, 2014 (calculation CSTT/NRIT Research)

3.6 Eco-efficiency

The carbon footprint of a holiday (or per day) can be compared with holiday spending. This is called 'eco-efficiency', expressed in kg CO_2 per Euro. The lower the figure, i.e. the fewer emissions per Euro spent, the better the eco-efficiency. Table 3.18 gives an overview of eco-efficiency values for holidays made by the Dutch. Short holidays clearly score better eco-efficiency values than long ones, because spending is relatively high and transport emissions low compared to long holidays.

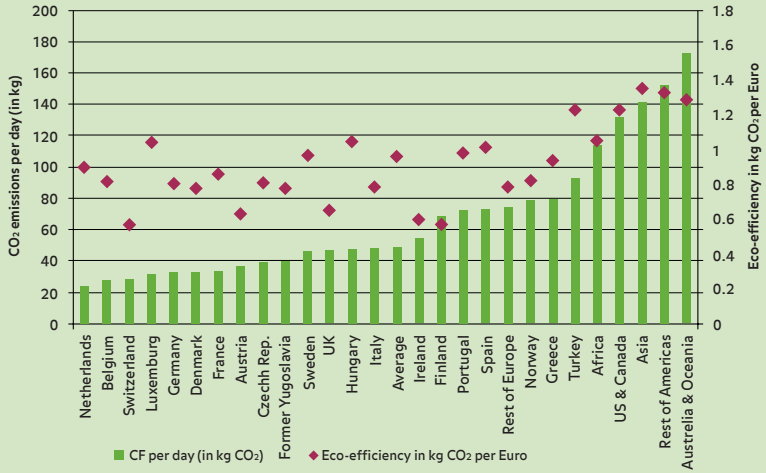
Table 3.18 Eco-efficiency, by destination and length of stay, 2014

Eco-efficiency in kg CO_2 per Euro	Short holiday	Long holiday	Total holidays
Domestic	0.80	0.96	0.90
Outbound	0.89	0.98	0.97
Average	0.83	0.97	0.96

Source: CVO, 2014 (calculation CSTT/NRIT Research)

However, between outbound destinations the eco-efficiency varies considerably (see figure 3.3). With 0.57 kg CO_2/€, Switzerland and Finland have the lowest, most favourable, eco-efficiency, whereas Asia has the highest (1.35 kg CO_2/€). With an eco-efficiency of around 1.22 kg CO_2/€, Turkey is the least favourable one within Europe. In 19 out of 22 European destination areas the spending in is more than the emissions in kg. In general the differences between destinations are smaller in eco-efficiency than in the carbon footprint per holiday or per day. Apparently, tourists' emissions increase along with their spending.

Figure 3.3 Eco-efficiency and carbon footprint per day, by destination, 2014



Source:CVO, 2014 (calculation CSTT/NRIT Research)

The eco-efficiency of the whole Dutch economy is approximately 0.24 kg CO_2/€ (total 2014 CO_2 emissions of 157.9 Mt, see section 3.1, divided by the 2014 GDP of €663 billion1 (CBS 2015b). Hence, all holiday types and destinations presented in this section are less eco-efficient. It is impossible to choose a more eco-efficient domestic or outbound holiday, as is shown in table 3.19. The average outbound holiday per train, the most eco-efficient holiday type based on the transport mode used, has a 50% higher emission per Euro than the Dutch economy. Domestic holidays are often less eco-efficient per transport mode than outbound holidays due to lower spending, though on average there is a small advantageous eco-efficiency for domestic, apparently due to the unfavourable eco-efficiency of outbound holidays by airplane.

Table 3.19 Eco-efficiency of domestic and outbound holidays by mode of transport, 2014

Eco-efficiency in kg CO_2 per Euro	Domestic holidays	Outbound holidays
Car	0.95	0.86
Airplane	-	1.09
Train	0.51	0.36
Touring car/shuttle bus	0.37	0.42
Boat: sailing boat/motor vessel	0.40	0.58
Bicycle	0.39	-
Other	0.60	0.81
Average	0.90	0.97

Source: CVO, 2014 (calculation CSTT/NRIT Research)

4 Developments 2002 - 2014

4.1 Introduction

This chapter shows the most important changes of the carbon footprint during the years 2002, 2005, 2008, 2009, 2010, 2011, 2012, 2013 and 2014. As reference values, the average and total emissions for Dutch holidays and for the Dutch on an annual basis are shown in table 4.1.

The two most prominent developments are seen in this table: from 2002 to 2014 total Dutch CO_2 emissions have decreased by 10.3%, but at the same time total Dutch holiday emissions have increased by 14.6%. 2014 has seen a very small 0.3% decrease in total holiday emissions compared to 2013. However, average emissions per day (2.9%) and per holiday (1.0%) increased, because of the fewer holidays taken. Compared to 2002, total holiday emissions growth has been higher in previous years, notably around 20% in 2008 and again in 2012.

This has resulted in an increase of the share of holiday emissions of the Netherlands' total emissions from 7.3% in 2002 to 9.4% in 2014. Emissions per day followed the same development: annual emissions per capita per day in the Netherlands have decreased by 14.0%, whereas those for holidays have increased by 18.4%. The table also shows the slight reductions of all emission figures (both for tourism and the economy) in 2009, after peaking in 2008. However, most of these figures were back to or over 2008 levels in 2010 again, though national emissions have decreased almost constantly since. The sometimes large variations in national emissions are largely due to changes in average autumn, winter and spring temperatures in the Netherlands, which have a considerable effect on home and industry energy use. Total holiday emissions, with their large outbound share, have developed differently and surpassed the previous record of 2008 in 2012, before decreasing in 2013 and 2014. Carbon footprint developments will be more explicitly shown in section 4.3.

Table 4.1 Reference values carbon footprint 2002, 2005, 2008-2014

	2002	2005	2008	2009	2010	2011	2012	2013	2014
Dutch average CO_2 emissions per holiday (kg)	363	411	429	413	424	423	422	416	421
Dutch average CO_2 emissions per holiday per day (kg)	41.4	46.8	48.6	47.9	48.7	48.9	49.1	47.6	49.0
Total Dutch holiday CO_2 emissions (Mt)	12.9	14.2	15.4	15.0	15.3	15.3	15.5	14.8	14.8
Average CO_2 emissions per person per year in the Netherlands (tonnes)	10.93	10.79	10.68	10.31	10.94	10.09	9.94	9.92	9.38
Average CO_2 emissions per person per day in the Netherlands (kg)	29.9	29.6	29.3	28.2	30	27.7	27.2	27.2	25.7
Total Dutch CO_2 emissions (Mt)**)	176	175.9	175.2	169.9	181.4	168.1	166.3	166.4	157.9
Contribution of Dutch holiday CO_2 emissions to total Dutch CO_2 emissions	7.32%	8.05%	8.79%	8.83%	8.44%	9.13%	9.32%	8.90%	9.35%

Source: CBS 2014b; CVO 2002, 2005, 2008, 2009, 2010, 2011, 2012, 2013, 2014 (calculation CSTT/NRIT Research)

*) preliminary figure (CBS 2014b) **) excl. LULUCF (emissions from forestry and land use)

4.2 Developments in distance, transport modes, organisation, and accommodation

The next table provides insight into the shares of different modes of transport of the total holiday market (number of holidays), and of the total distance travelled on holidays. For distance, the great circle distance between home and destination is used; the real distances are 5-15% longer. Looking at the total holiday market between 2002 and 2014, it appears that the number of holidays decreased by 1.1%, whereas the total distance travelled on holiday increased by 33.5%. Total distance increased by 3.2% between 2013 and 2014, after having decreased by -5.3% between 2012 and 2013. The average return distance for a holiday increased from 1,290 km in 2002 to 1,738 km in 2014 (+34.7%), surpassing the previous 'record' from 2010 (1,730 km). The most relevant development here is the increase of holidays by plane with 62.0% between 2002 and 2014. The total distance travelled on holidays by plane increased even more during the 2002-2014 period (57.3%). Overall, the Dutch have not only started travelling more by plane, but also travelled further with this transport mode. The average return distance for holidays by plane increased from 6,136

km in 2002 to 6,889 in 2010, and then decreased to 6,296 km in 2013, before increasing to 6,373 km again in 2014. The airplane is now used for 71.9% of the total holiday distance travelled, whereas holidays by plane still only make up 19.6% of all holidays.

Table 4.2 Holidays and distance per transport mode used

	Unit	2002	2005	2008	2010	2011	2012	2013	2014
Share of total Dutch holidays by transport mode used, per year	%								
Car		75.4	73.0	71.7	72.9	72.2	72.5	72.5	71.0
Airplane		12.1	15.9	17.7	17.4	18.1	18.4	18.5	19.6
Train		4.2	4.2	4.5	4.1	4.3	4.1	4.2	4.0
Touring car/shuttle bus		3.3	3.3	3.0	2.4	2.4	2.0	1.8	2.0
Boat		0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3
Bicycle		0.9	1.1	0.9	0.8	0.6	0.7	0.7	0.9
Other		3.7	2.3	1.9	2.1	2.1	2.0	2.0	2.2
Total	million holidays	35.5	34.4	35.9	36.1	36.3	36.7	35.6	35.1
Share of holidays of total distance travelled*) per transport mode per year	%								
Car		34.1	26.2	24.4	25.0	24.5	24.7	25.2	23.6
Airplane		57.5	67.5	69.6	69.1	70.6	71.0	70.0	71.9
Train		1.9	1.6	1.5	1.3	1.3	1.1	1.4	1.1
Touring car/shuttle bus		3.8	3.1	2.8	2.0	1.9	1.7	1.7	1.7
Boat		0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Bicycle		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other		2.5	1.5	1.6	2.5	1.5	1.4	1.7	1.4
Total	billion km	45.7	54.8	62.0	62.5	61.7	62.4	59.1	61.0

Source: CVO 2002, 2005, 2008, 2010 , 2011, 2012, 2013 and 2014 (calculation CSTT/NRIT Research)
*) not the actual distance travelled between home and destination, but the great circle distance; the actual distance will be between 5 and 15% higher.

The influence of the increasing amount of holidays by plane and flight kilometres is also clearly visible in the degree of organisation (see list of terms for an explanation). Package trips have the largest share of the total distance travelled on holidays (34.1% in 2014), although this share is lower than at its peak in 2005. The total distance travelled on package trips increased by 25.4% between 2002 and 2014. Combined trips show the greatest increase in distance travelled (278% between 2002 and 2014), which is partly due to the continuous increase of this type of trips during this period; 163%). Only non-organised holidays saw a decrease in the total distance travelled (-44.3%; 2002-2014). This can be entirely attributed to a decrease of this type of holidays (-44.1%).

Table 4.3 Holidays and distance by degree of organisation

	Unit	2002	2005	2008	2010	2011	2012	2013	2014
Share of holidays (by the Dutch) of total holidays by organisation type per year	%								
Package trip		10.8	12.9	12.8	11.0	11.3	11.2	10.9	11.2
Combined trip		3.3	4.0	5.5	5.6	7.3	7.7	7.7	8.8
Only transport organised		4.5	5.0	5.5	6.0	5.3	4.5	4.6	4.6
Only accommodation directly booked through booking office		20.7	27.1	28.2	30.5	34.6	35.4	36.0	34.8
Only accommodation directly organised		16.8	22.1	20.9	21.1	17.4	16.6	17.2	15.9
Non-organised		43.8	28.9	27.1	25.8	24.1	24.6	23.6	24.8
Total	million holidays	35.5	34.4	35.9	36.1	36.3	36.7	35.6	35.1
Share of holidays of total distance travelled *) by degree of organisation per year	%								
Package trip		36.3	43.4	40.4	35.8	35.4	36.5	34.3	34.1
Combined trip		9.2	12.0	15.3	16.5	21.9	23.5	23.9	26.0
Only transport organised		18.0	17.5	18.6	21.1	17.9	14.2	15.2	15.2
Only accommodation directly booked through booking office		9.4	9.7	9.0	9.8	10.6	11.0	11.2	10.2
Only accommodation directly organised		6.8	7.6	7.3	7.2	6.5	6.3	6.9	5.9
Non-organised		20.3	9.7	9.4	9.6	7.7	8.5	8.5	8.5
Total	billion km	45.7	54.8	62.0	62.5	61.7	62.4	59.1	61.0

Source: CVO 2002, 2005, 2008, 2010, 2011, 2012, 2013 and 2014 calculation CSTT/NRIT Research

*) not the actual distance travelled between home and destination, but the great circle distance.

Table 4.4 shows holidays and distance by accommodation type. Here, holidays spent in hotels have the largest share in total distance travelled (51.1% in 2014). Since 2002, the number of holidays of this type increased by 31.6% and the distance by 72.4%. Needless to mention that many holidays by airplane are spent in hotels.

Table 4.4 Holidays and distance by accommodation type

	Unit	2002	2005	2008	2010	2011	2012	2013	2014
Share of holidays (by the Dutch) of total holidays by accommodation type per year	%								
Hotel		24.9	29.0	30.6	31.4	31.6	33.3	32.6	33.1
Bungalow		25.0	23.9	25.8	25.3	27.5	26.3	25.8	24.8
Camping		26.8	24.1	21.3	21.8	21.7	20.1	20.6	20.6
Other		23.3	22.9	22.2	21.5	19.2	20.4	21.0	21.5
Total	million holidays	35.5	34.4	35.9	36.1	36.3	36.7	35.6	35.1
Share of holidays of total distance travelled *) by accommodation type per year	%								
Hotel		39.5	51.7	51.6	51.8	52.4	53.9	51.9	51.1
Bungalow		11.4	8.8	9.1	8.6	10.8	10.7	10.9	11.5
Camping		14.0	10.6	10.9	10.4	10.3	9.7	10.3	10.4
Other		35.0	28.8	28.4	29.3	26.5	25.7	26.8	27.0
Total	billion km	45.7	54.8	62.0	62.5	61.7	62.4	59.1	61.0

Source: CVO 2002, 2005, 2008, 2010 , 2011, 2012, 2013 and 2014 calculation CSTT/NRIT Research

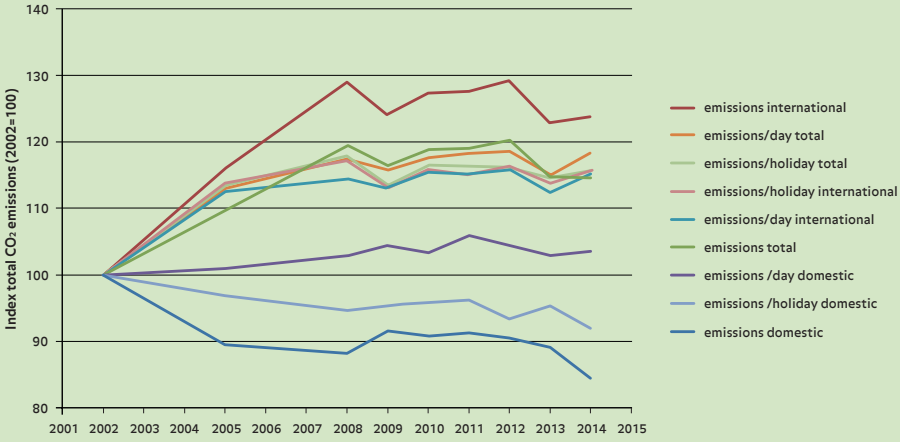
*) not the actual distance travelled between home and destination, but the great circle distance.

4.3 Developments in CO_2 emissions

The developments shown in the previous section can also be seen in the development of CO_2 emissions. Figure 4.1 displays the development of emissions for domestic and outbound holidays, in total, per holiday and per day. Until 2008, total emissions increased with an average of 3.0% per year. Between 2008 and 2012, total emission growth rates fluctuated between -2% and +2% per year. An all-time high was reached in 2012 (15.5 Mt), after which decreases set in again (2012-2013: -4.4%; 2013-2014: -0.3%). The average annual growth of total emissions between 2002 and 2014 was 1.1%. These increases and decreases in total emissions can be fully attributed to the growth and decline of outbound holiday emissions. These grew by 4.3% per year until 2008, but fluctuations between 2008 and 2012 and a strong decrease between 2012-2013 (-5.1%) and only minor growth in

2013-2014 (0.8%) have resulted in an average growth of 1.8% between 2002 and 2014. The emissions of domestic holidays show an unstable but overall decreasing development (2002-2014: -1.4% per year). After several years of minor fluctuations, 2013-2014 saw a strong -5.4% decrease (see also data in table 4.5).

Figure 4.1 Emission trends of domestic, outbound and total holidays, in total, per holiday and per day

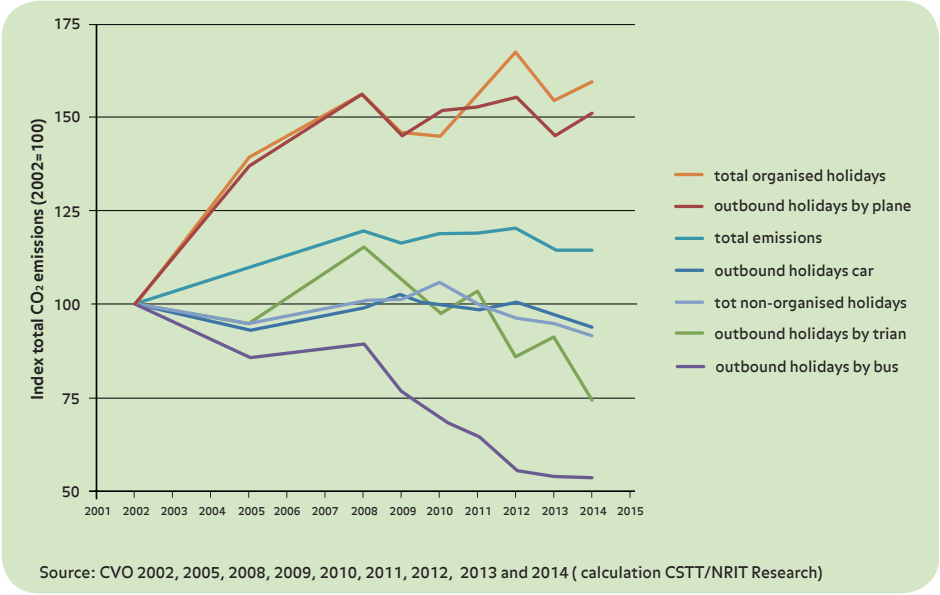


Source: CVO 2002, 2005, 2008, 2009, 2010, 2011, 2012, 2013 and 2014 (calculations CSTT/NRIT Research)

Figure 4.2 shows emission trends for holidays with different transport modes (only outbound) and organisation types (domestic and outbound)1. The very strong growth of emissions of holidays by plane, with 11.0% per year in the 2002-2005 period and 4.4% per year in the 2005-2008 period, is followed by several years of fluctuation. Between 2013 and 2014, emissions of holidays by plane have increased by 4.2%. Outbound emissions by car show a consecutive year of decrease in 2013-2014 (-3.6%). The emissions of outbound holidays by bus have decreased for six consecutive years now, by 9.6% per year on average. The main reason for this is a strong decline in this type of holidays. From 2008 to 2012, outbound train emissions have dropped by 7.2% per year on average, followed by a sudden 6.6% increase between 2012 and 2013. However, 2013-2014 saw another strong -18.4% decrease. Of particular interest is the very similar development in emissions of holidays by plane and organised holidays, and of holidays by car and non-organised holidays. The share of holidays by plane of all organised holidays is rather large, and a large number of holidays by plane are offered by tour operators. Holidays by car are mainly non-organised. After a break in this relation between 2009 and 2010, emissions of outbound holidays by plane and of organised holidays both increased between 2010 and 2012, decreased in 2013, then increased again in 2014. Apart from the year 2011-2012, emissions of non-organised holi-

days and emissions of holidays by car show an overall similar development, clearly visible in Figure 4.2.

Figure 4.2 Emission trends by transport mode and degree of organisation



Source: CVO 2002, 2005, 2008, 2009, 2010, 2011, 2012, 2013 and 2014 (calculation CSTT/NRIT Research)

When taking a closer look at the growth of emissions, it becomes evident that most of the total growth of 1.88 Mt between 2002 and 2014 is caused by holidays taken outside of Europe (intercontinental; +1.79 Mt). European holiday emissions increased much less (+0.57 Mt), while domestic holiday emissions decreased (-0.47 Mt). The emissions of inter-continental holidays had nearly doubled (96.0%) between 2002 and 2010, before showing a decline of 16.6% between 2010 and 2013 (see table 4.5). 2013-2014 showed an increase (4.7%) again. Most striking until 2010 have been the increases in emissions from holidays to developing countries (i.e. Asia, Africa, and the rest of the Americas), see also figure 4.3. Particularly the development of holiday emissions for Asia has been remarkable, increasing by 10.8% on average per year between 2002 and 2011, even during recession. Between 2010/2011-2013 this upward trend of holiday emissions for developing countries has stop-

ped, with minor to strong decreases for Africa, Asia and Rest of the Americas). Between 2013 and 2014 all intercontinental markets, except Africa, have increased again; Asia even by 10.6%. The share of emissions of all intercontinental holidays has grown from just under 20% (in 2002) to around 32% (in 2010) of all holiday emissions, before gradually declining to 28% (in 2013), and rising to 29% (in 2014). The small decrease of total holiday emissions between 2013 and 2014 can be attributed to the total losses in domestic (-5.4%) and European holiday emissions (-1.1%) outweighing the growth of intercontinental holiday emissions (4.7%).This overall development towards long-haul destinations is also visible in the total distance that people travelled to their destinations (+2.4% per year in 2002-2014). Consequently, the emissions of transport have grown faster (+1.9% per year) than average, whereas those from accommodations (+0.6% per year) and other holiday activities (+0.3% per year) grew considerably slower. The total number of holidays showed only a very small increase per year between 2002 and 2012 (+0.3%) and decreased by 2.2% per year from 2012 to 2014. It can therefore be concluded that the growth of the carbon footprint is due to changes in the way of holidaymaking (mainly a change in destinations), and not due to a growth in the number of holidays.

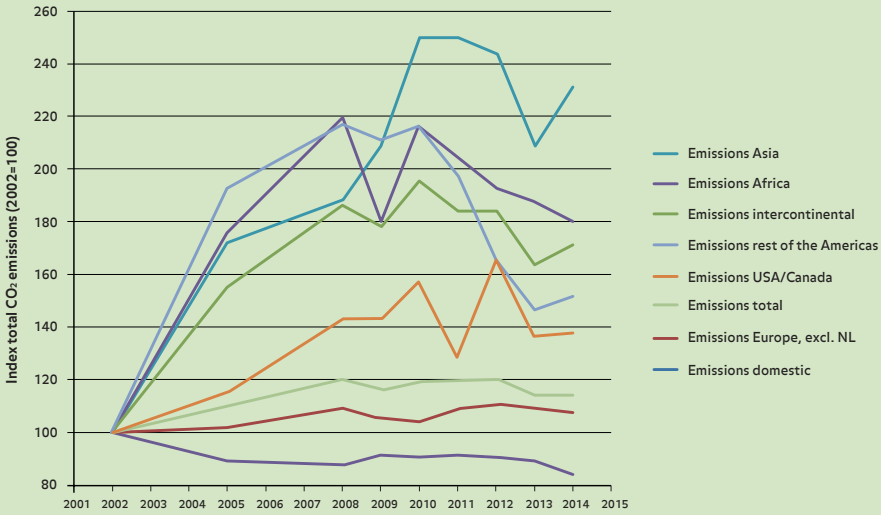
Table 4.5 Carbon footprint by destination

Carbon footprint in Mt CO_2	2002	2005	2008	2010	2011	2012	2013	2014
The Netherlands	3.008	2.697	2.658	2.742	2.748	2.727	2.695	2.558
Europe (excl. the Netherlands)	7.253	7.491	8.011	7.615	7.910	8.090	7.988	7.908
Outside Europe (intercontinental)	2.478	3.899	4.675	4.923	4.627	4.632	4.108	4.300
– of which Africa	0.385	0.687	0.858	0.843	0.803	0.753	0.733	0.704
– of which Asia	0.597	1.042	1.144	1.515	1.518	1.478	1.266	1.400
– of which the USA and Canada	0.784	0.922	1.143	1.254	1.024	1.327	1.090	1.101
– of which the rest of the Americas	0.504	0.988	1.108	1.101	1.013	0.848	0.748	0.776
– of which Australia and Oceania	0.207	0.260	0.422	0.210	0.269	0.227	0.270	0.319
Total	12.739	14.088	15.345	15.280	15.285	15.449	14.795	14.766

Source: CVO 2002, 2005, 2008, 2010, 2011, 2012, 2013 and 2014 (calculation CSTT/NRIT Research)

Figure 4.3 clearly shows the influence of the emissions of intercontinental holidays on total holiday emissions: first their fast, overall growth until 2008, and then their slowed growth and decline afterwards, with the exception of the steep increase of emissions for USA/Canada in 2012, and the general recovery in 2014. Both the growth and decline of emissions of intercontinental holidays can be attributed to the changes of the share of holidays by plane and the growth of the distance travelled on these holidays (see above). The emissions of long (nine days or more) outbound holidays by plane increased from 3.8 Mt in 2002 to 6.1 Mt in 2014. This type of holiday was solely responsible for 41% of all holiday emissions in 2014.

Figure 4.3 Emission trends by destination

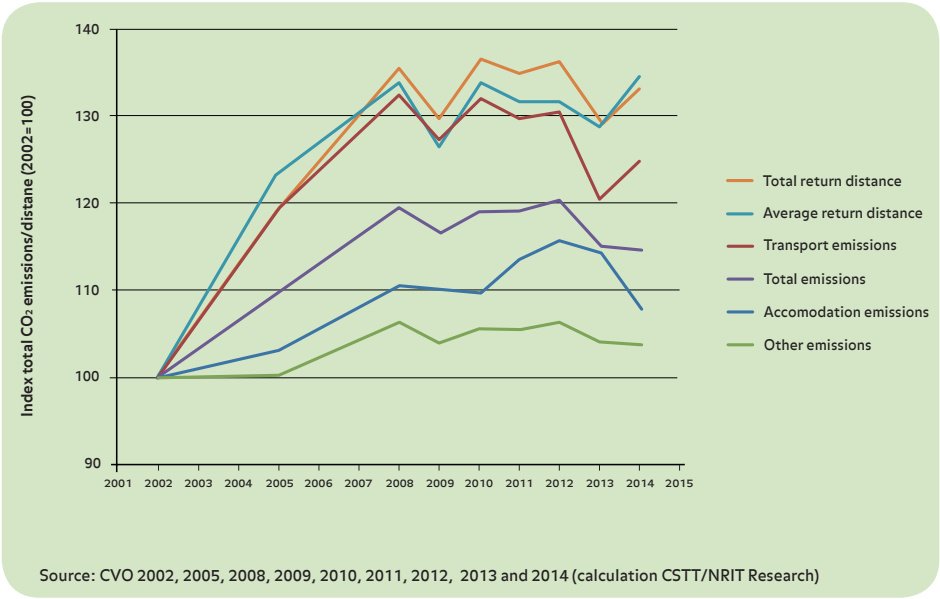


Source: CVO 2002, 2005, 2008, 2009, 2010, 2011,2012, 2013 and 2014 (calculation CSTT/NRIT Research)

Finally, the developments per tourism component are of interest (see figure 4.4). Overall until 2012, total transport emissions have increased above average, whereas those of accommodation and other activities grew below average. On the other hand, the latter two did also not experience a similar decline as transport emissions in 2009. In 2013, all per component emissions fell, particularly those of transport (by 7.5%). The stronger declines in transport emissions in 2009 and 2013, as well as the 3.5% increase in 2014, can be explained by this components' sensitivity to the (development of) emissions of intercontinental holidays, as opposed to those of accommodation or other activities. Average return distance is strongly linked to both (developments in) transport and intercontinental holiday emissions (see figure 4.3 and 4.4). In 2013 total distance travelled fell by 5.2%, increasing by 3.2% again in 2014.

Between 2002 and 2014, air transport emissions have increased slightly less than distances, mainly due to technological developments in global aviation (Peeters 2013). Therefore, the average emissions per km travelled improved slightly.

Figure 4.4 Development of emissions per tourism component and of average travel distance

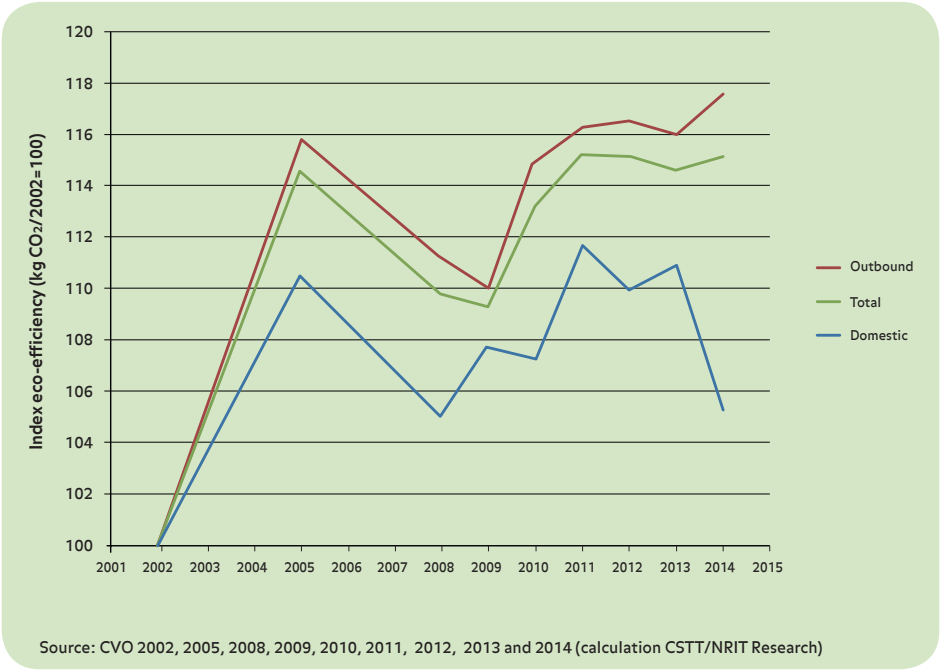


Source: CVO 2002, 2005, 2008, 2009, 2010, 2011, 2012, 2013 and 2014 (calculation CSTT/NRIT Research)

4.4 Developments in eco-efficiency

This final section addresses the eco-efficiency of tourism, expressed in kg CO_2 emissions per Euro spent. Tourist spending has been measured in real prices in the CVO and corrected for the consumer price index CPI for the Netherlands (CBS 2016). Between 2002 and 2005, total eco-efficiency increased (worsened) by 14.6%, followed by a 4.7% decrease between 2005 and 2009, another 5.5% increase between 2009 and 2011, a 0.5% decrease in 2011-2013 and finally a 0.4% increase between 2013 and 2014. During the entire 2002-2014 period, emissions have increased faster than spending, making the sector 15.2% less eco-efficient. Domestic holidays, having improved by 5.1% in 2014, have become 5.3% less eco-efficient over 2002-2014, whereas outbound holidays have become 17.5% less efficient in this period.

Figure 4.5 Eco-efficiency by destination



Source: CVO 2002, 2005, 2008, 2009, 2010, 2011, 2012, 2013 and 2014 (calculation CSTT/NRIT Research)

5 Discussions and conclusions

The Travelling Large reports, started in 2008 (de Bruijn et al. 2008, de Bruijn et al. 2009a, de Bruijn et al. 2009b, de Bruijn et al. 2010, de Bruijn et al. 2012, de Bruijn et al. 2013a, de Bruijn et al. 2013b, Pels et al. 2014), have gradually ensured that data on the environmental impact of Dutch holidays have become an integral part of statistics on Dutch holiday behaviour. Particularly since 2009, when Statistics Netherlands (CBS) started including a section on tourism emissions, based on the research for the Travelling Large reports, in its annual Tourism & Recreation in Figures report, since 2015 part of the Trendrapport (for the latest, see Eijgelaar et al. 2015). This new, eighth report is also based on the Continuous Holiday Survey (CVO) of NBTC-NIPO Research. Additionally, information on the carbon footprint of various touristic activities and holiday components, collected by the Centre for Sustainable Tourism & Transport of NHTV Breda University of Applied Sciences over the years, has been used (see also Peeters 2013).

In 2014, the total contribution of CO_2 emissions by Dutch holidaymakers was 14.8 Mt or 9.4% of all CO_2 emissions of the Dutch economy. It is not easy to define a sustainable level for CO_2, but it is gradually becoming clear that substantial reductions are needed to prevent 'dangerous climate change'. For the moment, the EU has set the goal of a 20% reduction by 2020 compared to 1990 levels. The current Dutch government has adopted the EU target and envisages to set stronger goals later during its governance period (VVD et al. 2012), after previous governments aimed at a 30% reduction in 2020 (VVD-CDA 2010). Recent scientific publications have addressed the necessity of reducing CO_2 emissions by 3 to 6% per year and a total reduction of 80% by the end of this century (see e.g. Meinshausen et al. 2009, Parry et al. 2008, Scott et al. 2010, van Vuuren et al. 2010). This implies ending our fossil fuel-based economy within this century. In terms of achieving this ambition, results of the Paris Climate Change Conference 2015 (COP21) have been more promising than those of previous COPs. In this respect, the emissions of Dutch holidaymakers show the opposite of what is needed: total emissions increased by an average 1.1% per year between 2002 and 2014. The main reason for the overall growth in emissions is the increase of the average distance between home and destination, which is caused by the overall strong increase in air travel and long-haul trips.

The differences in carbon footprint per holiday and per day are large: in 2014, 76.8% of all holidays had an individual carbon footprint per day that stayed below the average per day of 49.0 kg, whereas only 25.4% of all holidays' per day footprints were lower than the average per day emissions for everyday life of Dutch people (25.7 kg). The share of holidays that stays below the average holiday per day carbon footprint has been increasing steadily, as the increasing share of high-carbon intercontinental holidays has been pushing the average per day carbon footprint upwards (from 41.4 kg in 2002 to 49.1 kg in 2012, down to 49.0 kg in 2014).
The holiday types with the highest average environmental impact per day are the following (between brackets the deviation of the average footprint of Dutch holidays, 49.0 kg CO_2 per day):

- sea cruises (+309%)
- intercontinental (long-haul) holidays (ca. +180%)
- (outbound) holidays by airplane (+100%)
- organised holidays (+92%)
- European 'airplane' destinations (e.g. Greece: +52%, Turkey: +82%)
- all holidays in hotels/motels (ca. +65%)
- the average outbound holiday (+26%)

The holiday types with the **lowest** environmental impact per day are:

- domestic boating holidays (-84%)
- all camping holidays with a tent (-51%)
- the average domestic holiday (-50%)
- all non-organised holidays (-45%)
- outbound holidays by train (-45%) or bus (-40%)
- all nearby outbound holidays (e.g. in Belgium: -42%, France: -32%, Germany: -32%)

Again, the large influence of the destination choice on the environmental impact of tourism is obvious, followed by the choice of transport mode, though the latter is closely related to the chosen destination as the airplane is the only realistic choice for long-haul destinations for most tourists. However, the choice of accommodation and degree of organisation also plays a considerable role, probably caused by the large share of long-haul holidays and


holidays by plane in the offer of tour operators and travel agencies.The calculation of the eco-efficiency of holidays, expressed in holiday CO_2 emissions per Euros spent, primarily shows that the average Dutch holidaymaker produces four times as many emissions per Euro as the Dutch economy (0.96 kg CO_2/€ compared to 0.24 kg CO_2/€; see section 3.6). Here also, there are large differences between various holiday destinations and types. Long-haul destinations have the worst eco-efficiency (e.g. 1.35 kg/€ for Asia), while destinations like Switzerland have the best (0.57 kg/€). Still, these differences are smaller than for instance the holiday carbon footprint per day, because most high impact holidays are also more expensive. Only outbound holidays by train and bus come anywhere close to the eco-efficiency of the Dutch economy (0.36-0.42 kg CO_2/€ compared to 0.24 kg CO_2/ €).The fast growth of the carbon footprint of Dutch holidaymakers (1.1% per year on average, but 1.9% per year until 2012) contrasts starkly to the international climate crisis that demands significant reductions of the carbon footprint (by at least 3% per year) in order to prevent the worst impacts. The overall emissions growth is almost completely caused by the 33% increase in the total distance travelled between 2002 and 2014. The recession has reduced travel distances and total emissions between 2008 and 2009, and again between 2012 and 2013, but it is too early to determine whether it has a lasting impact on tourism emissions. In 2014, many components, including total emissions and distances, showed increases again. Nevertheless, the 2009-2012 and 2013-2014 recovery periods did not always see the strong increases of intercontinental holiday emissions and average return distances witnessed before 2008. Possibly, this effect will also be seen in the coming years, and could thus be an effect of the on-going recession.The overall growth can still be largely attributed to the increased use of the airplane for holiday purposes, due to the strong growth of intercontinental long-haul holidays. Many of these trips are made with a tour operator or through a travel agency. This puts a large responsibility on the Dutch outbound sector, also with respect to corporate social responsibility (CSR). Dutch tour operators, the Dutch Association of Travel Agents and Tour Operators (ANVR), and other partners have recognised this responsibility, and have started to engage in carbon management. For the moment, they are frontrunners in this area.The authors hope that this report will provide the sector and the government with insight into the most important contributing factors of the environmental impact of holidays. This insight will hopefully contribute to new policies on the sustainable development of outbound tourism. The report also indicates how the industry can reduce its environmental impact through carbon management, and how it can look for products that are less dependent on fossil fuels. The results of this research clearly show the importance of tourism for climate policy, specifically in regards to CO_2 reduction.The results can aid policymakers with the development of mitigation policy. For example, the impacts of impending emissions trading for aviation can be assessed using the data for carbon footprints. They could also be used to develop a tool for consumers, helping them to take their holiday carbon footprint more into account (see Eijgelaar et al. 2016).to take their holiday carbon footprint more into account.

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List of terms and abbreviations

Term, abbreviation	Description
CF	Carbon footprint; expressed in kg CO_2 emissions
Combined trip	Holidays where transport and accommodation have been booked separately in advance
CSR	Corporate Social Responsibility
CSTT	Centre for Sustainable Tourism & Transport (part of NHTV Breda University of Applied Sciences)
CVO	Continuous Holiday Survey (ContinuVakantieOnderzoek)
Great circle distance	Shortest route between two points measured along the earth's surface
LULUCF	Greenhouse gas emissions from forestry and land use
Mitigation policy	Policy aimed at preventing or reducing climate change, like emissions trading or the stimulation of alternative energy forms
Mt	Megaton or 1 million tonnes, equivalent to 1 billion kg
Non-organised	Holidays where accommodation or transport is not booked in advance, apart from e.g. train tickets bought in advance and/or accommodation booked directly with the accommodation facility itself
Organised car	All organised holidays with the car as transport mode. The car can be the tourist's own vehicle, but then the accommodation is booked through a travel agency
Organised holidays	Holidays where an agency or booking office has been used for the reservation of transport and/or accommodation in advance
Organised other	All organised holidays with a transport mode other than the airplane, the car or the touring car. The transport is not directly booked with a transport company
Organised plane	All organised holidays with the airplane as transport mode. The flight is not directly booked with the airline
Organised touring car	All organised holidays with the touring car as transport mode. The touring car is not directly booked with a touring car company
Package trip	Holidays from tour operator brochures where accommodation and transport are paid in one price in advance
Ppm	Part per million (one in a million parts)
Season-dependent recreational holidays	A season-dependent recreational holidays, also called "permanent pitch holiday", is a holiday where someone stays in his/her own accommodation on a permanent pitch (tent/caravan), a permanent mooring (boat), or in a second home

The impact of tourism on the environment, in general and specifically on the climate, is receiving plenty of attention. In 2008, the Centre for Sustainable Tourism and Transport of NHTV Breda University of Applied Sciences and NRIT Research, in collaboration with NBTC-NIPO Research, published the (Dutch) pilot-report 'Travelling large in 2005'. In this report the environmental impact of Dutch holiday behaviour was calculated. The carbon footprint was one tool used for this: the emissions of carbon dioxide are responsible for climate change. We now present the eighth volume in this series, presenting the carbon footprint of holidays by the Dutch in 2002, 2005, 2008, 2009, 2010, 2011, 2012, 2013 and 2014. This report not only contains a complete overview of the impacts of Dutch tourists on the climate in 2014, but also presents the development of the holiday carbon footprint through the years 2002-2005-2008-2009-2010-2011-2012-2013-2014.

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