Travelling large in 2018

The carbon footprint of Dutch holidaymakers in 2018 and the development since 2002

Breda University OF APPLIED SCIENCES

Travelling large in 2018

The carbon footprint of Dutch holidaymakers in 2018 and the development since 2002

A project of BUas Centre for Sustainability, Tourism and Transport in collaboration with NRIT Research and NBTC-NIPO Research

Eke Eijgelaar, Ivar Neelis & Paul Peeters (BUas *Centre for Sustainability, Tourism and Transport*)
Kim de Bruijn & Rob Dirven (NRIT Research)

Imprint

Travelling large in 2018
ISBN: 978-90-825477-6-4

This report is compiled by the *Centre for Sustainability, Tourism and Transport*, Breda University of Applied Sciences, in collaboration with NRIT *Research* and NBTC-NIPO *Research*.
www.cstt.nl

A special thanks goes to Evelien Jonker and Marieke Politiek of NBTC-NIPO Research for allowing access to the ContinuVakantieOnderzoek data of 2002, 2005, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017 and 2018.

This publication is part of the project 'Data-driven sustainable tourism: dealing with climate change', funded by CELTH.

This report should be cited as:
Eijgelaar, E., Neelis, I., Peeters, P., de Bruijn, K., & Dirven, R. (2020) Travelling large in 2018: The carbon footprint of Dutch holidaymakers in 2018 and the development since 2002. Breda, The Netherlands: Breda University of Applied Sciences.

Graphic design: Transvormatie, Bergen op Zoom
Photography: Eke Eijgelaar, Paul Peeters, Ivar Neelis

Contents


Miran
2015
NEMA
VREMENA
...

1 Introduction

This is the twelfth 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. 2013a, de Bruijn et al. 2013b, 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, Eijgelaar et al. 2015, Eijgelaar et al. 2016b, Eijgelaar et al. 2017, Pels et al. 2014, Sensagir et al. 2019)[1]. All reports were written by the Centre for Sustainability, Tourism & Transport of Breda University of Applied Sciences and NRIT Research, in collaboration with NBTC-NIPO. The current volume presents figures for 2018, and shows developments over 2002, 2005, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017 and 2018. The range of figures over a sixteen-year period not only allows for a presentation of trends, but also for insight on possible impacts of the economic recession on tourism emissions.

At the Paris climate conference (COP21) in December 2015, 195 countries adopted a universal, global climate deal and set out a global path to avoid dangerous climate change and a temperature rise of 2° C (UNFCCC 2015). It put the emissions of industrial sectors – including tourism – high on the agenda again. They are discussed by tourism stakeholders, for example as part of evolving Corporate Social Responsibility (CSR) strategies, COP21 itself (e.g. WTTC 2015), the Sustainable Development Goals (e.g. UNWTO 2016) and/or newly introduced climate policies (e.g. for aviation in ICAO 2016). 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.

In 2008, the World Tourism Organisation (UNWTO) reported on the effects of climate change on tourism as well as the effects of tourism on greenhouse gas emissions (UNWTO-UNEP-WMO 2008). The UNWTO report estimates the contribution of tourism to carbon dioxide emissions at approximately 5% in 2005 (UNWTO-UNEP-WMO 2008). Gössling et al. (2015) found the emission to double between 2010 and 2032. More recently, Peeters (2017) assessed the long term development of tourism's carbon footprint and found this to increase by a factor 4.6 between 2015 and 2100. Where currently 22% of tourism trips is based on air transport, the share of air CO_2 emissions is 55%. By 2100 this will have risen to 75%. The strong growth of emissions is in stark contrast with the Paris 2015 Climate Agreement, that seeks to reduce emissions to almost zero by 2100. According to Peeters (2017), near zero-emissions is only achievable for tourism when all mitigation opportunities are fully implemented. This also includes a physical barrier – cap on airport slots or global aircraft fleet - to unlimited growth of air transport. 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.

1 A short text and a selection of the tables and figures shown in this volume are published in Dutch in (Eijgelaar et al. 2019)

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 2018. Secondly, it shows some of the changes that have occurred throughout the period 2002-2005-2008-2009-2010-2011-2012-2013-2014-2015-2016-2017-2018. 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 fourteen survey years. Chapter 3 describes the results for 2018. 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 2002-2018. 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 407 ppm in 2018 (parts per million; see Dlugokencky et al. 2020), which causes the atmosphere to retain more heat. The atmosphere's ability to retain heat is called "radiative forcing", expressed in W/m^2. 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 and trend-breach

The CVO data have been processed with SPSS 26.0, 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 number 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 using 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 BUas/CSTT-report 'Carbon footprint emission factors; version 2018 and trends 2002-2019' (Peeters 2019).
This report contains small corrections in comparison with the emission factor report used for the 2017 CF report (Sensagir et al. 2019). These involve very small corrections to the emission factors for cars, public transport and coaches. In 2017, the set of subjects of the CVO has been extended with Dutch citizens with a migration background (registered but non-Dutch nationality). Combined with new weight-factors this caused an increase of the population for whom results are representative from 15.8 to 16.9 million Dutch citizens. The larger population means an increase in holidaymakers, holidays and amount of expenditures. At the same time, the sample size of Dutch citizens reporting at least one trip was increased only from 6,800 to 6,877 respondents[2]. However, the changes were larger as the new sample contained a total of 597 new respondents, while 520 respondents left the panel. For the 2017 report (Sensagir et al. 2019), the old sample was still used, but in the present report, the new sample is applied for the years 2017 and 2018. This causes trend-breaches in the data, making comparisons with earlier years (2002 to 2016) and reports difficult.

2 The full new sample size is 8,000 respondents but includes people that do not make holiday trips.

The trend-breach is strong in terms of CO_2 emissions. The changes in domestic tourism are small, but those for total international emissions show an upward jump of 40 percent points or 33% for the new sample compared to the old sample. About one-third of this rise is explained by an increase of the international emissions per holiday, the remainder stems from a volume increase. To assess the causes further, we created two additional samples: one with the new respondents and one with the removed respondents. Then, we compared the results for these two groups. The following differences were found:

- The total number of trips represented by the new subjects was 9.7 million, while the removed subjects only represented 2.0 million trips. This means, the new subjects represent almost a quarter of all trips made by the Dutch in a year.
- The body of subjects that remain in the new survey represented 30.6 million trips in the new survey, down by 12% from the 34.6 million in the old survey.
- Total number of trips increased by 10%, but outbound trips by 16%.
- The share of international trips of the subjects removed was 49% while the new group's share was up to 64%.
- The average carbon footprint of all trips is 39% higher for the new subjects compared to the ones removed. This is partly due to the much higher share of international trips and an increase of 19% of the carbon footprint of these international trips.
- The share of air travel for all trips was 10% higher for the added subjects as compared to the ones removed.
- The average distance travelled by the new subjects was 12% larger than for the removed subjects.

All the above changes substantially raise the carbon footprint of the whole sample by increasing the total number of trips by new entries, specifically for international travel. This combination of changes in the sample does explain the 33% jump in overall emissions between the old and the new sample.
To accommodate reasonable indexes and growth numbers over the trend-breach, we have corrected by multiplying all results for 2002-2016 by the ratio of 2017 with the new sample divided by 2017 with the old sample, and for the share of the population with a non-Dutch nationality (CBS 2020a). This is the closest we feel we can get to the real trends without the sample-trend-breach. This means that the values given for these older years may differ substantially from our earlier reports (see chapter 1).

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, 2011, 2014, 2017 and 2018 (other years have been omitted). We have corrected all pre-2017 values by the ratio 2017 new sample divided by the 2017 old sample, and for the share of the population with non-Dutch nationality (CBS 2020a), to get much closer to the real trends.

Table 2.1 Key figures holidays 2002, 2005, 2008, 2011, 2014, 2015, 2016, 2017, 2018

	Unit	2002	2005	2008	2011	2014	2017	2018
Dutch population on January 1	**million**	**16.1**	**16.3**	**16.4**	**16.7**	**16.8**	**17.1**	**17.2**
Categories:								
0-19 years	%	24.6	24.5	24.0	23.5	22.9	22.3	22.2
20-64 years	%	61.9	61.5	61.3	60.9	59.8	59.2	59.0
65 years and older	%	13.7	14.0	14.7	15.6	17.4	18.5	18.8
Share population with non-Dutch nationality	**%**	**4.3**	**4.3**	**4.2**	**4.6**	**4.8**	**5.7**	**6.1**
Holiday participation	**%**	**82**	**82**	**83**	**84**	**82**	**84**	**83**
Categories:								
Long holidays (5 or more days)	%	75	77	76	78	74	77	77
Short holidays (2-4 days)	%	42	41	41	44	43	45	44
Number of long holidays by the Dutch population	million	24.2	23.9	25.4	25.0	24.0	25.5	25.8
Number of short holidays by the Dutch population	million	14.0	13.0	13.1	14.1	14.0	14.8	14.1
Total number of holidays by the Dutch population	million	38.1	37.0	38.5	39.2	38.0	40.4	39.9
Average number of holidays per Dutch inhabitant								
For the whole population		2.4	2.3	2.4	2.5	2.4	2.4	2.3
For those that go on holidays		3.2	3.0	3.0	3.1	3.1	2.9	2.9
Domestic holidays	**million**	**19.1**	**17.7**	**17.8**	**18.1**	**17.6**	**18.1**	**17.7**
Outbound holidays	**million**	**18.9**	**19.2**	**20.7**	**21.0**	**20.3**	**22.2**	**22.2**
Of which:								
In France	million	3.5	3.0	3.1	3.2	2.8	2.9	2.8
In Germany	million	2.7	2.8	3.3	3.6	3.7	3.9	3.6
In Belgium	million	2.6	2.3	2.3	2.4	1.7	1.6	1.5
Overnight stays by Dutch	**million**	**299**	**290**	**303**	**300**	**289**	**324**	**326**
Categories:								
Domestic	million	112	99	95	95	89	99	102
Abroad	million	185	190	208	206	200	225	224
Expenditure by the Dutch on domestic holidays	billion Euro	3.2	2.7	3.0	3.1	3.1	3.5	3.9
Expenditure by the Dutch on outbound holidays	billion Euro	11.1	11.8	14.4	13.0	14.7	17.2	17.4
Total distance travelled on holidays by the Dutch*	billion km	53.9	64.6	72.9	73.5	73.2	84.0	82.9

Source: CVO 2002, 2005, 2008, 2011, 2014, 2017, 2018
Note: all values up to and including 2016 – except for those on population and nationality – have been corrected to accommodate for the 2017 sample trend-breach. They show differences with those reported by Statistics Netherlands (CBS) or other sources.
**) 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 2018

3.1 Introduction

In this chapter, the results of the calculations and analyses of the survey year 2018 are presented (in kg CO_2). The values in table 3.1 are used for reference. The 160.6 Mt total Dutch emissions figure and the population size in 2018 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, 2018

	2018
CO_2 emissions per average Dutch holiday	462 kg
CO_2 emissions per average Dutch holiday per day	50.6 kg
Total CO_2 emissions Dutch holidays	18.5 Mt
Average annual CO_2 emissions per person in the Netherlands	9.35 tonnes
Average CO_2 emissions per person per day in the Netherlands	25.6 kg
Total Dutch CO_2 emissions*)	160.6 Mt

Source: (CBS 2020c); the holiday values have been calculated in this study
**) excluding LULUCF (forestry- and land use)*

3.2 Total carbon footprint

The total carbon footprint of all Dutch tourists was around 18.5 Mt CO_2 in 2018. 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 (160.6 Mt CO_2 in total and just under 9.4 tonnes of CO_2 per person in 2018), the tourism emissions would amount to approximately 11.5% of the total Dutch carbon footprint. The carbon footprint per average holiday is 462 kg CO_2 and per day 51 kg CO_2. Because 17% of the Dutch population did not go on holiday in 2018 (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 1294 kg CO_2, which is 13.8% of the average annual emissions of a Dutch citizen in 2018.

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.

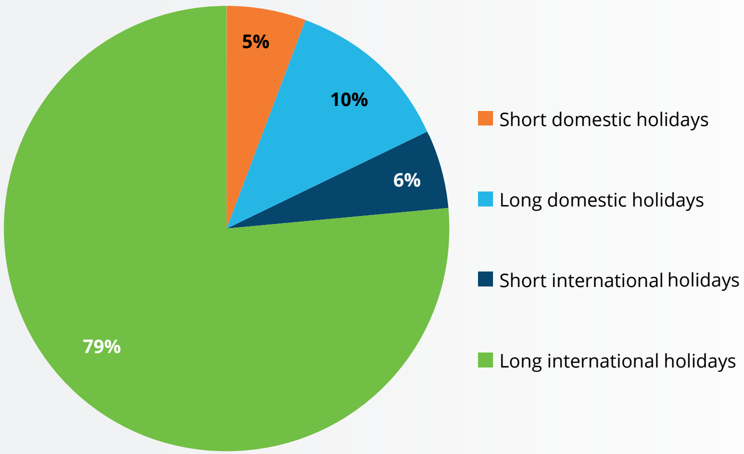
Table 3.2 Carbon footprint per day, per holiday and in total, by destination and length of stay, 2018

	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	87	0.85	22	234	1.87	24	154	2.72
Abroad	73	242	1.07	62	825	14.66	63	708	15.73
Belgium	34	104	0.09	22	197	0.13	26	145	0.22
France	53	180	0.10	31	439	1.01	32	390	1.11
Germany	43	139	0.21	31	291	0.63	33	229	0.84
Average	44	136	1.92	52	641	16.53	51	462	18.45

Source: CVO, 2018 (calculation CSTT/NRIT Research)

Domestic holidays produced a total carbon footprint of 2.7 Mt CO_2, which is 154 kg per holiday and 24 kg per day. An average outbound holiday has a much larger footprint of 708 kg or 63 kg per day. All outbound holidays produced 15.7 Mt CO_2. Thus, 15% of all holiday emissions were produced by domestic and 85% by outbound holidays (see figure 3.1), whereas the number of domestic holidays (17.7 million) is not that much lower than that of outbound holidays (22.2 million). The average carbon footprint for all holidays is 51 kg per day; 25 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 98% 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 emissions of a domestic holiday are 1.8 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. The same applies to outbound holidays to individual destinations. However, on average, the large number of long holidays to long-haul destinations pushes the carbon footprint per day of a long holiday towards the level of that of a short outbound holiday. The emissions of long outbound holidays produced 79% of all holiday emissions (see figure 3.1).
Per day and per holiday, the carbon footprint of a holiday in Belgium is at a similar level as that of 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, 2018



Source: CVO, 2018 (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 (23.8 vs. 25.6 kg/day).

Table 3.3 Carbon footprint per day, per holiday and in total, by length of stay for domestic holidays in 2018

	Carbon footprint in kg CO_2		
	Per day	**Per holiday**	**Total (Mt)**
2-4 days	29	87	0.85
5-8 days	25	160	0.88
9 days or more	20	395	1.00
Average	24	154	2.72

Source: CVO, 2018 (calculation CSTT/NRIT Research)

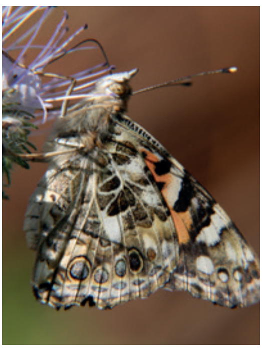
3.3.2 Accommodation type domestic holidays

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 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, 2018

	Carbon footprint in kg CO_2		
	Per day	**Per holiday**	**Total (Mt)**
Private homes	17	97	0.190
Hotel/motel	37	123	0.498
Pension/B&B	23	81	0.047
Apartment	32	203	0.057
Second home, bungalow	28	169	0.842
Tent, Bungalow tent	13	90	0.064
Caravan, tent trailer, campervan	26	272	0.465
Boat: sailing boat/motor vessel	12	88	0.012
Youth hostel or other group accommodation	19	75	0.020
Other	28	172	0.020
Average	**26**	**150**	**2.216**

Source: CVO, 2018 (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, 2018

	Carbon footprint in kg CO_2		
	Per day	**Per holiday**	**Total (Mt)**
Second home, bungalow	19	165	0.192
Caravan, tent trailer, campervan	18	213	0.295
Boat (with cabin for overnight stays)	7	44	0.009
Other	6	45	0.007
Average	**17**	**173**	**0.503**

Source: CVO, 2018 (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 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 2018

	Carbon footprint in kg CO_2		
	Per day	**Per holiday**	**Total (Mt)**
Car	24	160	2.544
Train	20	84	0.083
Touring car/shuttle bus	21	93	0.006
Boat: sailing boat/motor vessel	10	96	0.007
Bicycle	12	89	0.025
Other	20	125	0.054
Average	**24**	**154**	**2.720**

Source: CVO, 2018 (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 one of the lowest per day footprints. 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, 2018

	2-4 days			5-8 days			9 days or more			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	33	101	0.463	27	175	0.496	25	401	0.247	29	150	1.206
Organised other	25	71	0.049	21	128	0.030	19	276	0.017	22	97	0.095
Non-organised	25	76	0.337	23	145	0.349	19	397	0.731	21	163	1.418
Average	**29**	**87**	**0.849**	**25**	**160**	**0.876**	**20**	**395**	**0.996**	**24**	**154**	**2.720**

Source: CVO, 2018 (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, short- (2-4 days) and 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 2018

	Carbon footprint in kg CO_2		
	Per day	**Per holiday**	**Total (Mt)**
2-4 days	73	242	1.071
5-8 days	68	458	3.142
9 days or more	61	1056	11.520
Average	**63**	**708**	**15.733**

Source: CVO, 2018 (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 12. 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, 2018

	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	34	104	0.088	22	197	0.133	26	145	0.221
Luxembourg	45	142	0.009	29	272	0.039	31	233	0.048
France	53	180	0.097	31	439	1.011	32	390	1.108
Spain	138	505	0.122	54	726	1.779	57	706	1.901
Portugal	157	582	0.037	63	835	0.492	65	810	0.529
Austria	97	358	0.037	36	395	0.430	38	392	0.467
Switzerland	73	239	0.009	29	337	0.065	32	321	0.074
United Kingdom	88	289	0.114	39	415	0.249	48	365	0.362
Ireland	96	355	0.022	48	522	0.037	60	443	0.059
Norway	115	358	0.010	67	921	0.141	69	834	0.151
Sweden	111	414	0.015	39	567	0.095	42	540	0.109
Finland	129	517	0.001	51	607	0.033	52	604	0.034
Denmark	66	224	0.008	35	417	0.087	36	388	0.096
Germany	43	139	0.207	31	291	0.628	33	229	0.835
Italy	119	421	0.056	44	601	0.783	46	585	0.839
Greece	166	631	0.017	73	846	0.695	74	839	0.711
Turkey	180	720	0.005	59	978	0.625	60	975	0.630
Former Yugoslavia	123	427	0.006	40	619	0.288	40	613	0.295
Hungary	127	432	0.016	44	547	0.102	48	528	0.118
Czech Republic	84	316	0.025	35	422	0.079	41	391	0.103
Rest of Europe	124	458	0.062	58	703	0.439	62	660	0.501
Africa	264	990	0.034	105	1647	1.021	107	1613	1.054
Asia	434	1673	0.019	135	2642	2.400	136	2630	2.419
USA and Canada	573	1936	0.010	132	2328	1.428	132	2324	1.438
Rest of Americas	730	2919	0.009	150	2482	1.140	151	2485	1.149
Australia, Oceania	1337	4010	0.038	151	4825	0.444	162	4750	0.482
Average outbound	**73**	**242**	**1.071**	**62**	**825**	**14.662**	**63**	**708**	**15.733**

Source: CVO, 2018 (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 2018

	Carbon footprint in kg CO_2		
	Per day	**Per holiday**	**Total (Mt)**
Private home of friends or relatives	59	713	1.562
Private home (other)	40	430	0.669
Hotel/motel	90	819	7.258
Pension/B&B	60	539	0.382
Apartment	62	680	1.490
Second home, holiday cottage	51	524	1.194
Tent, Bungalow tent	29	409	0.337
Caravan, tent trailer, campervan	39	741	1.359
Boat: sailing boat/motor vessel/cruise*)	165	1959	0.472
Youth hostel or other group accommodation	94	1054	0.263
Other	69	733	0.075
Average	**65**	**716**	**15.064**

Source: CVO, 2018 (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), 2018

	Carbon footprint in kg CO_2		
	Per day	**Per holiday**	**Total (Mt)**
Second home, bungalows	41	642	0.577
Caravan, tent trailer, campervan	23	389	0.087
Boat (with cabin for overnight stays)	-	-	-
Other	6	129	0.005
Average	**36**	**576**	**0.669**

Source: CVO, 2018 (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 and touring car, 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 2018

	Carbon footprint in kg CO_2		
	Per day	**Per holiday**	**Total (Mt)**
Car	33	359	3.729
Airplane	93	1140	11.464
Train	27	192	0.125
Touring car/shuttle bus	28	223	0.147
Other	61	594	0.267
Average	**63**	**708**	**15.733**

Source: CVO, 2018 (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 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 2018

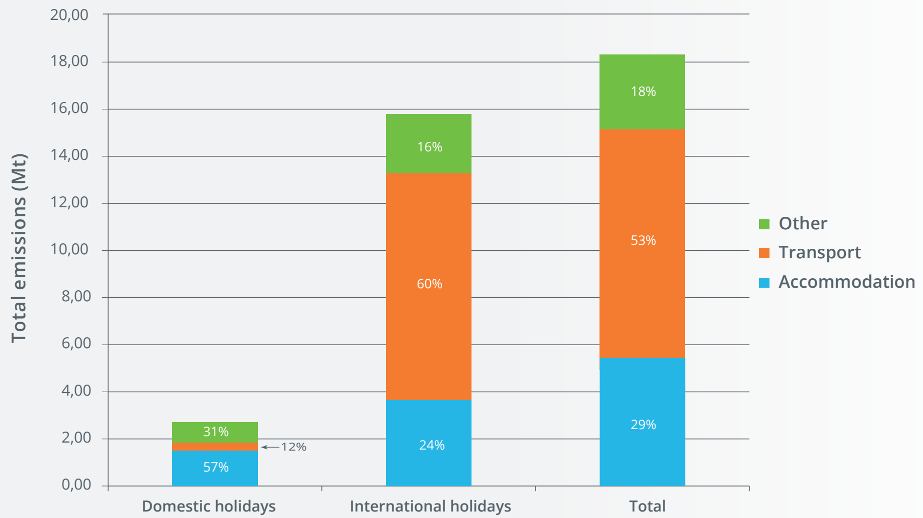
	Carbon footprint in kg CO_2		
	Per day	**Per holiday**	**Total (Mt)**
Organised car	35	395	1.624
Organised touring car	27	261	0.131
Organised airplane	96	1251	10.385
Organised other	46	491	0.295
Non-organised	32	523	2.227
Average	**62**	**825**	**14.662**

Source: CVO, 2018 (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 (53%). Accommodation is responsible for just under a third of all holiday emissions (29%).

Figure 3.2: Carbon footprint per holiday component in 2018



Source: CVO, 2018 (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 (57%), whereas transport is similarly important for outbound holidays (60%). 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. Sweden, Hungary and Spain, 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, 2018

	Carbon footprint per holiday in kg CO_2			Share of total carbon footprint in %*		
	transport	**accommodation**	**other**	**transport**	**accommodation**	**other**
Netherlands	19	87	47	12%	57%	31%
Belgium	27	67	51	19%	46%	35%
Luxembourg	66	90	77	28%	39%	33%
France	127	148	115	33%	38%	29%
Spain	402	198	106	57%	28%	15%
Portugal	500	186	124	62%	23%	15%
Austria	179	150	62	46%	38%	16%
Switzerland	126	123	71	39%	38%	22%
United Kingdom	131	145	89	36%	40%	24%
Ireland	245	90	108	55%	20%	24%
Norway	222	463	149	27%	56%	18%
Sweden	283	141	116	52%	26%	22%
Finland	324	191	89	54%	32%	15%
Denmark	131	133	125	34%	34%	32%
Germany	61	102	66	27%	44%	29%
Italy	255	202	128	44%	35%	22%
Greece	538	204	97	64%	24%	12%
Turkey	619	257	99	64%	26%	10%
Former Yugoslavia	262	184	167	43%	30%	27%
Hungary	298	142	87	57%	27%	17%
Czech Republic	162	130	98	42%	33%	25%
Rest of Europe	394	156	110	60%	24%	17%
Africa	1178	250	185	73%	16%	11%
Asia	2014	334	282	77%	13%	11%
USA and Canada	1747	329	249	75%	14%	11%
Rest of Americas	2037	267	181	82%	11%	7%
Australia, Oceania	3943	365	442	83%	8%	9%
Average	**244**	**135**	**84**	**53%**	**29%**	**18%**

Source: CVO, 2018 (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, 2018

	Carbon footprint per holiday in kg CO_2			Share of total carbon footprint in %*		
	transport	accommodation	other	transport	accommodation	other
Car	57	109	73	24%	45%	31%
Airplane	808	203	129	71%	18%	11%
Train	18	77	31	14%	61%	25%
Touring car/shuttle bus	32	138	40	15%	66%	19%
Boat**	0	39	56	0%	41%	59%
Bicycle	0	74	15	0%	83%	17%
Other	55	258	51	15%	71%	14%
Average	**244**	**135**	**84**	**53%**	**29%**	**18%**

Source: CVO, 2018 (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 (24%), 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, 2018

	Carbon footprint per holiday in kg CO_2			Share of total carbon footprint in %		
	transport	accommodation	other	transport	accommodation	other
Hotel	354	141	81	61%	24%	14%
Bungalow	109	133	59	36%	44%	20%
Camping	120	146	118	31%	38%	31%
Other	299	118	88	59%	23%	17%
Average	**244**	**135**	**84**	**53%**	**29%**	**18%**

Source: CVO, 2018 (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, 2018

	Carbon footprint per holiday in kg CO_2			Share of total carbon footprint in %		
	transport	**accommodation**	**other**	**transport**	**accommodation**	**other**
Package trip	618	245	104	64%	25%	11%
Combined trip	668	195	124	68%	20%	13%
Only transport organised	728	102	128	76%	11%	13%
Only accommodation organised via booking agency	51	101	67	23%	46%	31%
Only accommodation directly booked	61	121	90		44%	33%
Non-organised	95	119	63	34%	43%	23%
Average	**244**	**135**	**84**	**53%**	**29%**	**18%**

Source: CVO, 2018 (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.

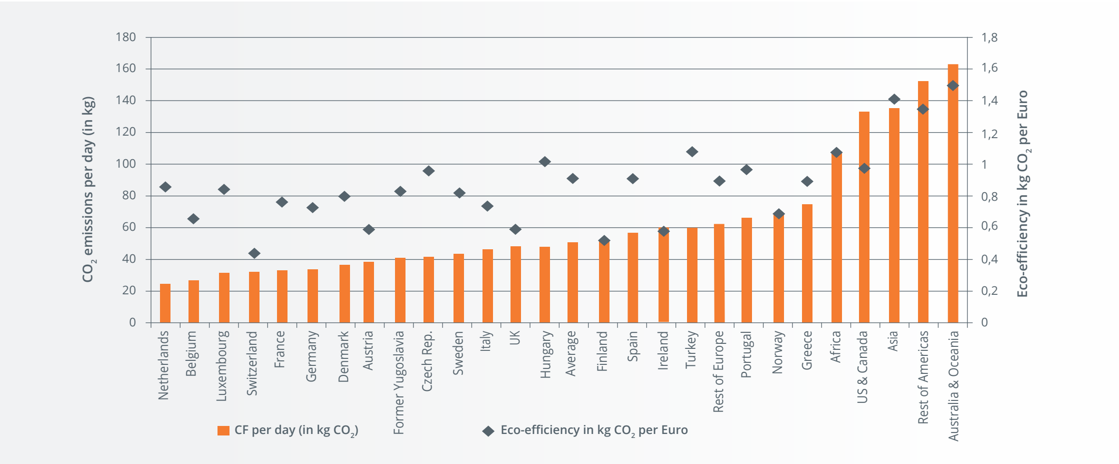
Table 3.18 Eco-efficiency, by destination and length of stay, 2018

	Eco-efficiency in kg CO_2 per Euro		
	Short holiday	**Long holiday**	**Total holidays**
Domestic	0.69	0.93	0.84
Outbound	0.84	0.93	0.92
Average	**0.77**	**0.93**	**0.91**

Source: CVO, 2018 (calculation CSTT/NRIT Research)

However, between outbound destinations the eco-efficiency varies considerably (see figure 3.3). With 0.42 kg CO_2/€, Switzerland has the lowest, most favourable, eco-efficiency, whereas Australia and Oceania have the highest (1.50kg CO_2/€). With an eco-efficiency of around 1.05 kg CO_2/€, Turkey is the least favourable one within Europe. In 20 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, 2018



Source: CVO, 2018 (calculation CSTT/NRIT Research)

The eco-efficiency of the whole Dutch economy is approximately 0.21 kg CO_2/€ (total 2018 CO_2 emissions of 160.6 Mt, see section 3.1, divided by the 2018 GDP of €774 billion[3] (CBS 2019). Hence, basically all holiday types and destinations presented in this section are less eco-efficient. It is almost impossible to choose a more eco-efficient domestic or outbound holiday, as is shown in table 3.19. 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, 2018

	Eco-efficiency in kg CO_2 per Euro	
	Domestic holidays	**Outbound holidays**
Car	0.87	0.76
Airplane	-	1.04
Train	0.45	0.36
Touring car/shuttle bus	0.32	0.35
Boat: sailing boat/motor vessel	0.61	-
Bicycle	0.72	-
Other	0.77	0.77
Average	**0.84**	**0.92**

Source: CVO, 2018 (calculation CSTT/NRIT Research)

3 Note that CBS reports a major recent revision of the national accounts, conform to new European guidelines, the European System of Accounts (ESA) 2010. Therefore GDP figures used in previous Travelling Large reports have now changed. More information about the revision can be found at www.cbs.nl under 'Revision national accounts: 2010'.

4 Developments 2002 – 2018

4.1 Introduction

This chapter shows the most important changes of the carbon footprint during the years 2002, 2005, and 2008 through 2018. 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.[4] Because of the 2017 sample-trend-breach, we have corrected all pre-2017 values by the ratio 2017 new sample divided by the 2017 old sample, and for the share of the population with non-Dutch nationality (CBS 2020a), to get much closer to the real trends. This of course means that the values given for these older years may differ substantially from our earlier reports (see chapter 1).
The two most prominent developments are seen in this table: from 2002 to 2018 total Dutch CO_2 emissions have decreased by 9.0%, but at the same time total Dutch holiday emissions have increased by 27.0%. 2018 has seen a stabilisation in total holiday emissions compared to 2017. Average emissions per day decreased slightly (-0.8%) while they increased per holiday (1.1%). Since monitoring started in 2002, total holiday emissions have never been higher than in 2017 and 2018. This has resulted in an increase of the share of holiday emissions of the Netherlands' total emissions from 8.2% in 2002 to 11.5% in 2018. Emissions per day followed the same development: annual emissions per capita per day in the Netherlands have decreased by 14.7%, whereas those for holidays have increased by 16.8%. Not shown by the table are 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, except for national emissions, which are still below the levels of the previous decade. 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, rising in 2015, and falling again in 2016, and reaching a new record height in 2017. Carbon footprint developments will be more explicitly shown in section 4.3.

Table 4.1 Reference values carbon footprint, 2002, 2005, 2008, 2011, 2014, 2016-2018

	2002	2005	2008	2011	2014	2016	2017	2018
Dutch average CO_2 emission per holiday (kg)*)	381	432	448	439	438	428	457	462
Dutch average CO_2 emission per holiday per day (kg)*)	43.3	49.1	50.7	50.7	51.0	49.3	51.0	50.6
Total Dutch holiday CO_2 emissions (Mt)*)	14.5	16.0	17.3	17.2	16.7	16.6	18.5	18.5
Average CO_2 emissions per person per year in the Netherlands (tonnes)	11.0	10.9	10.7	10.2	9.5	9.8	9.7	9.3
Average CO_2 emissions per person per day in the Netherlands (kg)	30.0	29.9	29.4	27.9	25.9	26.9	26.4	25.6
Total Dutch CO_2 emissions (Mt)**)	176.6	177.9	175.9	169.5	159.2	166.7	164.9	160.6
Contribution of Dutch holiday CO_2 emissions to total Dutch CO_2 emissions *)	8.2%	9.0%	9.8%	10.2%	10.5%	10.0%	11.2%	11.5%

Source: (CBS 2020c); CVO 2002, 2005, 2008, 2011, 2014, 2016-2018 (calculation CSTT/NRIT Research)
**) note: all values up to and including 2016 have been corrected to accommodate for the 2017 sample trend-breach*
***) 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 2018, it appears that the number of holidays increased much less (4.7%) than the total distance travelled on holiday (53.8%). Total distance decreased somewhat (-1.3%) between 2017 and 2018. The average return distance for a holiday increased from 1,413 km in 2002 to 2,078 km in 2018 (+47.1%), which was 4 km less than the all-time high of 2017. Over the whole 2002-2018 period, the most relevant development is also the near doubling of holidays by plane (94.2%). The total distance travelled on holidays by plane increased similarly during this period (93.9%). The Dutch have started travelling more by plane, but the average distance with this transport mode hardly changed: from 6,456 km in 2002 to 6,446 in 2018 (-0.2%). In many years in-between, this distance was considerably higher, culminating in 7,255 km in 2010. The airplane is now used for 78.2% of the total holiday distance travelled, whereas holidays by plane still only make up 25.2% of all holidays.

4 For lack of place, all tables in this chapter omit the years 2009, 2010, 2012, 2013 and 2015, and start with three-year jumps. These missing years do feature in the graphs in section 4.3 and 4.4.

Table 4.2 Holidays and distance per transport mode used

	Unit	2002	2005	2008	2011	2014	2016	2017*	2018*
Share of total Dutch holidays by transport mode used, per year	**%**								
Car		73.1	70.6	69.1	69.4	68.1	68.7	66.6	65.8
Airplane		13.7	17.9	19.8	20.2	22.2	21.6	24.4	25.2
Train		4.5	4.4	4.8	4.6	4.3	4.4	4.5	4.1
Touring car/shuttle bus		3.6	3.4	3.2	2.6	2.2	2.1	1.9	1.8
Boat		0.4	0.2	0.4	0.4	0.2	0.2	0.1	0.2
Bicycle		0.9	1.1	0.9	0.6	0.9	0.8	0.7	0.7
Other		3.8	2.3	1.8	2.2	2.2	2.2	1.9	2.2
Total	**million holidays**	**38.1**	**37.0**	**38.5**	**39.2**	**38.0**	**38.8**	**40.4**	**39.9**
Share of holidays of total distance travelled) per transport mode per year**	**%**								
Car		29.5	22.8	21.1	20.7	19.6	20.9	18.8	18.7
Airplane		63.1	72.1	74.5	75.2	76.9	75.9	78.3	78.2
Train		2.0	1.4	1.4	1.4	1.1	1.1	1.0	1.1
Touring car/shuttle bus		3.5	2.6	2.2	1.7	1.4	1.3	1.1	1.2
Boat		0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Bicycle		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other		1.8	1.0	0.7	0.9	0.8	0.7	0.7	0.8
Total	**billion km**	**53.9**	**64.6**	**72.9**	**73.5**	**73.2**	**73.6**	**84.0**	**82.9**

Source: CVO 2002, 2005, 2008, 2011, 2014, 2016-2018 (calculation CSTT/NRIT Research)
**) note: all values up to and including 2016 have been corrected to accommodate for the 2017 sample trend-breach*
***) 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 number of holidays by plane and flight kilometres is also clearly visible in the degree of organisation (see list of terms for an explanation). Combined trips have the largest share of the total distance travelled on holidays (31.1% in 2018), taking over from package trips. The total distance travelled on package trips increased by 26.6% between 2002 and 2018. Combined trips show the greatest increase in distance travelled (437% between 2002 and 2018), which is partly due to the continuous increase of this type of trips during this period; 245%). Only non-organised holidays saw a decrease in the total distance travelled (-38.6%; 2002-2018). This can be entirely attributed to a decrease of this type of holidays (-48.0%).

Table 4.3 Holidays and distance by degree of organisation

	Unit	2002	2005	2008	2011	2014	2016	2017*	2018*
Share of holidays (by the Dutch) of total holidays by organisation type per year	**%**								
Package trip		10.8	13.0	12.8	11.3	11.2	10.3	10.5	11.0
Combined trip		3.6	4.4	6.1	8.1	9.8	10.1	11.5	12.0
Only transport organised		5.4	6.0	6.6	6.5	5.6	5.6	6.8	6.7
Only accommodation directly booked through booking office		20.0	26.3	27.3	33.4	33.5	36.7	34.5	35.8
Only accommodation directly organised		15.9	21.0	19.8	16.4	14.9	13.5	12.6	12.5
Non-organised		44.2	29.2	27.3	24.3	25.0	23.6	24.1	22.0
Total	**million holidays**	**38.1**	**37.0**	**38.5**	**39.2**	**38.0**	**38.8**	**40.4**	**39.9**
Share of holidays of total distance travelled **) by degree of organisation per year	**%**								
Package trip		33.3	40.6	37.6	32.8	31.7	30.3	27.9	27.4
Combined trip		8.9	11.8	15.0	21.5	25.6	25.6	27.7	31.1
Only transport organised		21.6	21.4	22.5	22.1	19.0	19.3	21.1	19.1
Only accommodation directly booked through booking office		8.4	8.9	8.2	9.6	9.2	10.3	9.4	9.9
Only accommodation directly organised		5.8	6.6	6.3	5.6	5.1	4.8	3.9	3.8
Non-organised		21.9	10.7	10.3	8.5	9.5	9.7	10.1	8.8
Total	**billion km**	**53.9**	**64.6**	**72.9**	**73.5**	**73.2**	**73.6**	**84.0**	**82.9**

Source: CVO 2002, 2005, 2008, 2011, 2014, 2016-2018 (calculation CSTT/NRIT Research)
**) note: all values up to and including 2016 have been corrected to accommodate for the 2017 sample trend-breach*
***) 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 (50.6% in 2018). Since 2002, the number of hotel holidays increased by 44.6% and the distance by 104.8%. 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	2011	2014	2016	2017*	2018*
Share of holidays (by the Dutch) of total holidays by accommodation type per year	**%**								
Hotel		25.8	29.9	31.5	32.7	34.2	35.2	36.1	35.6
Bungalow		23.9	22.8	24.6	26.1	23.4	23.2	22.7	23.4
Camping		25.3	22.7	20.1	20.4	19.2	18.5	17.8	17.0
Other		25.1	24.6	23.8	20.8	23.2	23.1	23.4	24.0
Total	**million holidays**	**38.1**	**37.0**	**38.5**	**39.2**	**38.0**	**38.8**	**40.4**	**39.9**
Share of holidays of total distance travelled **) by accommodation type per year	**%**								
Hotel		38.0	50.0	49.9	50.6	49.2	51.6	50.5	50.6
Bungalow		11.8	9.2	9.5	11.3	12.0	12.0	11.6	11.3
Camping		12.5	9.6	9.8	9.2	9.2	9.1	8.8	8.7
Other		37.7	31.3	30.8	28.9	29.5	27.4	29.1	29.5
Total	**billion km**	**53.9**	**64.6**	**72.9**	**73.5**	**73.2**	**73.6**	**84.0**	**82.9**

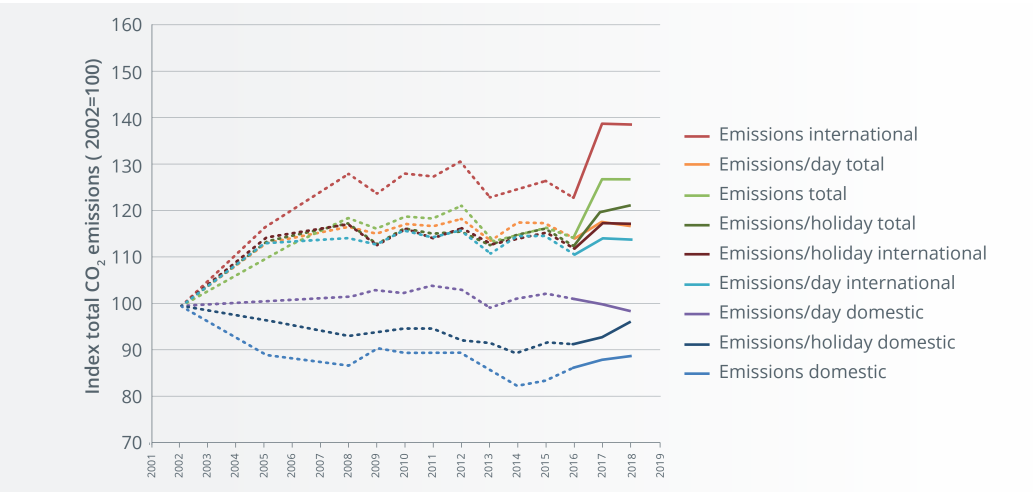
Source: CVO 2002, 2005, 2008, 2011, 2014, 2016-2018 (calculation CSTT/NRIT Research)
**) note: all values up to and including 2016 have been corrected to accommodate for the 2017 sample trend-breach*
***) not the actual distance travelled between home and destination, but the great circle distance*

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 2.9% per year (18.8% in total for 2002-2008). Between 2008 and 2012, total emission growth rates fluctuated between -2% and +2% per year. A record was reached in 2012, after which a decrease set in (notably 2012-2013: -5.6%), interrupted by a 1.4% increase between 2014 and 2015, but continued from 2015 to 2016 (-1.8%). Over the period 2002 to 2016, total emissions have increased by 14.4%. Between 2016 and 2017 we see an increase of 11.1%. Between 2017 and 2018 total emissions stabilised. The full 2002 to 2018 period shows an overall growth of 27.0% in total emissions.
The real 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 2016, with a strong decrease between 2012-2013 (-6.0%), amongst others, have resulted in an average growth of 1.5% between 2002 and 2016. A large 13.1% growth between 2016 and 2017 is followed up by a slight decrease of 0.2% in 2018.
The emissions of domestic holidays show an unstable but overall decreasing development until 2014 (-1.6% per year), then turning into a gradual increase (2014-2018: 1.9% per year) (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



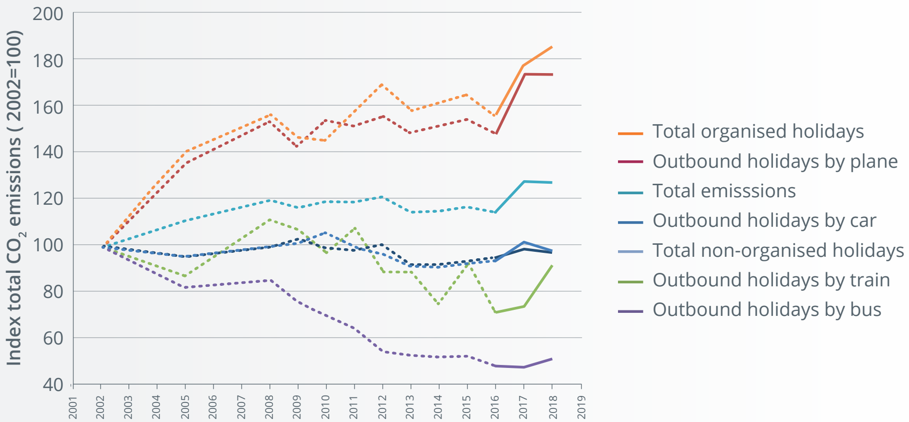
Source: CVO 2002, 2005, 2008-2018 (calculations CSTT/NRIT Research)
**) note: all values up to and including 2016 have been corrected to accommodate for the 2017 sample trend-breach*

Figure 4.2 shows emission trends for holidays with different transport modes (only outbound) and organisation types (domestic and outbound)[5]. The very strong growth of emissions of holidays by plane, with 7.4% per year in the 2002-2008 period, is followed by eight years of fluctuation and overall decrease (-0.4% per year 2008-2016). 2016 to 2017 sees a steep 17.0% growth, which is followed by a year of stabilisation (-0.1%). Outbound emissions by car have shown relatively small fluctuations over the years and were still around 2002 levels in 2018 despite the trend-breach. The emissions of outbound holidays by bus have seen almost constant decrease from 2002 to 2017 (by 4.8% per year on average and 52.5% in total), but 2017-2018 shows 7.7% growth. The main reason for this development is the strong overall decline in this type of holidays until 2017, and some growth afterwards. Outbound train emissions have shown strong fluctuations for the whole 2002-2018 period (overall -7.5%). Exemplary is a strong decrease in 2015-2016 after a similarly strong increase the year before. Of particular interest is the very similar development in emissions of holidays by

5 Please note that in this figure, organised holidays are package and combined holidays only, and non-organised holidays also include those where accommodation or transport have been booked.

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. Both developments are clearly visible in Figure 4.2.

Figure 4.2: Emission trends by transport mode and degree of organisation



Source: CVO 2002, 2005, 2008-2018 (calculation CSTT/NRIT Research)
**) note: all values up to and including 2016 have been corrected to accommodate for the 2017 sample trend-breach*

When taking a closer look at the growth of emissions, it becomes evident that most of the total growth of 3.92 Mt between 2002 and 2018 is caused by holidays taken outside of Europe (intercontinental; +3.47 Mt). European holiday emissions increased much less (+0.79 Mt), while domestic holiday emissions decreased (-0.34 Mt), see table 4.5. The emissions of intercontinental holidays had doubled between 2002 and 2010, before showing an overall decline of 12.9% from 2010 to 2016. The huge 19.3% growth of intercontinental holiday emissions between 2016 and 2017 is followed by a relatively stable year (2017-2018; -0.2%). Most striking until 2010 had 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 between 2002 and 2010, increasing by 12.2% on average per year. The share of emissions of all intercontinental holidays has grown from just over 21% in 2002 to more than 36% (in 2010) of all holiday emissions, and since then has been fluctuating between 32% and 34%, climbing to 35.5% in 2017 and 2018. The increase in total holiday emissions between 2016 and 2017 can be attributed to all regions (domestic 1.9%), but mainly the outbound ones: European (8.6%) and, particularly, intercontinental holiday emissions (19.3%). The 0% total change between 2017 and 2018 is made up of some growth of domestic emissions (1.2%) and minimal decline of European (-0.3%) and intercontinental (-0.2%) holiday emissions.

The overall development towards long-haul destinations is visible in the total distance that people travelled to their destinations (+2.7% per year in 2002-2018). Consequently, over the whole 16 years, the emissions of transport have grown faster (+2.3% per year) than average (total emissions grew 1.5% per year), whereas those from accommodations (+0.9% per year) and other holiday activities (+0.7% per year) grew considerably slower. The total number of holidays showed only a small increase per year between 2002 and 2018 (+0.3%). 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.

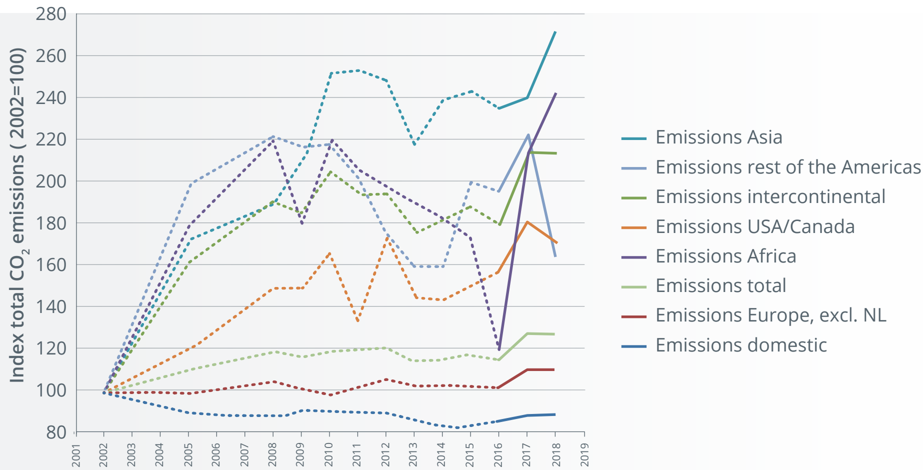
Table 4.5 Carbon footprint by destination

	Carbon footprint in Mt CO_2							
	2002	**2005**	**2008**	**2011**	**2014**	**2016**	**2017**	**2018**
The Netherlands	3.058	2.731	2.663	2.750	2.518	2.637	2.688	2.720
Europe (excl. the Netherlands)	8.400	8.310	8.747	8.535	8.614	8.486	9.214	9.191
Outside Europe (intercontinental)	3.072	4.963	5.853	5.932	5.548	5.498	6.557	6.542
- of which Africa	0.436	0.781	0.958	0.895	0.793	0.524	0.931	1.054
- of which Asia	0.893	1.538	1.691	2.248	2.130	2.096	2.141	2.419
- of which the USA and Canada	0.843	1.009	1.251	1.123	1.211	1.327	1.521	1.438
- of which the rest of the Americas	0.699	1.380	1.549	1.414	1.117	1.361	1.554	1.149
- of which Australia and Oceania	0.201	0.254	0.404	0.252	0.298	0.191	0.410	0.482
Total	**14.531**	**16.004**	**17.262**	**17.218**	**16.680**	**16.622**	**18.459**	**18.452**

Source: CVO 2002, 2005, 2008, 2011, 2014, 2016-2018 (calculation CSTT/NRIT Research)
**) note: all values up to and including 2016 have been corrected to accommodate for the 2017 sample trend-breach*

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, except for the increase of emissions for USA/Canada in 2012, and the steep increases in 2017. 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).

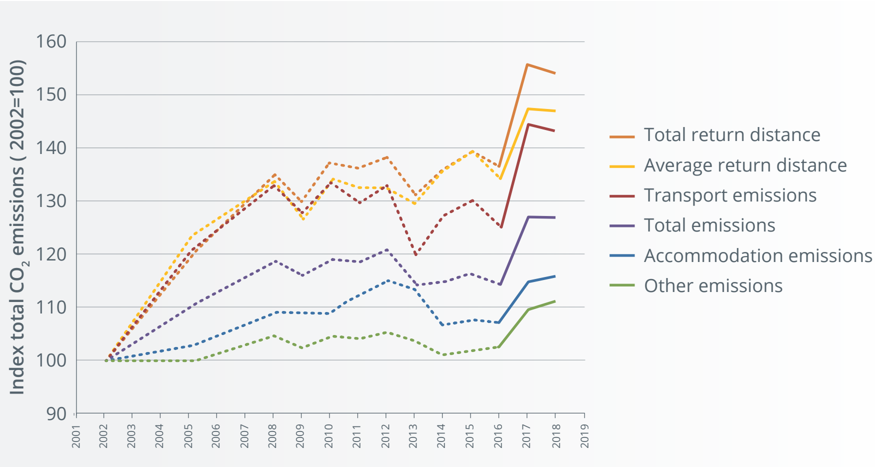
Figure 4.3: Emission trends by destination



Source: CVO 2002, 2005, 2008-2018 (calculation CSTT/NRIT Research)
**) note: all values up to and including 2016 have been corrected to accommodate for the 2017 sample trend-breach*

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. In 2013, all per component emissions fell, particularly those of transport. The stronger declines in transport emissions in 2009, 2013 and 2016, as well as the increases in 2014, 2015 and 2017, can be explained by this components' sensitivity to the (development of) emissions of intercontinental holidays, as opposed to those of accommodation or other activities. Both total distance and average return distance are strongly linked to both (developments in) transport and intercontinental holiday emissions (see figure 4.3 and 4.4). Between 2002 and 2018, air transport emissions have increased slightly less than distances, mainly due to technological developments in global aviation (Peeters 2019). Therefore, the average emissions per km travelled improved slightly.

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

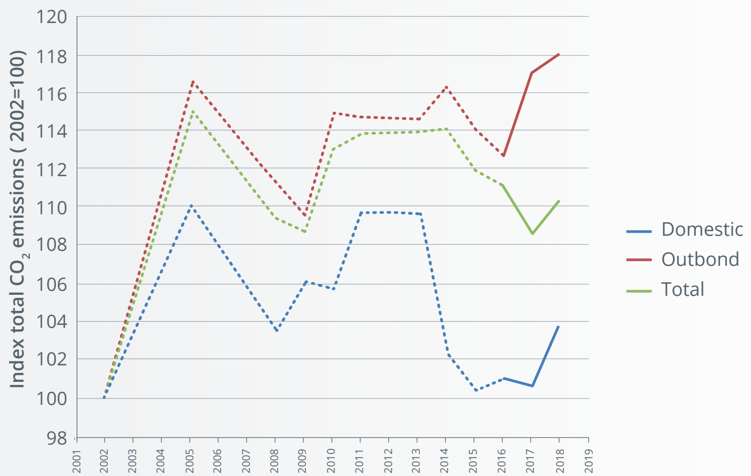


Source: CVO 2002, 2005, 2008-2018 (calculation CSTT/NRIT Research)
**) note: all values up to and including 2016 have been corrected to accommodate for the 2017 sample trend-breach*

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 2020b). Between 2002 and 2005, total eco-efficiency increased (worsened) by 14.9%, followed by a 6.2% decrease between 2005 and 2009, another 5.2% increase between 2009 and 2011, and a 5.3% decrease (improvement) between 2013 and 2017. Between 2017 and 2018, eco-efficiency increased (worsened) again by 1.8%. During the entire 2002-2018 period, emissions have increased faster than spending, making the sector 10.4% less eco-efficient. Domestic holidays have become 3.8% less eco-efficient over the 2002-2018 period, whereas outbound holidays have become 18.0% less efficient in this period.

Figure 4.5: Eco-efficiency by destination



Source: CVO 2002, 2005, 2008-2018 (calculation CSTT/NRIT Research)
**) note: all values up to and including 2016 have been corrected to accommodate for the 2017 sample trend-breach*

5 Conclusions and discussion

The Travelling Large reports, started in 2008 (de Bruijn et al. 2013a, de Bruijn et al. 2013b, 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, Eijgelaar et al. 2015, Eijgelaar et al. 2016b, Eijgelaar et al. 2017, Pels et al. 2014, Sensagir et al. 2019), 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. 2019). This new, twelfth report is also based on the Continuous Holiday Survey (CVO) of NBTC-NIPO Research. It is the first report using the new CVO sample which, unfortunately, causes a trend-breach in the series. We have therefore corrected all pre-2017 values by the ratio 2017 new sample divided by the 2017 old sample, and for the share of the population with non-Dutch nationality (CBS 2020a), to get much closer to the real trends. This of course means that the values given for these older years may differ substantially from our earlier reports. Additionally, information on the carbon footprint of various touristic activities and holiday components, collected by the Centre for Sustainability, Tourism & Transport of Breda University of Applied Sciences over the years, has been used (see also Peeters 2019).

In 2018, the total contribution of CO_2 emissions by Dutch holidaymakers was 18.5 Mt or 11.5% of all CO_2 emissions of the Dutch economy. It is not easy to define a sustainable level for CO_2, but it has become clear that substantial reductions are needed to prevent 'dangerous climate change'. The latter has been linked to more than 1.5-2 degrees warming in the 2015 Paris Agreement (UNFCCC 2015), which entered into force in November 2016 (UN 2016). For the moment, the EU has set the goal of a 20% reduction of GHG emissions by 2020 (and 40% in 2030) compared to 1990 levels (EC 2016). The new Dutch government has adopted a more ambitious target of 49% in 2030 (VVD et al. 2017); a target that has been confirmed in the national Climate Agreement published in 2019 (EZK 2019). 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). However, more recent analyses show that regardless "of the carbon budget, emissions need to reach zero between 2050 in 2100 (as specified by the Paris Agreement). An earlier achievement of this goal will lead to lower temperature. And equity requires rich countries to reach zero before poor countries" (Peters 2018: 380). This implies ending our fossil fuel-based economy in the west within three-four decades. In terms of achieving this ambition, results of the Paris Agreement are 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 1.5% per year between 2002 and 2018. 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 2018, 73.8% of all holidays had an individual carbon footprint per day that stayed below the average per day of 50.6 kg, whereas 24.0% of all holidays' per day footprints were lower than the average per day emissions for everyday

life of Dutch people (25.6 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 43.3 kg in 2002 to 51.0 kg in 2017, and slightly down to 50.6 kg in 2018).
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, 50.6 kg CO_2 per day):
- sea cruises (+337%)
- intercontinental (long-haul) holidays (ca. +167%)
- organised holidays (+87%)
- (outbound) holidays by airplane (+84%)
- all holidays in hotels/motels (ca. +63%)
- European 'airplane' destinations (e.g. Greece: +46%)
- the average outbound holiday (+24%)

The holiday types with the **lowest** environmental impact per day are:
- domestic boating (-81%) and bicycle holidays (-76%)
- all camping holidays with a tent (-55%)
- the average domestic holiday (-53%)
- all non-organised holidays (-48%)
- outbound holidays by train (-46%) or bus (-45%)
- all nearby outbound holidays (e.g. in Belgium: -49%, France: -36%, Germany: -35%)

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 more than four times as many emissions per Euro as the Dutch economy (0.91 kg CO_2/€ compared to 0.21 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. 1.50 kg/€ for Australia and Oceania), while destinations like Switzerland have the best (0.42 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 bus and train (0.35-0.36 kg CO_2/€) come anywhere close to the eco-efficiency of the Dutch economy (0.21 kg CO_2/€).
The fast growth of the carbon footprint of Dutch holidaymakers (1.5% per year on average) 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 increase in the total distance travelled between 2002 and 2018. The recession has reduced travel distances and total emissions at times, and also post-recession years such as 2016 have seen reductions in many components, but the many emission and distance

‘records’ broken in 2017 show that there is no lasting (desirable) impact on tourism emissions to date. 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, even more so under the new CVO sample. 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. 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 regarding 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. 2016a).

References

CBS (2019) *National accounts of the Netherlands 2018.* The Hague/Heerlen/Bonaire: Statistics Netherlands.

CBS (2020a) *Bevolking, huishoudens en bevolkingsontwikkeling; vanaf 1899*. Online documents at URL https://opendata.cbs.nl

CBS (2020b) *Consumer prices; European harmonised price index 2015=100 (HICP)*. Online documents at URL https://opendata.cbs.nl/statline/#/CBS/en/dataset/83133ENG/table?fromstatweb [14-5-2020].

CBS (2020c) *Emissies van broeikasgassen berekend volgens IPCC-voorschriften*. Online documents at URL https://opendata.cbs.nl [8-4-2020].

de Bruijn, K., Dirven, R., Eijgelaar, E. & Peeters, P. (2013a) *Travelling large in 2012: The carbon footprint of Dutch holidaymakers in 2012 and the development since 2002.* Breda, The Netherlands: NHTV Breda University of Applied Sciences.

de Bruijn, K., Dirven, R., Eijgelaar, E., Peeters, P. & Nelemans, R. (2013b) *Travelling large in 2011: The carbon footprint of Dutch holidaymakers in 2011 and the development since 2002.* Breda, Netherlands: NHTV Breda University of Applied Sciences.

de Bruijn, K., Dirven, R., Eijgelaar, E. & Peeters, P. M. (2008) *Reizen op grote voet 2005. De milieubelasting van vakanties van Nederlanders. Een pilot-project in samenwerking met NBTC-NIPO Research.* Breda: NHTV University for Applied Sciences.

de Bruijn, K., Dirven, R., Eijgelaar, E. & Peeters, P. M. (2009a) *Reizen op grote voet 2008. De carbon footprint van vakanties van Nederlanders in 2008 en de ontwikkeling sinds 2002.* Breda: NHTV University for Applied Sciences in samenwerking met NBTC-NIPO Research.

de Bruijn, K., Dirven, R., Eijgelaar, E. & Peeters, P. M. (2009b) *Travelling large in 2008. The carbon footprint of Dutch holidaymakers in 2008 and the development since 2002.* Breda: NHTV University for Applied Sciences in collaboration with NBTC-NIPO Research.

de Bruijn, K., Dirven, R., Eijgelaar, E. & Peeters, P. M. (2010) *Travelling large in 2009. The carbon footprint of Dutch holidaymakers in 2009 and the development since 2002.* Breda: NHTV University for Applied Sciences in collaboration with NBTC-NIPO Research.

de Bruijn, K., Dirven, R., Eijgelaar, E. & Peeters, P. M. (2012) *Travelling large in 2010. The carbon footprint of Dutch holidaymakers in 2010 and the development since 2002.* Breda: NHTV University for Applied Sciences in collaboration with NBTC-NIPO Research.

Dlugokencky, E. & Tans, P. (2020) *Trends in Atmospheric Carbon Dioxide, Recent Global CO_2*. Online documents at URL http://www.esrl.noaa.gov/gmd/ccgg/trends/global.html [19-2-2020].

EC (2016) *EU climate action*. Online documents at URL http://ec.europa.eu/clima/citizens/eu_en [19-12-2016].

Eijgelaar, E., Nawijn, J., Barten, C., Okuhn, L. & Dijkstra, L. (2016a) Consumer attitudes and preferences on holiday carbon footprint information in the Netherlands. *Journal of Sustainable Tourism,* 24 (3), 398-411.

Eijgelaar, E., Peeters, P., de Bruijn, K. & Dirven, R. (2015) *Travelling large in 2014: The carbon footprint of Dutch holidaymakers in 2014 and the development since 2002.* Breda, The Netherlands: NHTV Breda University of Applied Sciences.

Eijgelaar, E., Peeters, P., de Bruijn, K. & Dirven, R. (2016b) *Travelling large in 2015: The carbon footprint of Dutch holidaymakers in 2015 and the development since 2002.* Breda, The Netherlands: NHTV Breda University of Applied Sciences.

Eijgelaar, E., Peeters, P., de Bruijn, K. & Dirven, R. (2017) *Travelling large in 2016: The carbon footprint of Dutch holidaymakers in 2016 and the development since 2002.* Breda, The Netherlands: NHTV Breda University of Applied Sciences.

Eijgelaar, E., Peeters, P. & Schreven, L. (2019) Toerisme en duurzaamheid. IN CBS (Ed.) *Trendrapport toerisme, recreatie en vrije tijd 2019*, 298-317. Breda: Pleisureworld NRIT, CBS, NBTC Holland Marketing, CELTH.

EZK (2019) *Climate Agreement.* The Hague, Netherlands: Ministry of Economic Affairs and Climate Policy, Directorate-General for Climate and Energy, Climate Department.

Forster, P. M. d. F., Shine, K. P. & Stuber, N. (2006) It is premature to include non-CO_2 effects of aviation in emission trading schemes. *Atmospheric Environment,* 40 (6), 1117-1121.

Forster, P. M. d. F., Shine, K. P. & Stuber, N. (2007) Corrigendum to "It is premature to include non-CO_2 effects of aviation in emission trading schemes" [Atmos. Environ. 40(2006) 117-1121]. *Atmospheric Environment,* 41, 3941.

Gössling, S. & Peeters, P. (2015) Assessing tourism's global environmental impact 1900–2050. *Journal of Sustainable Tourism,* 23 (5), 639-659.

Graßl, H. & Brockhagen, D. (2007) *Climate forcing of aviation emissions in high altitudes and comparison of metrics* Online documents at URL http://www.mpimet.mpg.de/fileadmin/download/Grassl_Brockhagen.pdf [10-11-2008].

ICAO (2016) *Resolution A39-3: Consolidated statement of continuing ICAO policies and practices related to environmental protection – Global Market-based Measure (MBM) scheme.* Montreal, Canada: International Civil Aviation Organization.

IPCC (2007) *Climate Change 2007: The physical science basis. Working Group I contribution to to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* 978-0-52170596-7 Cambridge (UK): Cambridge University Press.

Lee, D. S., Fahey, D. W., Forster, P. M., Newton, P. J., Wit, R. C. N., Lim, L. L., Owen, B. & Sausen, R. (2009) Aviation and global climate change in the 21st century. *Atmospheric Environment,* 43, 3520-3537.

Meinshausen, M., Meinshausen, N., Hare, W., Raper, S. C. B., Frieler, K., Knutti, R., Frame, D. J. & Allen, M. R. (2009) Greenhouse-gas emission targets for limiting global warming to 2° C. *Nature,* 458 (7242), 1158-1162.

Parry, M., Palutikof, J., Hanson, C. & Lowe, J. (2008) Squaring up to reality. *Nature Reports Climate Change*, 68.

Peeters, P. (2017) *Tourism's impact on climate change and its mitigation challenges. How can tourism become 'climatically sustainable'?* Delft, Netherlands: TU Delft

Peeters, P., Szimba, E. & Duijnisveld, M. (2007a) Major environmental impacts of European tourist transport. *Journal of Transport Geography,* 15, 83-93.

Peeters, P. M. (2019) *Carbon footprint emissie factoren; versie 2017 en trends 2002-2017.* Breda: NHTV.

Peeters, P. M., Williams, V. & Gössling, S. (2007b) Air transport greenhouse gas emissions. IN Peeters, P. M. (Ed.) *Tourism and climate change mitigation. Methods, greenhouse gas reductions and policies*, 29-50. Breda: NHTV.

Pels, J., Eijgelaar, E., de Bruijn, K., Dirven, R. & Peeters, P. (2014) *Travelling large in 2013: The carbon footprint of Dutch holidaymakers in 2013 and the development since 2002.* Breda, Netherlands: NHTV Breda University of Applied Sciences.

Peters, G. P. (2018) Beyond carbon budgets. *Nature Geoscience,* 11, 378–380.

Scott, D., Peeters, P. M. & Gössling, S. (2010) Can tourism deliver its 'aspirational' greenhouse gas emission reduction targets? *Journal of Sustainable Tourism,* 18 (3), 393 - 408.

Sensagir, I., Eijgelaar, E., Peeters, P., De Bruijn, K. & Dirven, R. (2019) *Travelling large in 2017: The carbon footprint of Dutch holidaymakers in 2017 and the development since 2002.* Breda, Netherlands: Breda University of Applied Sciences.

UN (2016) *Paris Agreement: Entry into force. C.N.735.2016.TREATIES-XXVII.7.d*. New York, USA: United Nations.

UNFCCC (2015) *Adoption of the Paris Agreement. Proposal by the president.* Geneva, Switzerland: UNFCCC.

UNWTO-UNEP-WMO (2008) *Climate change and tourism: Responding to global challenges.* Madrid: UNWTO.

UNWTO (2016) *Tourism and the SDGs*. Online documents at URL http://icr.unwto.org/content/tourism-and-sdgs [30-8-2016].

van Vuuren, D. P., Stehfest, E., den Elzen, M. G. J., van Vliet, J. & Isaac, M. (2010) Exploring IMAGE model scenarios that keep greenhouse gas radiative forcing below 3 W/m^2 in 2100. *Energy Economics,* 32 (5), 1105-1120.

VVD, CDA, D66 & ChristenUnie (2017) *Vertrouwen in de toekomst: Regeerakkoord 2017 – 2021 [Confidence in the future: Coalition agreement 2017-2021].* The Hague, Netherlands: Tweede Kamer.

Wiedmann, T. & Minx, J. (2007) *A definition of 'Carbon Footprint'.* 07-01 Durham, UK: ISAUK Research & Consulting.

WTTC (2015) *Travel & tourism 2015. Connecting global climate action.* London, UK: World Travel and Tourism Council.

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 Sustainability, Tourism and Transport of 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 twelfth volume in this series, presenting the carbon footprint of holidays by the Dutch in 2002, 2005, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017 and 2018. This report not only contains a complete overview of the impacts of Dutch tourists on the climate in 2018, but also presents the development of the holiday carbon footprint through the years 2002-2005-2008-2009-2010-2011-2012-2013-2014-2015-2016-2017-2018.

Centre for Sustainability, Tourism and Transport
Breda University of Applied Sciences
PO Box 3917
4800 DX Breda
Phone +31(0)76 533 22 03
Email cstt@nhtv.nl
www.cstt.nl

Breda University OF APPLIED SCIENCES