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Research Article

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The Carbon Footprint of Volunteer Tourism

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Abstract: Tourism is growing at a fast rate and so is its carbon footprint. Alongside conventional tourism, a new form of tourism, so-called voluntourism, has emerged. The discussion on voluntourism in the existing literature has hereby mainly centred around its positive impacts on the health and education of communities and the local environment in developing countries. Nevertheless, little attention has been drawn to its climate impacts. This study set out to investigate the carbon footprint of voluntourism. The data were collected at a local non-governmental organisation (NGO) in India working with voluntourists. Both the carbon footprint of the stay in India and that from the round trip by air were taken into consideration. The results showed that although the carbon footprint of voluntourists during their stay is comparable with that of locals, the flight significantly contributes to the carbon footprint of voluntourism. Depending on the distance flown and the length of the stay, the average share of the carbon footprint stemming from the flight can be between 83% and 96%. The article concludes that faraway destinations and short stays should be avoided; otherwise voluntourism might cause more harm than good. On the basis of the findings, this article provides recommendations for policymakers and further research.

Keywords: Carbon footprint; Tourism; Volunteering; Voluntourism; Air transport; Sustainability

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1 Introduction

According to Lenzen et al. (2018), tourism is currently responsible for about 8% of all global greenhouse gas emissions. Furthermore, the tourism industry's contribution to emissions is expected to rise, because it is experiencing fast growth (Simpson et al., 2008; UNWTO, 2018). According to a report by UNWTO (2018), total international tourist arrivals grew by 7% during 2017, which was the highest growth in the past 7 years. Several studies have highlighted the high emission intensity of tourism (Dwyer, Forsyth, Spurr & Hoque, 2010; Gössling & Peeters, 2015; Rico et al., 2018; Sharp, Grundius & Heinonen, 2016; Simpson et al., 2008). The major impacts include aviation, which is the number one emissions contributor in most of the studies that include aviation in their boundaries, with a share ranging from 50% to 95% of the total carbon footprint (Dwyer et al., 2010; Gössling & Peeters, 2007; Peeters & Schouten, 2006; Sharp et al., 2016), other transportation, accommodation and production and import of goods (Dwyer et al., 2010; Hu et al., 2015; Jones & Munday, 2007; Liu et al., 2017; Puig et al., 2017; Rico et al., 2018; Sharp et al., 2016).

An emerging trend alongside conventional tourism is volunteer tourism, the so-called voluntourism (Wearing & McGehee, 2013). A volunteer tourist is a person who uses 'discretionary time and income to travel out of the sphere of regular activity to assist others in need' (McGehee & Santos, 2005). Despite research being conducted on assessing how international voluntourism impacts the target communities, the volunteers' attitudes and perceptions and the local environment (Bailey & Fernando, 2011; Brown, 2005; Lough et al., 2014; Lupoli et al., 2014; McGehee & Santos, 2005; Schneller & Coburn, 2018), little attention has been drawn to the question of how international volunteering affects the global climate and what are the trade-offs of voluntourism in the environmental context (Mustonen, 2007; Rattan, 2015). Similarly, little emphasis has been given to the carbon footprint of voluntourism and its contribution to global climate change. As conventional tourism continues to grow, it is likely that voluntourism will also grow in the future, as more and more young people are interested in making an impact whilst simultaneously enjoying the cultural experience of tourism (Wearing & McGehee, 2013). Therefore, it is important to estimate the climate impact of voluntourism in order to formulate mitigation policies and to be able to inform the voluntourism industry and international volunteers about their environmental impacts. When the quantity of the emissions is known, offsetting, compensation and awareness creation programmes can be designed more efficiently and accurately.

The aim of this research is to study the carbon footprint of international volunteer tourists, which has yet to receive much attention in the literature even though its environmental impacts might resemble that of conventional tourism. Although voluntourism is often considered for its positive impacts on the health and education of communities and the local environment in developing countries, it also creates environmental impacts that need to be addressed. Otherwise voluntourism might cause more harm than good. For this purpose a comprehensive carbon footprint analysis was conducted to understand and quantify the extent of emissions of international voluntourism. The study was conducted in an Indian non-governmental organisation (NGO) working with volunteer tourists. India is one of the most popular voluntourism destinations worldwide. Between 2006 and 2015, India has seen significant growth in the arrivals of foreign tourists, which has further fuelled India's economic growth (Vedapradha, Hariharan & Niha, 2017). Yet the environmental costs of such growth have received little attention. This study focuses on both direct (scope 1) and indirect (scopes 2 and 3) emissions, with an emphasis on Scope 3 emissions, those being the major contributors of emissions in many case studies yet not very widely studied (Larsen et al., 2013; Liu et al., 2017; Matthews, Hendrickson, & Weber, 2008; Ozawa-Meida et al., 2013; Rico et al., 2018; Sharp et al., 2016).

2 Carbon Footprint

In quantifying emissions, carbon footprint is one of the widely used tools. Even though there has not been a clear definition for carbon footprint in the literature (Matthews et al., 2008; Weidmann & Minx, 2008), Weidmann and Minx (2008) suggest that carbon footprint could be defined as 'a measure of the exclusive total amount of carbon dioxide (CO_2) emissions that is directly and indirectly caused by an activity or is accumulated over the life stages of a product' (p. 4). However, it should be noted that this definition does not include gases other than CO_2. One of the keys for the success of carbon footprint as a method for quantifying emissions is its simplicity and straightforwardness, when compared to, for example, conventional life cycle assessment (LCA) (Weidema et al., 2008).

Carbon footprint is usually expressed in terms of CO_2 equivalents (CO_2-eq) (Weidmann & Minx, 2008). This means that in addition to CO_2, other greenhouse gases (GHGs), such as methane (CH_4) and nitrous oxide (N_2O), are converted into equivalent amounts of CO_2 based on their radiative properties (IPCC, 2014), also known as the global warming potential (GWP).

An important aspect of a carbon footprint is its system boundaries. By defining system boundaries, decisions are made as what aspects to include in the scope of the carbon footprint. Carbon footprint commonly uses the concept of life cycle thinking (Weidema et al., 2008), meaning that the emissions are investigated throughout the life cycle of a product or a service. The different boundaries are referred to as 'scopes' or 'tiers' of the carbon footprint (e.g. Greenhouse Gas Protocol, 2019; Matthews et al., 2008). Scope 1 emissions include direct emissions, such as those emissions coming directly from the production of goods at a manufacturing site. Scope 2 emissions consist of indirect emissions caused by external energy and electricity production. Scope 3 emissions are all other indirect emissions such as consumption of goods or the consequential emissions from waste management. Even though the definition of scope 3 emissions can be a daunting task, these emissions have been the major source of emissions in many studies, thereby indicating their importance in carbon footprint analysis (Larsen et al., 2013; Liu et al., 2017; Matthews et al., 2008; Ozawa-Meida et al., 2013; Rico et al., 2018; Sharp et al., 2016). However, the lack of data often makes it challenging to widen the system boundaries and include scope 3 emissions in the carbon footprint analysis.

Matthews et al. (2008) discussed the importance of carbon footprint estimation boundaries in the context of the United States. They estimated that scope 1 emissions only contribute to around 14% of total industry emissions, on an average, whereas scopes 1 and 2, when combined, contribute to around 26%. This would suggest that most of what is left would fall under scope 3 emissions, which raises concerns about misleading results if narrow boundaries are followed. Clarke, Heinonen and Ottelin (2017) raised a similar concern in the case of Iceland, where the national energy supply is almost 100% renewable. However, as they studied the carbon footprint of Icelandic households using a consumption-based method, they found that transportation and the import of products were the most important factors in determining high GHG emissions in Iceland. Furthermore, Ivanova et al. (2015)

showed, in their study of global household consumption, that the indirect carbon footprint of household consumption contributes to a major share of the total household carbon footprint in many countries. For example, in India where production is largely domestic, the indirect domestic carbon footprint was relatively large for households.

Whilst carbon footprint analysis is a useful tool to easily assess the climate change impacts of products and services, it has also been criticised for overly simplifying environmental impacts and consequences (Laurent, Olsen, & Hauschild, 2012; Weidema et al., 2008). Using carbon footprint as the only environmental indicator can lead to misleading results and misguide policymakers (Laurent et al., 2012; Weidema et al., 2008). For example, carbon footprint does not correlate with the possible emissions of toxic substances (Laurent et al., 2012), which is why it could be said that carbon footprint is not always a good representative of holistic environmental sustainability. However, Weidema et al. (2008) also argued that the simplicity of carbon footprint has made it possible for it to become a widely used concept and tool. Whether holistic evaluation of environmental impacts is important or not, carbon footprint can at least provide a direction, which can be enough for decision-making (Weidema et al., 2008).

3 Carbon Footprint of Tourism

Tourism is globally responsible for about 8% of all GHG emissions (Lenzen et al., 2018). The emission intensity of tourism has to be taken into account to tackle climate change effectively. With a growth of 7% in international tourism arrivals in 2017 (UNWTO, 2018), tourism might be an even larger contributor to climate change in the future.

Many studies have tried to assess the emissions caused by tourism, which is usually a complicated task because of the complexity of the tourism industry, which comprises both products and services, meaning indirect impacts have a high importance (De, Peeters, Petti, & Raggi, 2012; Dwyer et al., 2010; Hu et al., 2015; Liu et al., 2017; Munday, Turner, & Jones, 2013; Puig et al., 2017; Rico et al., 2018; Sharp et al., 2016).

Sharp et al. (2016) studied the carbon footprint of tourism on a larger scale, using a consumption-based LCA methodology to assess the carbon footprint of inbound tourism to Iceland. They found that from 50% to 82% of the carbon footprint consists of aviation-related impacts, the fluctuation being a result of different flight distances. A study by Rico et al. (2018) also discussed the importance of indirect transportation-related emissions (96% of the total emissions), particularly aviation, in the carbon footprint of tourism in Barcelona. They also identified accommodation and leisure activities as important contributors. Overall, scope 3 emissions contributed to 96% of the total emissions. However, it is important to notice that this study did not take into account the energy used for the production of goods. In the context of Australia, Dwyer et al. (2010) estimated that, between 3.90% and 5.30% of the total industry, GHG emissions is caused by tourism. They included domestic aviation in the direct emissions, and it contributed to around 57% (domestic air transport) of the total direct emissions, followed by accommodation services (9%) and shopping (7%). The largest contributors in indirect emissions were electricity by coal, which contributed to around 37% of the total indirect emissions, followed by agriculture, forestry and fishery (31%). These studies suggest the importance of the transportation-related impacts of international tourism and that system boundaries should be wide when assessing tourism-related carbon footprints.

4 Voluntourism

Many researchers have studied voluntourism from a variety of different perspectives ranging from social research investigating the motivations of volunteers (Brown, 2005; Mustonen, 2007) and how volunteering impacts the volunteers and the host communities in a positive way (Bailey & Fernando, 2011; Lough et al., 2014; McGehee & Santos, 2005; Schneller & Coburn, 2018) to research that takes a more critical stance towards voluntourism (Guttentag, 2009; Pluim & Jorgenson, 2012). These studies, and many others, suggest a strong growth in the voluntourism sector, a view which is further supported in the review conducted by Wearing and McGehee (2013).

According to a popular definition, volunteer tourists are people ‘who for various reasons, volunteer in an organised way to undertake holidays that might involve the aiding or alleviating the material poverty of some groups in society, the restoration of certain environments, or research into aspects of society or environment’ (Wearing, 2001). Another, broader definition is given by McGehee and Santos (2005), who described volunteer tourists as people who use ‘discretionary time and income to travel out of the sphere of regular activity to assist others in need’ (p. 760). Volunteer projects usually extend from a couple of weeks to over several months and up to 1 year (Tomazos & Butler, 2009). Popular projects in voluntourism organisations include environmental projects such as the planting of trees and plants, environmental education, the care and monitoring of wildlife, trail maintenance and organic gardening/agriculture. Community development project encompass education for children and adults, skills training for community members, infrastructure development, promoting income generation activities and empowering women's groups (Lupoli et al., 2014).

Some scholars have attempted to study the motivations of people who embark on volunteering journeys. Brown (2005) listed four main themes as the main motivators for volunteers: cultural immersion, desire to give back, friendship and relationships with other volunteers and family bonding. Her study also identified two different types of volunteers: those who are inclined towards the actual volunteering work (volunteer minded) and those who are focused on travelling and other tourism-related activities (vacation minded) (Brown, 2005). Mustonen (2007) studied the motivations of volunteers from another perspective, assessing the concept of altruism and egoism and which would be the motivator for a volunteer tourist. He argued that volunteers' motives lie in both altruism and egoism and that they are interconnected. This mix of motives is formed by a combination of 'pursuit of individuality' and sociality (Mustonen, 2007).

Some benefits of voluntourism for its participants and for society could be the enhancement of civic attitudes and activism (Bailey & Fernando, 2011; McGehee & Santos, 2005), growing concern for social and environmental issues amongst participants (Schneller & Coburn, 2018), and the improvement of international concern and intercultural relations (Lough et al., 2014). Furthermore, Schneller and Coburn (2018) reported that host communities (voluntourism target communities) in Costa Rica felt that the implemented projects were meaningful and had visible benefits, and some studies have observed positive cross-cultural exchanges and financial benefits in host community members (Rattan, 2015).

On the other hand, only a few researchers have studied the possible negative impacts of voluntourism. Some reported negative impacts include the idea of voluntourism being an alternative form of neo-colonisation (Pluim & Jorgenson, 2012). According to this idea, voluntourism promotes dominant values and reinforces the superiority–inferiority binary, where host communities see volunteers as something superior. In addition, it is argued that although some volunteering programmes can be quite costly, it mostly allows middle or upper class people to participate, thus reinforcing the value systems that these people have according to their social positioning (Pluim & Jorgenson, 2012). Guttentag (2009) listed 'a neglect of locals' desires, a hindering of work progress and completion of unsatisfactory work, a disruption of local economies, a reinforcement of conceptualizations of the "other" and rationalisations of poverty, and an instigation of cultural changes' (p. 537) as some of the negative impacts of voluntourism. Similarly, Rattan's (2015) review of negative impacts includes cultural clashes, effects on local economies (e.g. unemployment) and the problem of commodification.

Rattan (2015) suggested that certifications and ecolabels could be an answer to addressing some of the issues caused by voluntourism. However, as he argued, these certifications should be closely followed and including tangible aspects is important. These certifications could be of help when the appropriate information about the negative impacts is known, but it is evident that there is little if any research focusing on the global environmental impact of voluntourism. Studies on the environmental impacts of conventional tourism are prevalent but to get a comprehensive picture of the role of voluntourism in terms of its global impacts, more research needs to be done. This would also assist voluntourism operators in forming suitable certifications and offsetting programmes.

Giving a more comprehensive picture of the environmental impact of voluntourism is one of the main aims of this study, which will hopefully initiate a discussion on not only the psychology and social impact of volunteering but also on its global environmental impact. Such a discussion would make it easier for voluntourism researchers, policymakers and practitioners to understand the comprehensive impact of voluntourism from all viewpoints of sustainability.

5 Data and Method

The data for the research were collected between June and November 2018, at the study site located in a village in Dharamshala area, Himachal Pradesh, India. The studied NGO operates in many areas such as agriculture, sanitation, health, education and waste management. Besides promoting the Sustainable Development Goals, the organisation aims at providing young people with leadership opportunities in order to for them to become responsible world citizens. The organisation is run by 9 locals and receives about 140 volunteers per year.

Regarding scope 1 emissions, data about distance driven by NGO's car were gathered through interviews and observations. The car was mainly used for airport pick-ups and drop-offs as well as for other work-related journeys. Information on the electricity consumption (scope 2 emissions) was obtained directly from the voluntourists' accommodations electricity bills. Not all electricity bills were available and some assumptions had to be made. Information on the scope 3 emissions (indirect emissions from consumption of food and other products) was collected through intensive waste analysis and interviews. Waste produced by volunteers and disposed at the volunteer houses was analysed by examining the packaging of disposed products. Data were collected to determine the product group (e.g. snacks) and category (e.g. food product), net quantity, manufacturing location and sales price. After a specific waste bag was analysed, it was stored, and an empty bag was made ready for use again. The analysis period lasted for 54 days. The waste analysis did not reach all the products used by volunteers, because they would not spend all of their time at the volunteer house. Furthermore, the analysis did not take into account products that do not have any disposable packaging (e.g. fruits and services).

Nearly all of the domestic product packaging examined in this study contained the manufacturer's postal code, which allowed the distance of transportation to be estimated with the help of Google Maps. After the transport distance for goods were determined, the capacity of an average transport vehicle was estimated, which was 15.6 tons according to Premier Road Carriers (2019), ranging from 3.50 to 27 tons. The current valid Indian emission's standard of EURO4 was considered. The accuracy of the transportation calculations should be reviewed critically. For example, the capacity of a transport vehicle can vary significantly from the average, which could cause error to the estimations. It is also possible that the types of transport have regional differences in India. However, the analysis provides an estimation of the possible magnitude of emissions associated with transportation of goods in this specific case.

The carbon footprint for local emissions was calculated using openLCA software with ecoinvent 3.4 and EXIOBASE 2.2 databases. ecoinvent was used because it contains international information on several different products and product sectors, which made it possible to calculate a fairly representative life cycle carbon footprint for some of the products included in this study. The major difference to EXIOBASE (besides the database using different methodology) was the ability to use physical units instead of having to rely on monetary conversions. Some food-related carbon footprints were calculated based on Pathak et al. (2010), because the openLCA databases did not contain such specific information. Pathak et al. (2010) provided more detailed information on the carbon footprint of Indian meals, taking both vegetarian and non-vegetarian diets into account. The carbon footprint of liquefied petroleum gas (LPG) that is used as a cooking fuel at the NGO was assumed to emit 134 kg of CO_2-eq per GJ (Jungbluth, Kollar & Koß, 1997) whilst 1 ton of LPG equals 49.6 GJ (UC Berkeley, 2019).

Data for all direct flights from the five countries from which the organisation received the most volunteers (Australia, Canada, Japan, the United Kingdom and the United States) to Delhi Indira Gandhi International Airport (DEL) were considered in this study. Because no detailed information was available from the volunteer's exact ports of departure, the largest airports of the five origin countries were chosen for the study. For Australia, this was Kingsford Smith International Airport in Sydney (SYD); for Japan, it was Narita International Airport in Tokyo (NRT); and for the UK, it was London Heathrow Airport (LHR). For the United States and Canada, the two major east and west coast airports were selected. In the United States, these were John F. Kennedy International Airport in New York (JFK) and San Francisco International Airport (SFO). For Canada, these were Pearson International Airport in Toronto (YYZ) and Vancouver International Airport (YVR). As all volunteers continued their onward journey from Delhi to Dharamshala area by airplane, all direct flights from Delhi to Gaggal Airport in Dharamshala (DHM) were added to the study.

The CO_2-eq emissions per passenger for a round trip from the seven origin airports to Gaggal Airport in Dharamshala were calculated based on the following formula:

$$CO_2 - eq\ (kg)/p = \left(\frac{total\ fuel\ (kg)}{pax\ to\ freight\ factor} \times 3.169\right) + \left(28 \times \frac{total\ fuel\ (MJ)}{pax\ to\ freight\ factor} \times 0.0000005\right) + \left(265 \times \frac{total\ fuel\ (MJ)}{pax\ to\ freight\ factor} \times 0.000002\right) \div (total\ seats\ \times pax\ load\ factor)$$

All direct flights from the seven origins to Delhi, the flight numbers, distance and aircraft type were obtained from FlightStats (2019). The fuel data were extracted from the Euorpean Environmental Agency Air Pollutant Emissions Inventory Guidebook (EEA, 2016) based on the aircraft type and flight distance. CO_2 emissions were calculated by multiplying the fuel burned by 3.169, which represents the kilograms of CO_2 produced when burning 1 kg of aviation fuel (VTT, 2017). For calculating the CH_4 and N_2O emissions, respectively, 0.0005 and 0.002 g/MJ were assumed, whilst the heat value of the fuel in MJ was determined with 43 MJ/kg of fuel based on Technical Research Center of Finland (VTT, 2017). In order to allocate the fuel burned for transporting passengers, a region-specific passenger-to-freight factor based on International Civil Aviation Organization's (ICAO) Carbon Emissions Calculator Methodology, Version 10 (2017) was multiplied with the fuel. Following Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report, we estimated the global warming potential for 100 years (GWP_{100}) by multiplying CH_4 by a factor of 28 and N_2O by a factor of 265 (IPCC, 2014). Finally, in order to calculate the CO_2-eq emissions per passenger, the total emissions per flight were divided by the total amount of seats provided on the flight, extracted from FlightGuru (2019) and multiplied by the load factor that was region-specific, estimated by ICAO (2017). On those routes where more than one direct flight option was available (LHR-DEL, NRT-DEL and DEL-DHM), the emissions for all flights were calculated separately and then the average CO_2-eq emissions for these routes were determined.

6 Results

The annual CO_2-eq emissions in kilograms per volunteer during their stay are presented in Table 1. The emission categories 'Food products (other)', 'Beverages (other)', 'Tobacco products' and 'Electronics' include emissions from product transportation, which partly explains their higher contribution to the overall carbon footprint. The transportation emissions for the other product groups were not known.

Table 1: CO_2-eq emissions in kg per volunteer's stay per annum

Emission Category	CO2-eq (kg)/year	Share from total (%)
Transportation	44.05	3.19
Electricity (hydro)	14.89	1.08
Cooking fuel (LPG)	14.48	1.05
Rice	17.36	1.26
Potatoes	0.74	0.05
Tomatoes	0.39	0.03
Pulses (lentils)	1.61	0.12
Poultry meat	0.74	0.05
Mutton	18.76	1.35
Eggs	1.56	0.11
Milk	5.95	0.43
Onion	2.06	0.15
Wheat	4.81	0.35
Sugar	1.72	0.12
Oil	0.69	0.05
Salt	0.13	0.01
Tissue paper (toilet)	1.55	0.11
Food products (others)	626.12	45.32
Beverages (others)	476.86	34.51
Tobacco products	91.45	6.62
Electronics	55.78	4.04
Total	1,381.61	100.00

Table 2 provides a more detailed look into the emissions of certain product categories, revealing the separate emissions of production and transportation.

Although the results in Table 1 and 2 only present CO_2-eq emissions figures for an average volunteer in the studied organisation, Table 3 presents the results of the CO_2-eq calculations for round-trip flights by the different nationalities arriving from seven origins to Gaggal Airport in Dharamshala.

According to Otoo et al. (2016), a voluntourist's duration of stay can vary from a few days up to more than a year, and to date, the literature has established no clear consensus for the typical length of stay. On the basis of the information provided by the studied organisation, volunteers typically stayed from 2 to 5 weeks with some staying for longer periods such as 10 weeks or even longer. In order to compare the carbon footprint of the entire stay with that of the emissions produced by the flight alone, we have calculated those for the length of 2 weeks, 5 weeks, 10 weeks and, in addition, 1 year. The share of the flight round trip of the entire emissions is presented in Table 4:

According to the Emissions Database for Global Atmospheric Research (European Commission, 2017), the CO_2-eq emissions per capita for the departure countries of volunteers were 26,360 kg for Australia, 20,560 kg for Canada, 10,660 kg for Japan, 8,720 kg for the United Kingdom and 19,560 kg for the United States. To better understand the overall impact of voluntourism in relation to a volunteer's emissions in their home country, the emissions a volunteer would have produced in their home country was compared with the time a voluntourist spent in India. The results of this comparison are presented in Table 5.

7 Discussion

Although, scope 1 emissions were amongst the highest because of the carbon-intensive flights, the results also showed that scope 3 emissions can be significant, especially when the transport-related emissions are taken into account as shown in Table 2. Scope 2 emissions were rather marginal in this study. The average flight emissions per voluntourist (1349.36 kg CO_2-eq) for a round trip to India is at a similar level to the average emissions for a voluntourist's stay for an entire year (1381.61 kg CO_2-eq). When comparing the average share of the flight emissions with the total emissions depending on the length of the

Table 2: CO_2-eq emissions in kg for producing and transporting goods

Emission Category	Production Emissions	Transportation Emissions	Total
Food products (others)	1.75	624.37	626.12
Beverages (others)	0.31	476.55	476.86
Tobacco products	9.80	81.65	91.45
Electronics	38.89	16.89	55.78
Total	50.75	1,199.47	1,250.22

Table 3: CO_2-eq emissions in kg for volunteer's round trips

Country	Route	Flights	CO2-eq (kg)/p
Australia	SYD-DEL-DHM	AI 301	1,523.94
Canada East	YYZ-DEL-DHM	AC 42	1,204.65
Canada West	YVR-DEL-DHM	AC 44	1,152.52
Japan	NRT-DEL-DHM	JL 749/NH 827	1,201.22
United Kingdom	LHR-DEL-DHM	AI 162/BA 257/	968.94
		VS 300/9W 121	
USA East	JFK-DEL-DHM	AI 102	1,544.21
USA West	SFO-DEL-DHM	AI 174	1,849.99
Average			1,349.35

Table 4: Flights share of voluntourist's carbon footprint depending on stay

Country	2 weeks	5 weeks	10 weeks	1 year
Australia	96.64%	92.00%	85.19%	52.45%
Canada East	95.79%	90.09%	81.97%	46.58%
Canada West	95.60%	89.69%	81.31%	45.48%
Japan	95.77%	90.07%	81.93%	46.51%
United Kingdom	94.81%	87.97%	78.53%	41.22%
USA East	96.68%	92.10%	85.35%	52.78%
USA West	97.22%	93.32%	87.47%	57.25%
Average	96.07%	90.75%	83.11%	48.89%

stay (Table 4), the share ranges from 48.89% for a 1-year stay up to 96.07% for a 2-week stay. When comparing the carbon footprint of voluntourist's share of the flight emissions with those of conventional tourists, the share of voluntourists is significantly higher. This finding is especially surprising, given the fact that voluntourists usually stay longer at the destination than conventional tourists (Otoo, 2014; Sin, 2009). Sharp, Grundius and Heinonen, (2016), for example, found that the share of flight-related emissions for a 6–10 night stay in Iceland ranges between 50% and 82%, depending on the distance flown. Dwyer et al. (2010) also found that only 57% of the total carbon footprint of conventional tourists stems from aviation. Gössling and Peeters (2007) and Peeters and Schouten (2006) came up with similar results, indicating that the flight-related shares of conventional tourist's carbon footprint is between 60% and 95% of the total carbon footprint.

The results indicated that whilst the flight's share is a major part of a voluntourist's carbon footprint, it significantly decreases with the increase in length of stay. The lower share of the carbon footprint of voluntourists during their stay is most likely explained by the fact that voluntourists show similar consumption habits than locals in terms of housing, eating and local transport. In contrast to that, conventional tourists stay in hotels, dine out and use more transportation for sightseeing and recreation. According to the European Commission (2017), the average CO_2-eq emission of an Indian citizen is 2,500 kg. This is in the line with our results, given the fact that the carbon footprint for the stay of voluntourists contains only the daily consumption of food, electricity, heating and local transportation but does not include consumption of clothing, housing, other transportations or tourism.

When comparing the total emissions of a voluntourist's stay and the flight emissions with the average CO_2-eq emissions of an average citizen staying in his or her origin

Table 5: CO_2-eq emissions in kg for staying at home versus going to India

Country	2 weeks	5 weeks	10 weeks	1 year
Australia				
Stay at home	1,013.85	2,534.62	5,069.23	26,360.00
Go to India	1,620.10	1,764.33	2,004.71	2,903.94
Canada East				
Stay at home	790.77	1,976.92	3,953.85	20,560.00
Go to India	1,300.81	1,445.04	1,685.42	2,584.65
Canada West				
Stay at home	790.77	1,976.92	3,953.85	20,560.00
Go to India	1,248.68	1,392.91	1,633.29	2,532.52
Japan				
Stay at home	410.00	1,025.00	2,050.00	10,660.00
Go to India	1,297.38	1,441.61	1,681.99	2,581.22
United Kingdom				
Stay at home	335.38	838.46	1,676.92	8,720.00
Go to India	1,065.10	1,209.33	1,449.71	2,348.94
USA East				
Stay at home	752.31	1,880.77	3,761.54	19,560.00
Go to India	1,640.37	1,784.60	2,024.99	2,924.22
USA West				
Stay at home	752.31	1,880.77	3,761.54	19,560.00
Go to India	1,946.15	2,090.38	2,330.77	3,230.00

country instead (see Table 5), the results again showed that longer stays in the volunteering country are recommended. Depending on the average CO_2-eq emissions of the country of origin and the flight distance to India, avoiding a volunteering period of 2 weeks would have resulted in lower CO_2-eq emissions. For Japanese voluntourists as well as volunteers from the United Kingdom and the West Coast of the United States, a 5-week stay in India would have been more carbon intensive than staying home. Only for stays of more than 10 weeks, the emissions for volunteering in India would be lower than staying at home.

The existing literature also recommends a longer stay in target countries, not because of the large flight-related carbon footprint, as this study found, but also because of the greater impact the volunteering has on site and for the voluntourists themselves. Alexander (2012), for example, identified more potential benefits from volunteers staying 5 to 12 weeks, whereas Laythorpe (2009) detected an increased cultural immersion in the local community for volunteers staying longer than 6 months. Otoo et al. (2016) also found that shorter stays require more resources from the volunteering organisation because of the increased need for supervision. Finally, Birdwell (2011) found that longer stays provide volunteers with a greater learning experience and better career opportunities after the stay.

Finally, the results also showed that the role of transportation emissions in the life cycle emissions of different products is significant. The product categories that include transportation emissions (Table 2) represent a share of 90.50% from the total emissions (excluding flights). The average share of transportation emissions from the total emissions (production + transportation) in the studied categories is approximately 80%. This would indicate that the carbon footprint of other product categories, where transportation emissions are unknown, could rise substantially. Dwyer et al. (2010) included emissions from transport of imports (expenditure-based approach); they only accounted for 2.60% of the total direct and indirect GHG emissions in the Australian context. Similarly, Jones and Munday (2007) found, in the context of tourism consumption in Wales, that distribution and retail contributed to 4% of total emissions. Even though our study is different in both scope and methods, the conflict between these studies suggests that more research needs to be conducted to understand the role of transportation in the complete life cycle emissions of voluntourism and tourism.

8 Conclusion

The discussion on voluntourism in the existing literature has centred around its positive impacts on the health and education of communities and the local environment in developing countries. Yet little attention has been given to its climate impacts. This study set out to investigate the climate impacts of voluntourists by studying their carbon footprint. Voluntourists' carbon footprints were found to be rather extensive because of the carbon-intensive flight to reach the destination. At the destination, however, the carbon footprint was significantly lower than that of conventional tourists and more comparable with those of the local population. Therefore, in order to better justify the carbon-intensive flight, voluntourists should stay longer at the destination. Depending on the departure country and flight distance, short stays of less than 5 weeks should be avoided because they produce more carbon emissions than staying back home. At the same time, longer stays also have an increased impact on local communities, as previous studies have shown. On the basis of our findings, it would be recommended that voluntourists avoid short stays or alternatively search for less faraway destinations and try to reach those destinations with other modes of transportation that are less carbon intensive than flying. Our research also showed the importance of applying wide system boundaries when studying the carbon footprint, especially in the field of tourism. In addition, the inclusion of emissions related to the transportation of goods should be considered because it can have a significant impact on the total product-related scope 3 emissions.

In terms of limitations, the results of this study are only based on India as one possible voluntourist destination. In addition, the volunteers studied had all arrived from faraway countries that required extensive air travel, which resulted in a high share of flight-related CO_2-eq emissions. Although this study also took into account emissions related to the transportation of goods, the emissions for all the product categories were not available. Further studies could examine the carbon footprint of volunteering destinations other than India, particularly those that require less carbon-intensive transportation to reach. The possibility for voluntourism in the volunteer's own home country could also be further explored. In addition to the above considerations, the role of transporting goods in carbon footprint analysis should be recognised more because transportation adds a significant share to the overall carbon footprint.

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