Emissions from UBC Air Travel

Noni Nabors

University of British Columbia

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GEOG 447
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Special Thanks to:
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Executive Summary

Reducing greenhouse gas (GHG) emissions is increasingly recognized as a necessary step towards mitigating climate change (United Nations Framework Convention on Climate Change, 2016). The University of British Columbia (UBC) has pledged to reduce GHG emissions by 67% by 2020 compared to 2007 levels (UBC CAP 2010). Currently UBC is lacking a program to mitigate emissions from air travel. Air travel produces 2% of global emissions, but this number is expected to increase (Edwards et al., 2016).

The goal of this project was to quantify air travel emissions from five UBC Vancouver Departments (Geography, Psychology, Theatre & Film, Chan Centre for the Performing Arts and the Institute for Resources, Environment, and Sustainability). A carbon calculator was created, and air travel information from an 18-month period was analyzed.

In total, 709 trips were made with total emissions of 1070.25 tCO2e. For reference, emissions from the Geography building are estimated to be 4.5-6 tCO_2e for the same period (Jamee DeSimone, personal communication, Nov 2016). Many of these trips were indirect (i.e. with layovers). Had the trips been direct, emissions would have been 981.93 tCO2e. The primary trip purpose was to attend a conference (412), followed by travel done by non-UBC travellers (144), for example a guest lecturer at UBC. Most trips (609) were economy class. Average trip emissions were 1.51 tCO2e, though this varies between departments. IRES reported the highest average trip emissions with 2.02 tCO2e, while Psychology reported average trip emissions of 1.29 tCO2e.

It is recommended that economy class tickets be purchased for all UBC trips, and that direct flights be purchased whenever available. This will ensure that individual trip emissions are kept to a strict minimum. Furthermore it is recommended that trips be consolidated into fewer multi-purpose trips. Lastly the nature of non-UBC travellers work at UBC should be investigated, as they account for one fifth of total emissions.

Background and Objectives

Anthropogenic climate change is a well-documented and well-researched global concern. The burning of fossil fuels, from the Industrial Revolution to present time, releases greenhouse gases into the atmosphere, resulting in warmer temperatures worldwide. Greenhouse gases (GHG) concentrations are presently higher than at any other point in human history (Intergovernmental Panel on Climate Change, 2014). As per the Paris Agreement, Canada is committed to limiting global temperatures to "well below 2 °C above pre-industrial level" (United Nations Framework Convention on Climate Change, 2016). This ambitious target requires bold actions to limit the amount of GHGs emitted each year. Though the particular atmospheric effects of air travel, such as releasing GHGs directly into the upper atmosphere, are not fully understood, the increase in air travel and subsequent release of GHGs are alarming. Emissions from air travel account for 2% of global emissions, and are expected to rise (Edwards et al., 2016).

As part of the ongoing Climate Action Plan, the University of British Columbia has pledged to reduce GHG emissions by 67% by 2020 compared to 2007 levels (UBC CAP 2010). Areas of focus include updating existing buildings, investing in green infrastructure, including LEED certified building, and fostering behavior change on and off campus. UBC pays a carbon tax of $25 per ton of carbon-dioxide equivalents to the Provincial Government to offset its Scope 1 and Scope 2 emissions (Carbon Neutral Action Report, 2015). Air travel emissions are qualified as Scope 3 and fall outside the offsets mandated by the Province (UBC CAP, 2010).

UBC does not have a consolidated program to calculate, mitigate or offset emissions from university-related travel (UBC CAP, 2010), which is integral to academic collaboration and administrative operations. Flights made through the UBC travel agent, North South, are used to estimate GHG-equivalents but this booking system is estimated to account for less than half of all travel done by UBC faculty and staff.

As part of UBC's ongoing commitment to reducing emissions this project aims to

quantify emissions from five UBC Vancouver Departments: Geography, Psychology, Theatre & Film, Chan Centre for the Performing Arts and the Institute for Resources, Environment, and Sustainability. It aims to provide a sample audit of UBC air travel emissions, to better understand travel patterns and motivations, and to suggest possible emissions mitigation options.

Methodology

The Department of Geography, the Department of Psychology, the Department of Theatre and Film, the Institute for Resources, Environment, and Sustainability (IRES), and the Chan Centre for the Performing Arts provided travel requisition forms from January 2015 - June 2016 for analysis. Relevant flight information was recorded on a carbon calculator created on Excel (table 1). Entering the airport codes of the departure city, the destination city, and the ticket class of the flight produced the associated emissions of that flights. This process was repeated for the total number of flights composing a trip (i.e. minimum two flights for a roundtrip flight).

Recorded Information	
Date on Requisition Form	Requisition Number
Origin Airport Code	Destination Airport Code
Name (later anonymized)	Cost of trip
Ticket Class	Length of trip (nights)
Purpose (primary and secondary)	Additional flight information (e.g. multiple segments)

Table 1. Information recorded from departmental requisition forms

The equations used to calculate air travel emissions derive from the UK Department of Business Energy and Industrial Strategy and Department for Environment, Food and Rural Affairs (DEFRA) conversion factors (2016). The DEFRA conversion factors were chosen because of their prevalence in global emissions accounting. DEFRA includes the effects of radiative forcing in their factors. The conversion factors produce an estimate of an individual passenger's share of total flight emissions.

Two characteristics of an individual trip are used to estimate the associated emissions: ticket class (economy, economy plus, business and first class) and distance of flight (short haul [<463 km], medium haul [463 km<x<3700 km], and long haul [>3700 km])(table 2). First the distance between the departure city and the destination city is calculated using the great circle distance between the two, which is the shortest distance between two points on a sphere. The distance is then increased by 8% to reflect the delays of real-time aviation, such as weather problems and holding patterns. Finally a conversion factor based on the ticket class and the distance of flight is applied to calculate the total kilograms of carbon dioxide equivalents (Kg CO_2e) emitted. Final emissions are expressed in tons of carbon dioxide equivalent (tCO_2e).

	Long Haul	Medium Haul	Short Haul
Economy Class	0.14678 *Kg CO_2e*	0.16508 *Kg CO_2e*	0.27867 *Kg CO_2e*
Economy Plus	0.23484 *Kg CO_2e*	0.24761 *Kg CO_2e*	
Business Class	0.42565 *Kg CO_2e*		
First Class	0.58711 *Kg CO_2e*		

Table 2. Emissions (Kg CO_2e) per passenger km, based on ticket class and flight distance (DEFRA)

Economy class tickets account for less of the plane's total emissions than business class tickets, because they take up less of the total area on the plane. Thus an economy class ticket from Vancouver to San Francisco accounts for less CO_2e than a first class ticket on the same flight. Interestingly short haul flights produce more emissions per passenger kilometre flown than long haul flights when economy class tickets are purchased. In this way an economy class ticket from Vancouver to Seattle produces more emissions per passenger kilometre than an economy class ticket from Vancouver to London.

Trips were coded by purpose: conference (CF), field work/research (FL), lecture/ business at another university (LT), university business (UB), other/unknown (OT), and non-UBC travelers (N). This final category included conferences hosted by UBC and non-UBC speakers invited to UBC Vancouver. When stated a secondary trip purpose was coded. An additional category was added as a secondary trip purpose: personal (P).

Trip emissions were divided into two categories: direct trip emissions and

indirect trip emissions. Direct trips do not have layovers, and by definition a direct round trip includes two flight segments. Indirect flights have layovers or multiple destinations. An indirect round trip could theoretically include infinite flight segments, though in this data set the maximum number of flight segments for an indirect trip was six. In order to compare the emissions of direct and indirect trips, indirect trips' emissions were calculated a second time as if they had been direct flights by calculating the emissions between the city of departure and the destination city. This was done to make possible emissions comparisons between direct trips and indirect trips.

Select assumptions were made to make the data workable:

- Trips were assumed to be round trip
- When not otherwise indicated, a flight back to the departure city was assumed to be the same as the flight to the destination city
- Trips without a stated ticket class were coded as economy-class tickets
- Flights were assumed to be at seating capacity
- The costs of trips purchased in foreign currency were converted into CAD based on the exchange rate of the date of the requisition form

Results

Overall Findings

The Department of Psychology accounted for 322 trips, the Department of Geography for 276 trips, IRES for 63 trips, the Department of Theatre and Film for 35 trips and the Chan Centre for 13 trips, for a total of 709 trips between January 2015 and June 2016 (table 3). The departments' data were analyzed separately, and then combined for an aggregate assessment. In total the five departments emitted 1070.25 tCO_2e from air travel over the 18-month period, with average trip emissions of 1.51 tCO_2e (table 3).

	GEOG	**PSYCH**	**IRES**	**T&F**	**Chan**	**TOTAL**
Trips	276	322	63	35	13	709
Total Emissions (tCO_2e)	453.97	415.24	127.56	56.97	16.50	1070.25
Direct Trip Emissions (tCO_2e)	428.95	379.19	108.86	49.84	15.08	981.93
Indirect to Direct Reduction in Emissions	5.51%	8.68%	14.66%	12.51%	8.6%	8.25%
Total Cost of Trips	$317 245	$237 281	$63 970	$30 280	$8 536	$657 312
Average Trip Cost	$1149.44	$736.90	$1015.40	$865.14	$517.32	$927.10
Average Trip Emissions (tCO2e)	1.64	1.29	2.02	1.63	1.27	1.51
Faculty/Staff Members	29	54	12	18	20	-
Emissions per Faculty or Staff Member (tCO2e)	22.70	7.69	10.63	3.16	1.27	-

Table 3. Comparison of emissions and costs data across all departments

Direct and Indirect Trips

Total emissions from the five departments were 1070.25 tCO_2e. Had all the trips been direct, that is to say without layovers or multiple destinations, the total emissions would have been 981.93 tCO_2e, a reduction of 88.32 tCO_2e (table 3).

Trip Length

Of the 709 trips, 538 were under seven nights (Fig. 1a). Of this sub-category, 134 trips were three nights and 123 were four nights (Fig. 1b).

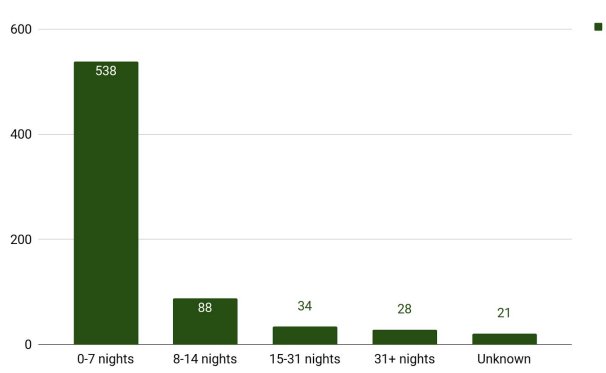


Figure 1a. Length of Trips (All Departments)

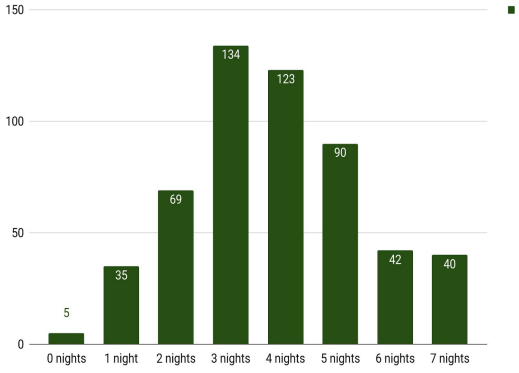


Figure 1b. Trips Under Seven Nights (All Departments)

Trip Purpose

The primary trip purpose was to attend a conference, followed by non-UBC travellers and doing field work (Fig. 2a). University business was listed as the primary purpose for a single trip. Only 67 of the 709 trips had secondary purposes, the most popular being to attend a conference followed by fieldwork (Fig. 2b).

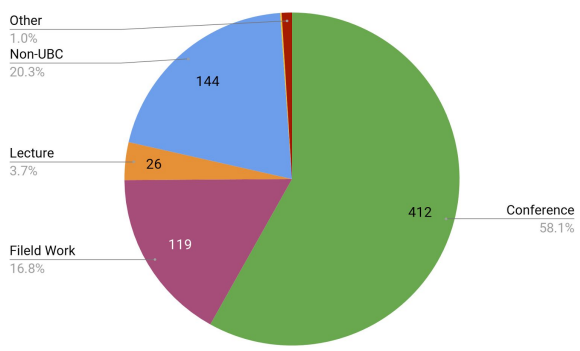


Figure 2a. Primary Purpose of Travel (All Departments)

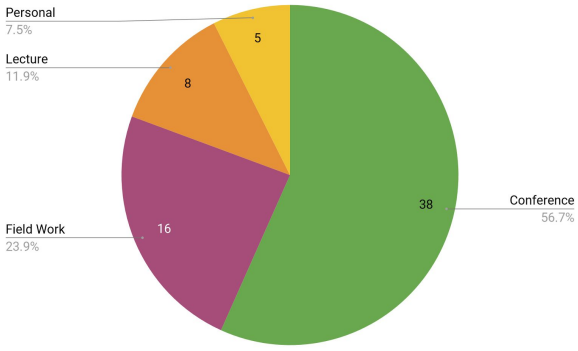


Figure 2b. Secondary Purpose of Travel (All Departments)

Ticket class

The vast majority of trips were economy class (Fig. 3). However this includes a number of trips assumed to be economy due to missing trip information.

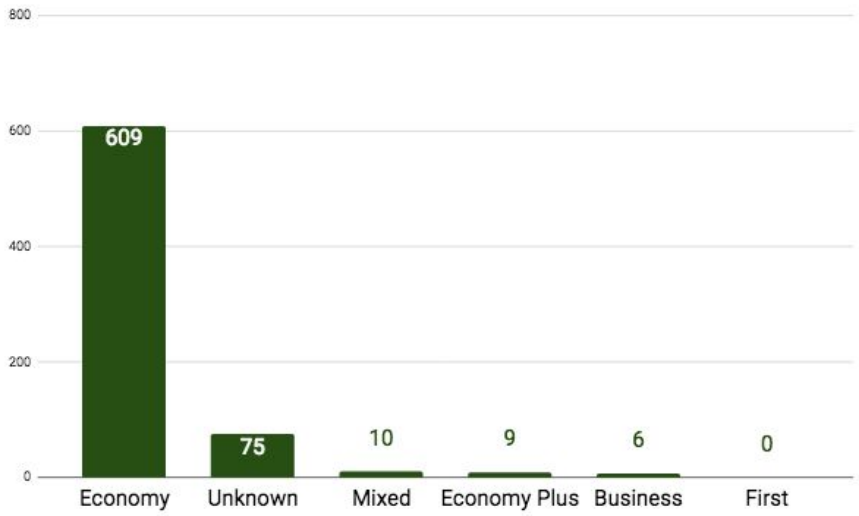


Figure 3. Trip Ticket Class (All Departments)

Emissions and cost

When plotted against each other, the Significance of F value between trip cost and trip emissions is extremely low (1.6E067) revealing that trip cost and trip emissions are significantly related (figure 4). However the R-square value is low, 0.35, indicating the variance in trip cost only explains 35% of the variance in trip emissions, and that there is a not a linear relationship. Trip cost is thus not a strong predictor of emissions.

Overall there is a significant relationship between trip cost and trip emissions at each department. However the R-square value varies between departments (e.g. 0.86 for the Chan Centre, 0.24 for Geography). Trip cost is not a constant predictor of trip emissions. There are other factors influencing trip emissions and creating noise in the models. For instance, trip destinations and flying behaviours vary depending on the type of work performed by the department.

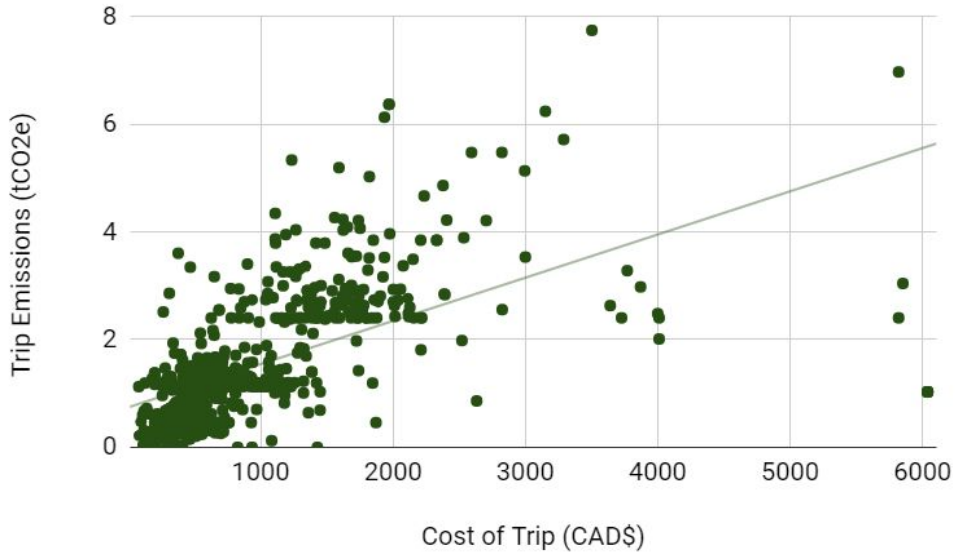


Figure 4. Trip Cost and Trip Emissions (All Departments) with R-Square of 0.35 and Significance of F of 1.6E-067)

Emissions and distance

The vast majority of trips were long haul, with average emissions of 1.66 tCO_2e (table 4). There were only 10 short-haul trips made, with an average of 0.27 tCO_2e.

	Number of trips	Average Emissions per trip (tCO_2e)	Standard Deviation
Short-haul trips (<463 km)	10	0.27	0.40
Medium-haul trips (463<X<3700 km)	120	0.92	0.94
Long haul trips (>3700 km)	698	1.66	1.19

Table 4. Average emissions of trips based on trip distance

Department of Geography

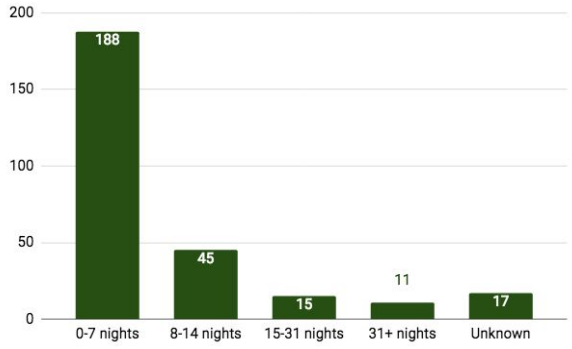
The Department of Geography had 276 trips with emissions of 453.97 tCO_2e

Direct and Indirect Trips

Total emissions from Geography were 453. 97 tCO_2e. Had all Geography trips been direct trips emissions would have been 428.97 tCO_2e, a reduction of 25.02 tCO_2e. However only 74 of the 276 requisition forms contained sufficient flight information to perform this analysis (87 trips were already direct, while 115 lacked flight information).

Trip Length

Of the 276 trips, 188 were under seven days (Fig. 5a). Of those trips 36 were three days, 33 were four days and 31 were two days (Fig. 5b). The Department of Geography was the first department to be audited. Initially trip length was recorded as days rather than nights, thus the shortest trip in Geography was listed as 1 night.



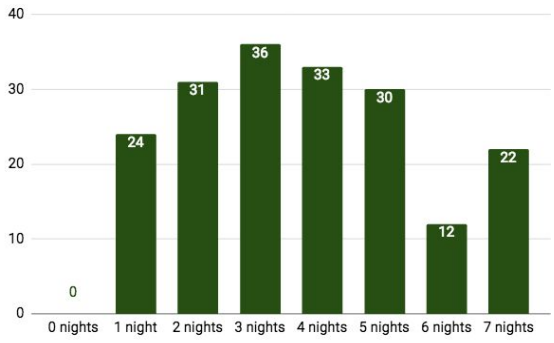


Figure 5a. Length of Trips (Geography)

Figure 5b. Trips Under Seven Nights (Geography)

Trip Purpose

The primary trip purpose was to attend a conference, followed by work done by non-UBC travellers and doing field work (Fig. 6a). Only 26 trips had a secondary purpose. Attending a conference was the most popular secondary purposes (Fig. 6b).

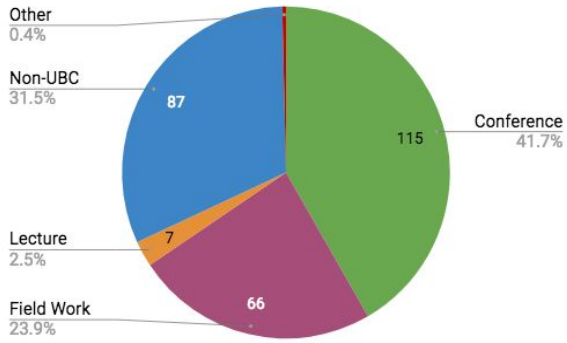


Figure 6a. Primary Purpose of Trips (Geography)

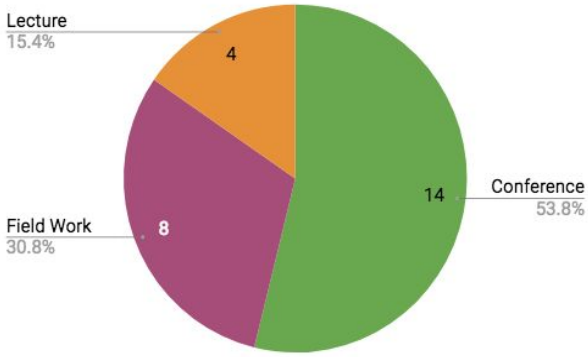


Figure 6b. Secondary Purpose of Trips (Geography)

Ticket Class

The majority of trips were economy-class or assumed to be economy (Fig. 7). There were five economy-plus trips made and two business class trips.

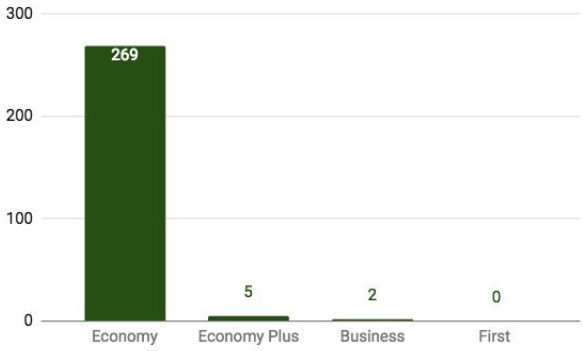


Figure 7. Trip Ticket Class (Geography)

Emissions and Cost

When analyzing trip emissions and cost, the Significance of F is very low (8.21E-18) indicating a significant relationship between trip cost and trip emissions (Fig. 8). However the R-squared value for Geography is only 0.24, indicating that variance in trip cost explains 24% of the variance in trip emissions. Thus cost is not an adequate predictor of emissions for this department.

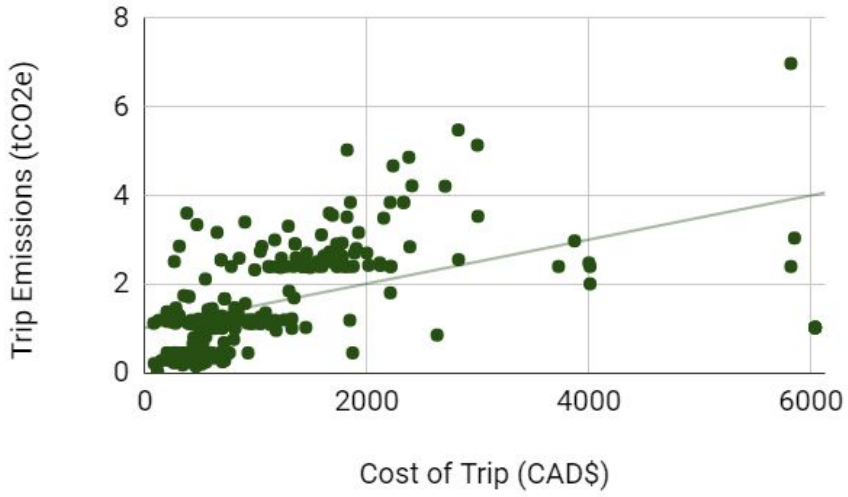


Figure 8. Trip Cost and Trip Emissions (Geography)
with R-Square of 0.24 and Significance of F of 8.21E-18)

Number of Travelers

There were 154 travelers in the Geography. Ten of these travelers were responsible for 147.6 tCO_2e, and accounted for 81 trips of the 276 trips.

Department of Psychology

The Department of Psychology had 322 trips with emissions of 415.24 tCO2e.

Direct and Indirect Trips

Total emissions from Psychology were 415.24 tCO_2e. Had all the trips been direct total emissions would have been 379.19 tCO_2e, a reduction of 36.05 tCO_2e.

Trip Length

Of the 322 trips, 280 were under seven nights (Fig. 9a). Of this sub-category, 83 trips were three nights and 73 were four nights (Fig. 9b).

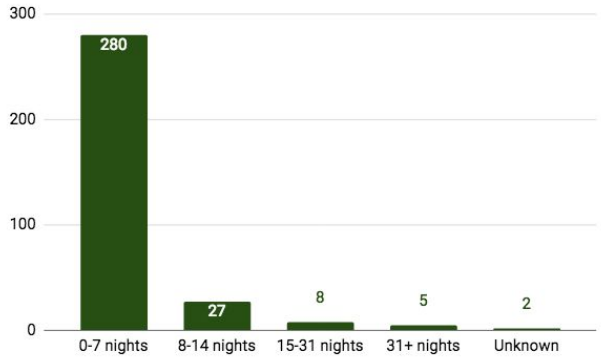


Figure 9a. Length of Trips (Psychology)

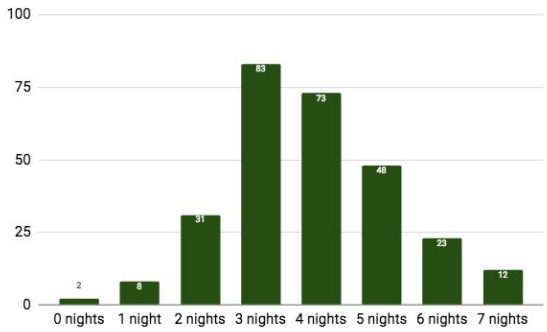


Figure 9b. Trips Under Seven Nights (Psychology)

Trip Purpose

The primary trip purpose was to attend a conference, followed by non-UBC travellers and field work (Fig. 10a). Only 26 of the 322 trips had secondary purposes, the most popular being to attend a conference, field work and personal reasons (Fig. 10b).

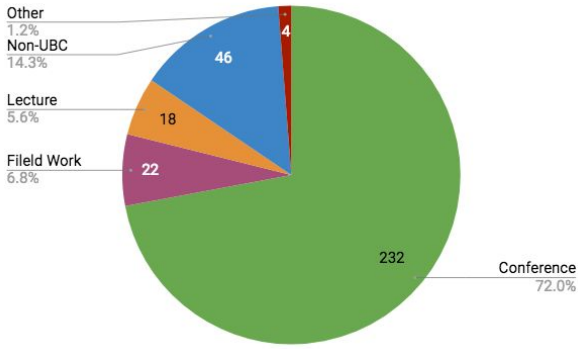


Figure 10a. Primary Purpose of Trips (Psychology)

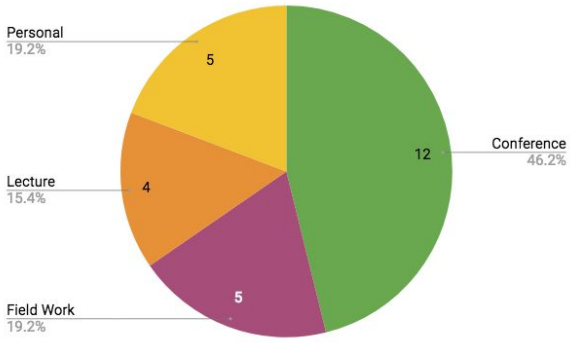


Figure 10b. Secondary Purpose of Trips (Psychology)

Ticket class

The majority of trips were economy class, though a large number of trips had unreported ticket classes (Fig. 11). Psychology reported high numbers of economy plus (four), business (four) and mixed-class tickets (10). The trips in this final category contained the following: six economy/economy plus trips, three economy/economy plus/business class trips, and one economy plus/first class trip. This last trip is the only

trip in any department to include a first class ticket.

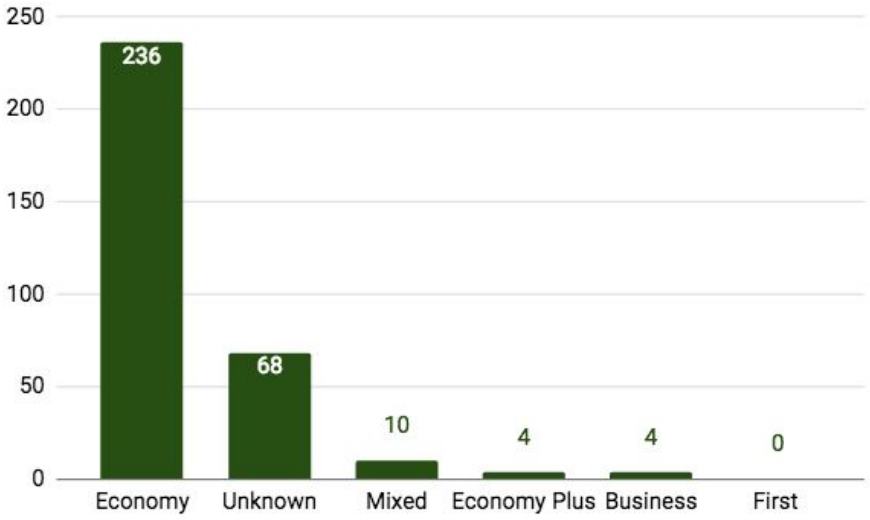


Figure 11. Trip Ticket Class (Psychology)

Emissions and Cost

When comparing trip cost and trip emissions the Significance of F value is close to zero (at 7.87E-62), indicating that trip cost and trip emissions are significantly related (Fig. 12). The R-square for Psychology is 0.58, indicating that trip cost explains about 58% of the variance in trip emissions. Once again trip cost is not a strong predictor of trip emissions.

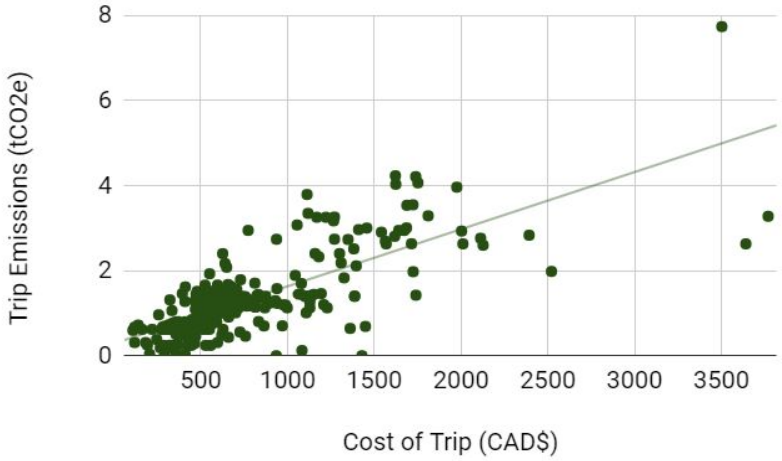


Figure 12. Trip Cost and Trip Emissions (Psychology) with R-Square of 0.58 and Significance of F of 7.87E-62

Number of Travelers

There were 188 travelers in Psychology. Of these, 12 were responsible for 108.46 tCO_2e of the total 415.24 tCO2e. One individual in Psychology, who was responsible for the only first class tickets in the data set, had emissions of 16.17 tCO_2e.

Institute for Resources, Environment and Sustainability

IRES had 63 trips with emissions of 127.56 tCO2e.

Direct and Indirect Trips

Total emissions from IRES were 127.56 tCO_2e. Had all the trips been direct total emissions would have been 108.86 tCO_2e, a reduction of 18.7 tCO_2e.

Trip Length

Of the 63 trips, 37 were under seven nights (Fig. 13a). Of this sub-category, eight trips were four nights and there were seven two-night and seven five-night trips (Fig. 13b)

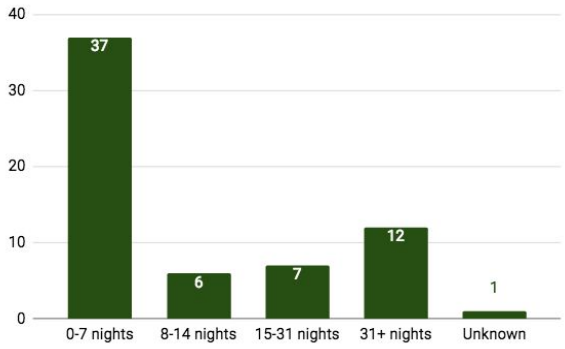


Figure 13a. Length of Trip (IRES)

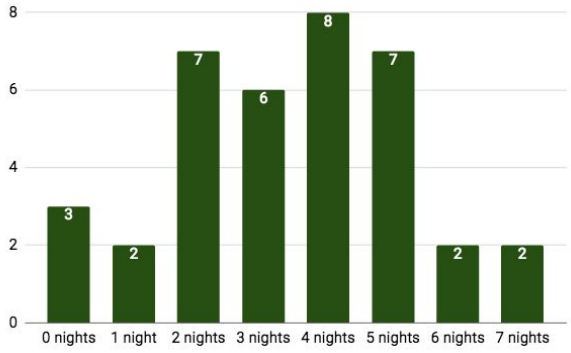
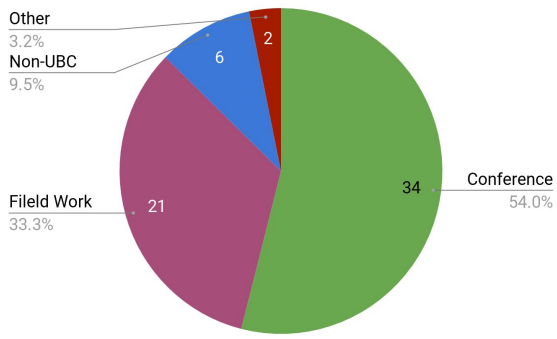


Figure 13b. Trips Under Seven Nights (IRES)

Trip Purpose

The primary trip purpose was to attend a conference, followed by fieldwork (Fig. 14a). Only 13 of the trips had secondary purposes, the most popular being to attend a conference followed by fieldwork (Fig. 14b).



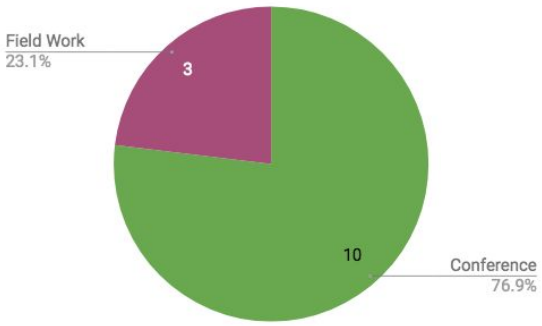


Figure 14a. Primary Purpose of Trips (IRES) *Figure 14b. Secondary Purpose of Trips (IRES)*

Ticket class

All trips made by IRES were economy-class, aside from five trips with unreported ticket classes (Fig. 15).

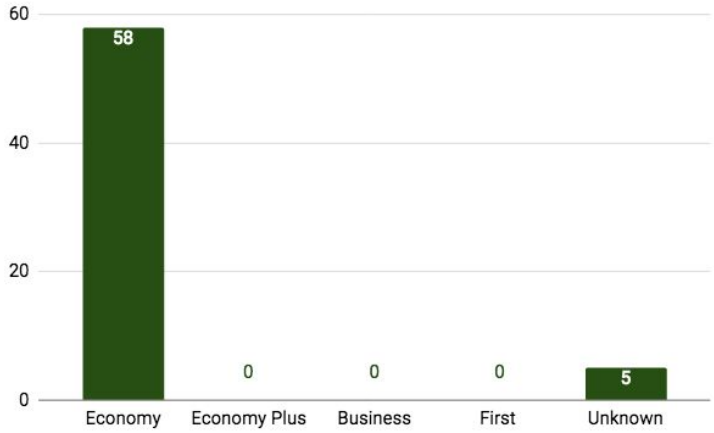


Figure 15. Trip Ticket Class (IRES)

Emissions and Cost

When plotted against each other, the Significance of F value for trip cost and trip emissions is 5.88E-18, once again indicating a significant relationship between trip cost and trip emissions (Fig. 16). The R-square value is 0.71, which is stronger than previous departments. There is less noise in the data than in previous departments. For IRES 71% of the variance in trip emissions is explained by variance in trip costs.

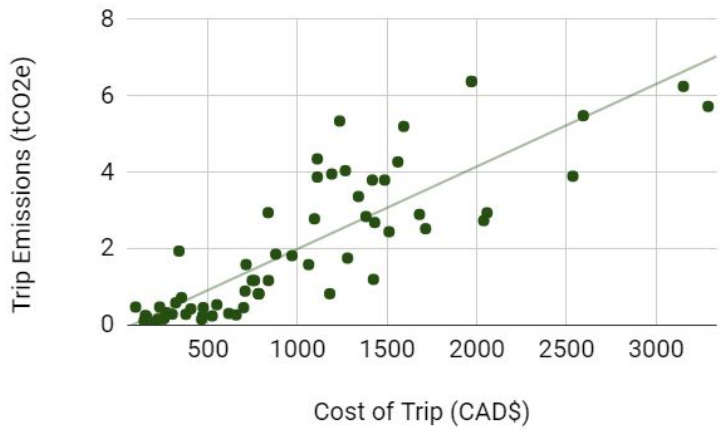


Figure 16. Trip Cost and Trip Emissions (IRES)
with R-Square of 0.71 and Significance of F of 5.88E-18

Number of Travelers

There were 28 travelers in IRES. Of these, six were responsible for 71.93 tCO_2e of the total 127.56 tCO2e.

Department of Theatre and Film

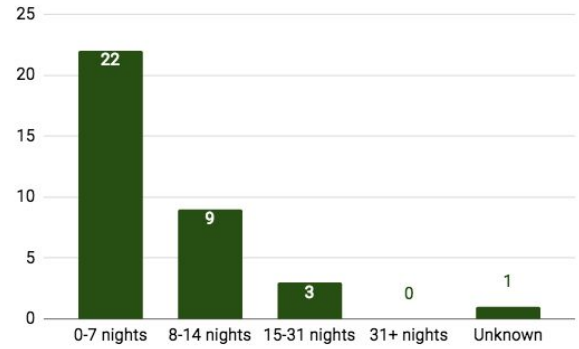
Theatre & Film had for 35 trips with emissions of 56.97 tCO_2e.

Direct and Indirect Trips

Total emissions from Theatre & Film were 56.97 tCO_2e. Had all the trips been direct total emissions would have been 49.84 tCO_2e, a reduction of 7.13 tCO_2e.

Trip Length

Of the 35 trips, 22 were under seven nights (Fig. 17a). Of this sub-category, seven trips were three nights and there were four four-night and four six-night trips (Fig. 17b).



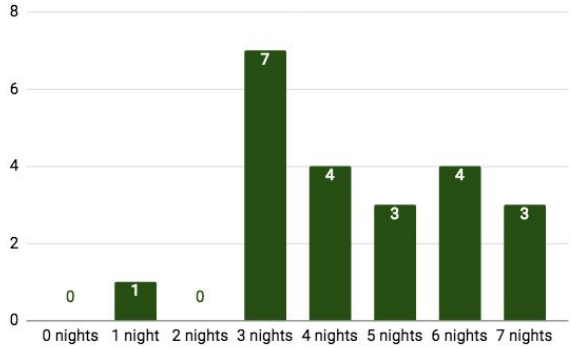
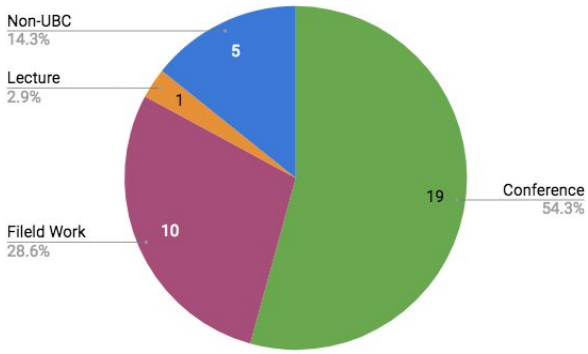


Figure 17a. Length of Trips (Theatre & Film) *Figure 17b. Trips Under Seven Nights (Theatre & Film)*

Trip Purpose

The primary trip purpose was to attend a conference, followed fieldwork (Fig. 18a). Only two of the 35 trips had secondary purposes, both being to attend a conference (Fig. 18b).



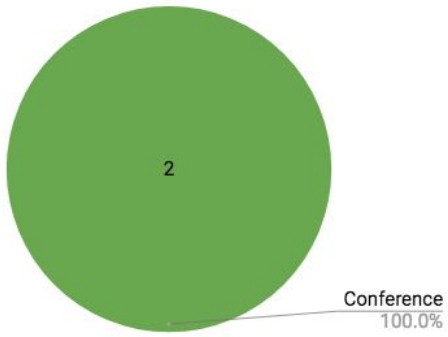


Figure 18a. Primary Purpose of Trips (Theatre & Film)

Figure 18b. Primary Purpose of Trips (Theatre & Film)

Ticket class

All trips made by Theatre & Film were economy-class, aside from one trip with an unreported ticket class (Fig. 19).

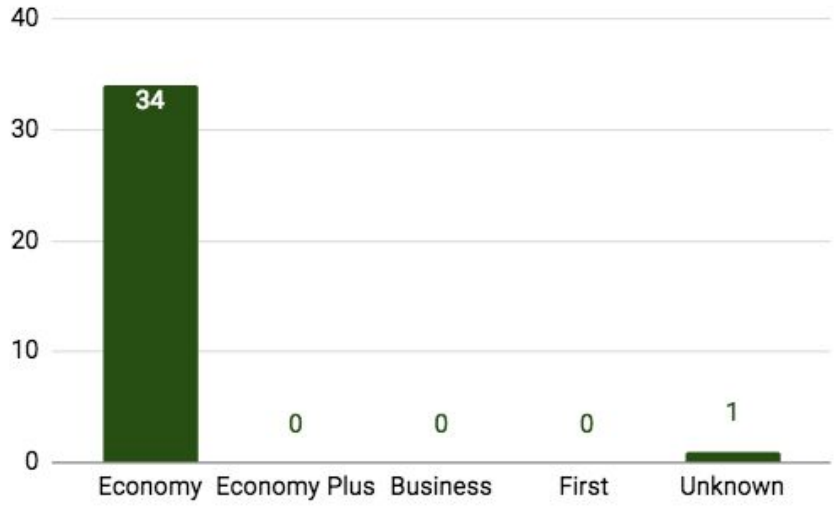


Figure 19. Trip Ticket Class (Theatre & Film)

Emissions and Cost

When comparing trip cost and trip emissions the Significance of F value for Theatre and Film is 9E-09, once again indicating a significant relationship between trip cost and trip emissions (Fig. 20). The R-square value is 0.65, indicating that 65% of variance in trip emissions can be explained by variance in trip costs.

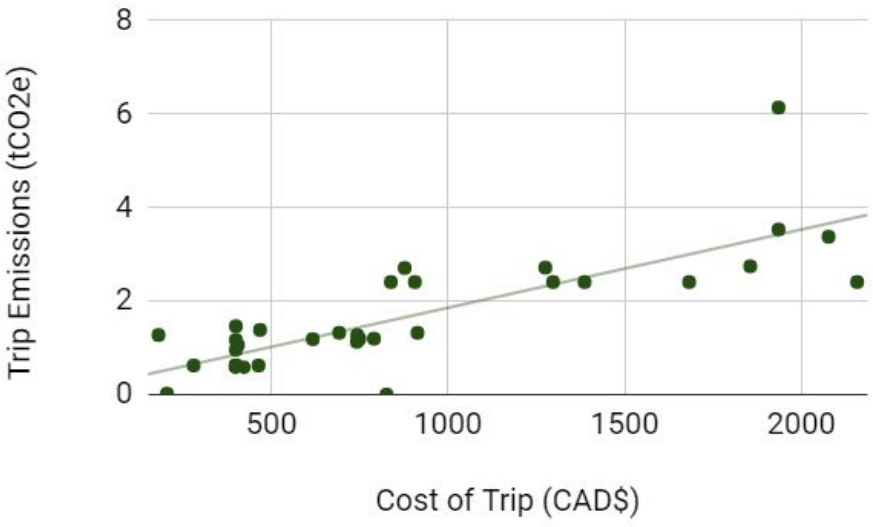


Figure 20. Trip Cost and Trip Emissions (Theatre & Film) with R-Square of 0.65 and Significance of F of 9E-09

Number of Travelers

There were 22 travelers in Theatre & Film. Of these, two were responsible for 28.04 tCO_2e of the total 56.97 tCO_2e, with a combined 13 trips.

Chan Centre for the Performing Arts

The Chan Centre had for 13 trips with emissions of 16.50 tCO_2e.

Direct and Indirect Trips

Total emissions from the Chan Centre were 16.50 tCO_2e. Had all the trips been direct total emissions would have been 15.08 tCO_2e, a reduction of 1.42 tCO_2e.

Trip Length

Of the 13 trips, 11 were under seven nights (Fig. 21a). Of this sub-category, five trips were four nights and there were two three-night and two five-night trips (Fig. 21b).

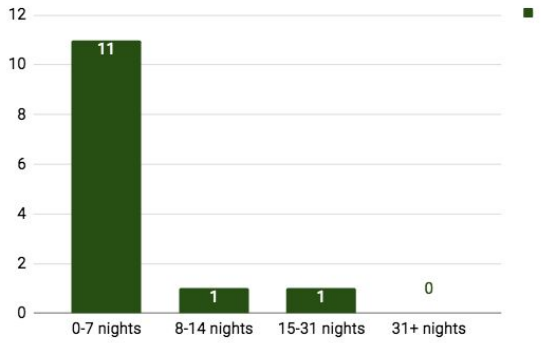


Figure 21a. Length of Trips (Chan Centre)

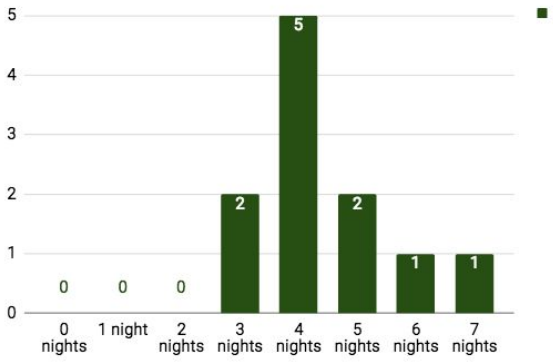


Figure 21b. Trips Under Seven Nights (Chan Centre)

Trip Purpose

The primary trip purpose was to attend a conference, followed by university/administrative business (Fig. 22). None of the trips had a secondary purpose.

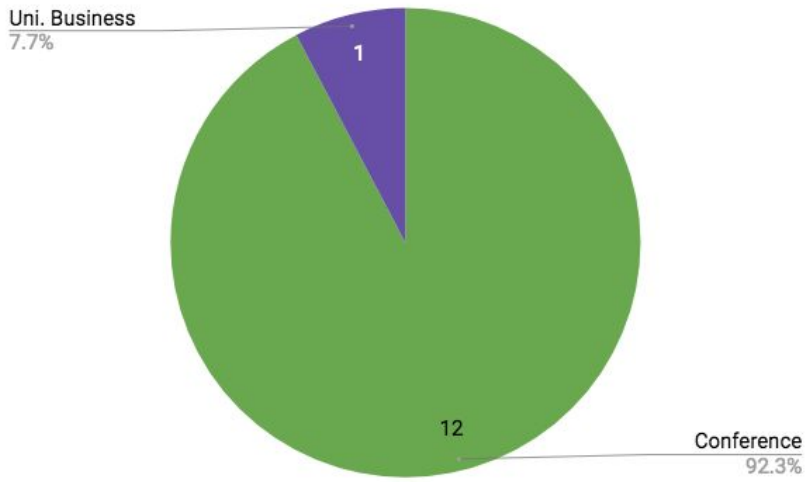


Figure 22. Primary Purpose of Trips (Chan Centre)

Ticket class

All trips made by the Chan Centre were economy-class, aside from one trip with an unreported ticket class (Fig. 23).

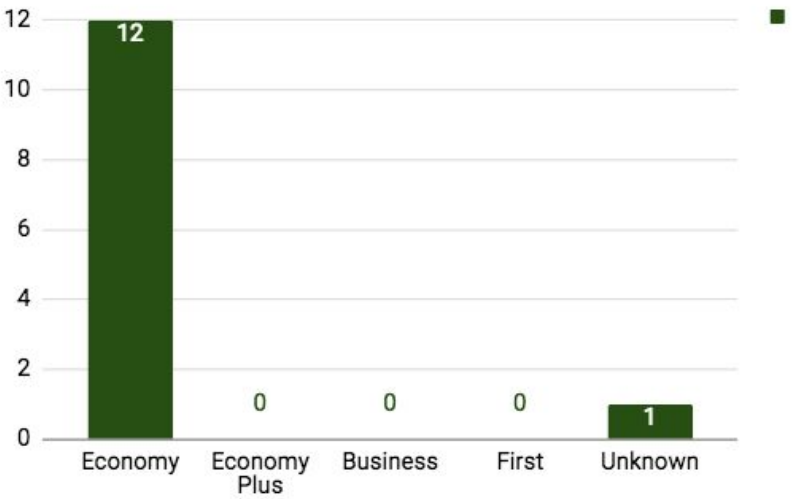


Figure 23. Trip Ticket Class (Chan Centre)

Emissions and Cost

The Significance of F value is 1.7E-05, once again indicating a significant relationship between trip cost and trip emissions (Fig. 24). The R-square value for the Chan Centre is

0.86, the highest of any of the departments. Here trip cost is a strong predictor of trip emissions, though there are only 13 data points in this department to analyze.

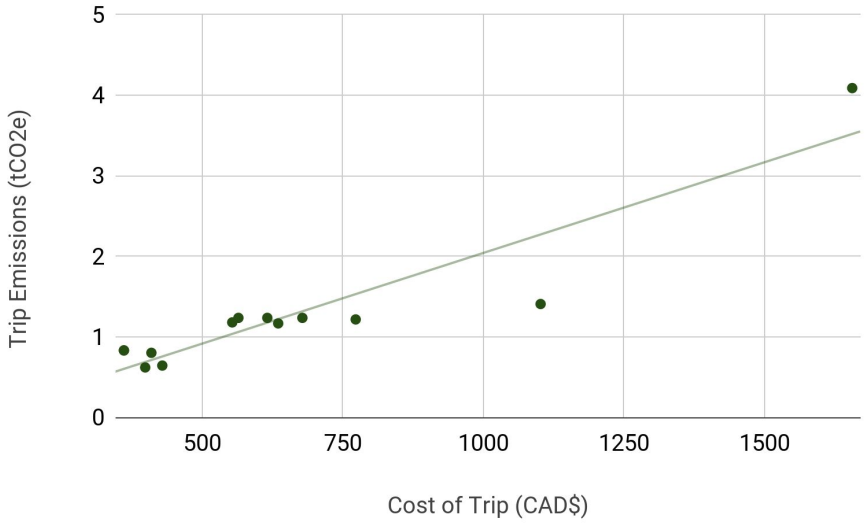


Figure 24. Trip Cost and Trip Emissions (Chan Centre) with R-Square of 0.86 and Significance of F of 1.7E-05

Number of Travelers

There were six travelers in the Chan Centre. Of these, two were responsible for 12.63 tCO_2e of the total 16.50 tCO_2e. with a combined nine trips.

Mitigation Options

Mitigation experiments were performed to understand how certain trip characteristics contribute to total emissions, and to determine the reduction in emissions if certain trip types were eliminated. Eliminating a) 0 night and 1 night trips, b) 0, 1 and 2-night trips, c) short haul trips (>463 km one way), d) trips under 700 km one way and e) trips made by non-UBC travelers (i.e. purpose code "N"). Travel by non-UBC travelers contributed the most to total emissions out of the five categories, at 214.74 tCO_2e (table 5). Short haul trips and trips under 700 km contributed the least to total emissions.

	Number of Trips	*Emissions*	*Percentage of Total Emissions*
Short Haul Trips	29	23.60 tCO_2e	2.2%
Trips Under 700 km	34	28.23 tCO_2e	2.6%
0 and 1 night	40	45.91 tCO_2e	4.3%
0, 1 and 2 night	109	114.78 tCO_2e	10.7%
Non-UBC Travelers	142	214.74 tCO_2e	20.1%

Table 5. Effects of eliminating various trip types on total emissions

Policy Options to Reduce GHGs

Non-UBC Travelers

Emissions could be reduced by one fifth if non-UBC affiliates flights were eliminated. Better understanding of the nature and frequency of non-UBC affiliates travelling to UBC is needed to determine whether or not this is feasible. It is not clear whether this pattern is typical across UBC departments or among other universities. Regardless, emissions from non-UBC affiliates account for the highest percentage of total emissions based on primary purpose.

Economy Class Only

Economy class flights for all distances travelled produce the lowest amount of emissions per passenger kilometer. Creating a policy encouraging or requiring economy class flights would ensure that, regardless of destination, emissions are kept at a strict minimum for each trip.

Multi-Purpose Trips and Consolidated Trips

Encouraging multi-purpose trips to minimize overall distance traveled could also reduce emissions. Only 12% of trips listed a secondary purpose, though it is possible travelers

did not explicitly list secondary purposes on their requisition forms. Furthermore replacing repeat trips to the same destination with a consolidated trip could be encouraged. Such trips could be extended over a longer time period with a reduction in the number of flights and thus emissions. This may be a challenge to those whose research is time-sensitive or who have obligations in multiple destinations.

Direct Flights Only

As demonstrated by the indirect versus direct trip analysis, direct trips produce less GHGs. Direct trips should be purchased, wherever feasible. This is also an attractive option to travelers who would spent less time waiting in airports or in transit to their final destination.

Carbon Offsets

Lastly, the purchase of carbon offsets is worth consideration. UBC pays $25/tonne to offset Scope 1 and Scope 2 emissions (UBC Carbon Neutral Action Report, 2015). This amounted to 42 846 tCO_2e in 2015 (UBC Vancouver Campus, 2015 Greenhouse Gas Emissions Inventory), at a cost of over one million dollars. Offsetting 1070.25 tCO_2e would cost $26 756.25, or the equivalent of 28.9 trips made at the average cost of a trip.

Conclusion

This report quantified air travel emissions and analyzed related information from five UBC Vancouver departments (Geography, Psychology, IRES, Theatre & Film and the Chan Centre) to understand travel patterns and highlight possible emissions mitigation options. In total, over an 18-month period, 1070.25 tCO_2e were emitted from air travel. For reference, it is estimated that the building emissions for the Department of Geography are 4.5-6 tCO_2e for the same period (Jamee DeSimone, personal communication, Nov 2016). Though air travel emissions are not mandated to be offset the same way building emissions are, there are reasonable reductions that can be made to address air travel emissions at UBC.

Positive Signals

Overall the departments are minimizing emissions on flights by purchasing economy class on the vast majority of flights. This ensures that, regardless of destination or frequency, emissions are at the lowest possible level per trip. However emissions can be further reduced by decreasing the number of trips made, though this presents institutional and cultural challenges particular to academia when travel is part of the work experience.

Cost and Emissions

Though there is a significant relationship between cost of trips and emissions, cost is not a reliable predictor of emissions. To accurately assess emissions more information beyond cost, including ticket class and number of flight segments, is needed.

Next Steps

Whether or not an institutional mitigation policy is made to address air travel emissions, faculty and staff can and should be made aware of their personal emissions. Though few and far between, the travelers purchasing business and first-class tickets had startlingly high emissions compared to their economy-class counterparts. Simple changes to minimize emissions can be made without dramatically altering flying habits: purchasing direct flights where available, continuing to book economy-class tickets and consolidating multiple purposes into one trip.

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