



Assessment of Carbon Footprints of Staff in University of Agriculture Makurdi, Benue State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Authors SAS and GAI designed the study, wrote the protocol and wrote the first draft of the manuscript. Author ETT managed the literature searches, analyses and discussion of the study. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The study was carried out to assess the carbon footprints of staff of three agricultural-based Colleges of the University of Agriculture, Makurdi.

Study Design and Methodology: Staff Departments, cadre (academic and non-academic) and gender were assessed using an online questionnaire by World Wide Fund for Nature (WWF). Variables ranging from food consumption, home, travel and stuff were assessed among 120 respondents within the selected Colleges of the University. Descriptive statistics were used to analyze data obtained.

Place and Duration of Study: The study was carried out in University of Agriculture, Makurdi between March, 2017 to May, 2017.

Results: The study revealed that, staff from the College of Animal Science had the highest carbon footprints of 597.60 tonnes/year, requiring approximately 3.90 planets to maintain their lifestyle.

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The Department of Animal Production had the highest carbon footprints of 314.80 tonnes/year among Departments investigated and required up to 4.00 planets. The academic staff had the highest cumulative carbon footprints of 880.40 tonnes, a lifestyle that could be accommodated within 6.20 planets. The female staff of the selected Colleges emitted higher than their male counterparts (893.20 tonnes/year), requiring 6.30 planets to continue with their lifestyles.

Conclusion: The footprints of staff in the Colleges studied were higher than the UK emission standard per capita per annum of 3.06 tonnes/year, indicating that they would need more than the earth to live in, if everyone else in the world adopted their lifestyles. The study recommends that adequate awareness on the negative impacts of high carbon emissions be carried out to help citizens reduce their carbon emissions in order to live within the limits of the earth.

Keywords: Assessment; carbon footprints; carbon calculator; staff; university of agriculture; Makurdi.

1. INTRODUCTION

Climate change is increasingly recognized as a major challenge and it is widely accepted that the greenhouse gas emissions caused by humans are having a negative impact on the environment [1]. According to [2], nearly everything we do produces greenhouse gas (GHG) emissions either directly or indirectly. We use energy in everyday activities, from turning on the lights to driving to school and most of it is derived from burning fossil fuels, which releases greenhouse gases (GHGs) such as carbon dioxide (CO₂) into the atmosphere [3]. It is estimated that about 37 billion tonnes of carbon dioxide are produced every year from the burning of fossil fuels alone whilst about 7 billion tonnes are produced from deforestation [4]. Greenhouse gases are also released when products are disposed of at the end of their useful lives [2]. Many of our actions generate carbon emissions, which contribute to accelerating global warming and climate change. A rise in temperature by 0.74°C has already been recorded and hence, climate scientists are focusing on an urgent action to curb global warming [5,6]. The imbalances caused in natural systems due to warming are already being signaled in the form of extreme weather events and climate change [7]. The carbon footprint is the total amount of GHG emissions caused directly or indirectly by an individual, organization, event, or product [1]. [8] defined the carbon footprint as a measure of the exclusive total amount of carbondioxide emissions that is directly or indirectly caused by an activity or is accumulated over the life stages of a product. A household's carbon footprint varies depending on factors such as home size, types of vehicles used, and what household members eat and purchase [3]. The author adds that by measuring our carbon footprint, we can learn how we are contributing to this rise in

atmospheric CO₂ and how we might use energy more efficiently. This study which is a follow up of an earlier study on undergraduates of the University [9] focuses on assessing the carbon footprints of staff of the University to determine their carbon emission status, whether their lifestyles are within the limits of the earth or otherwise.

2. MATERIALS AND METHODS

2.1 Study Area

The study area is located on Longitude 8° 33N and Latitude 7° 44E in Makurdi Local Government Area of Benue State, North-central Nigeria. The University of Agriculture Makurdi was established in 1988, by a Federal Government white paper on Higher Education curriculum and development in Nigeria [10].

2.2 Sampling Strategy

The study covered the three agriculture-based colleges of the University involving all the three agriculture-based Colleges and their Departments. In each of the 3 Colleges, 2 Departments representing 50% of Departments were randomly selected for the study [9]. In each Department, 2 cadre of staff (made up of academic and non-academic) with 5 male and 5 female staff were engaged for the study. A total of 120 staff were assessed for the study.

2.3 Data Collection

Data for the study was collected using a UK-based online Carbon Footprint Calculator designed by World Wide Fund for Nature (WWF) [11]. The calculator provided a questionnaire for each respondent, after which instant results were

displayed based on the lifestyle options selected. A break down of an individual's footprint was presented in percentages according to the various categories of Food, Home, Travel and Stuff together with the total carbon footprints emitted in tonnes.

3. RESULTS AND DISCUSSION

3.1 Carbon Footprint of Study Colleges in the University of Agriculture, Makurdi

College of Animal Science had the highest carbon footprints of 597.60tonnes/year, with food constituting 40.73% (243.40 tonnes/year) out of total footprints generated (Table 1).

This was attributed to their interest in raising livestock which mostly require the use of incubators and other machines powered by energy sources and generates high amount of GHGs especially CO₂ and methane. The least carbon footprint generated by staff of the College was from stuff (58.00 tonnes) with a percentage contribution of 9.71%. Total number of tonnes generated by staff of the College of Animal Science was 14.95 tonnes/year, exceeding the UK emission standard per capita per annum of 3.06 tonnes by 11.89 tonnes. This implies that, they required additional 3.89 planets to maintain their lifestyles if they do not change their current lifestyles.

College of Forestry and Fisheries generated relatively less carbon footprints. The College's total carbon footprint was 539.70 tonnes/year; this may be attributed to their awareness on the negative impacts of climate change caused by GHG emissions and activities such planting and maintenance of trees, use of low carbon facilities and teaching of climate friendly practices in all levels of study. The total tonnage emitted by the College was 13.51 tonnes/year which exceeded the UK emission standard per capita per annum by 10.45 tonnes, thus requiring 3.42 extra planets if they do not change their current lifestyles.

3.2 Carbon Footprints of Study Departments in the University

The carbon footprints of Departments in each of the Colleges were analyzed as presented in Table 2.

Staff of Department of Animal Production in the College of Animal Science generated the highest amount of carbon footprints of 314.80 tonnes/year, this may be due to their ignorance or negligence of the negative impacts of high carbon footprints and their keenness to rear animals which generates significant carbon footprints. This agrees with [9], a similar study among undergraduates where the Department of Animal Production had the highest amount of footprints among all Departments studied.

Table 1. Carbon footprints of selected colleges in university of agriculture, Makurdi, Nigeria

College	Category	No of respondents	Total carbon footprints (Tonnes/year)	Percentage footprints (%)	Carbon footprints per respondent (Tonnes/year)	No of Planets required per College
Agricultural Economic & Extension	Food	40	276.70	49.83	6.92	3.54
	Home	40	166.30	29.95	4.16	
	Travel	40	80.50	14.50	2.01	
	Stuff	40	31.80	5.73	0.80	
	Total	40	555.30	100.00	13.89	
Animal Science	Food	40	243.40	40.73	6.09	3.89
	Home	40	201.60	33.73	5.04	
	Travel	40	94.60	15.83	2.37	
	Stuff	40	58.00	9.71	1.45	
	Total	40	597.60	100.00	14.95	
Forestry and Fisheries	Food	40	283.40	52.51	7.09	3.42
	Home	40	144.20	26.72	3.61	
	Travel	40	67.50	12.51	1.69	
	Stuff	40	44.60	8.26	1.12	
	Total	40	539.70	100.00	13.51	

Table 2. Carbon footprints of departments in the study colleges of the University of Agriculture, Makurdi, Nigeria

College	Departments	Category	No of respondents	Total carbon footprints (Tonnes/year)	Percentage footprints (%)	Carbon footprints per respondent (Tonnes/year)	No of planets required per Department
Agricultural Economic & Extension	Agricultural Economic	Food	20	121.20	43.60	6.06	3.54
		Home	20	87.60	31.50	4.38	
		Travel	20	50.20	18.10	2.51	
		Stuff	20	19.00	6.83	0.95	
		Total	20	278.00	100.00	13.89	
	Agricultural Extension	Food	20	155.50	56.08	7.78	3.54
		Home	20	78.70	28.38	3.94	
		Travel	20	30.30	15.83	1.52	
		Stuff	20	12.80	0.05	0.64	
		Total	20	277.30	100.00	13.88	
Animal Science	Animal Nutrition	Food	20	112.60	39.82	5.63	3.62
		Home	20	91.70	32.43	4.59	
		Travel	20	48.00	16.97	2.40	
		Stuff	20	30.50	10.79	1.53	
		Total	20	282.80	100.00	14.15	
	Animal Production	Food	20	130.80	41.65	6.54	4.12
		Home	20	109.90	34.91	5.50	
		Travel	20	46.60	14.80	2.33	
		Stuff	20	27.50	8.74	1.38	
		Total	20	314.80	100.00	15.75	
Forestry and Fisheries	Forestry	Food	20	135.70	55.16	6.79	3.02
		Home	20	60.30	24.51	3.02	
		Travel	20	31.40	12.76	1.57	
		Stuff	20	18.60	7.56	0.93	
		Total	20	246.00	100.00	12.31	
	Fisheries	Food	20	147.70	50.29	7.39	3.80
		Home	20	83.90	28.57	4.20	
		Travel	20	36.10	12.29	1.81	
		Stuff	20	26.00	8.85	1.30	
		Total	20	293.70	100.00	14.70	

The sum of individual carbon footprints of the Department was estimated at 15.75 tonnes/year, exceeded the UK emission standard per capita per annum of 3.06 tonnes by 12.69 tonnes. Department of Animal Nutrition in the College of Animal Science generated relatively less amount of total carbon footprints of 282.80 tonnes/year and the Department's food sources had the highest carbon footprints of 39.82%. This may be attributed to the high carbon footprints of feed production processes and the ignorance of staff towards the use of carbon friendly approaches and technologies in their activities. Staff had the least amount of 30.50 tonnes/year which constitutes 10.59% of generated carbon footprints. Their total carbon footprint was 14.15 tonnes/year; hence the Department required 3.62 additional planets to maintain its lifestyle. Staff from the Department of Forestry generated relatively less carbon footprints of 539.70 tonnes/year compared to other Departments and this can be attributed to their environment-based curriculum, facilitating more exposure to climate resilience building information.

3.3 Carbon Footprints of Staff Cadre in Study Colleges of the University

Academic staff recorded a higher increase in total carbon footprint generation of 880.40 tonnes/year compared with 812.20 tonnes/year generated by non-academic staff of study colleges in the University as shown in Table 3. Academic staff of the Colleges generated higher carbon footprints in home (277.80 tonnes/year), travel (135.70 tonnes/year) and staff

(69.50 tonnes/year) compared to non-academic staff that generated less in all the categories. The increase in the home category may be attributed to possession of homes equipped with high energy impact facilities. In the travel category, higher carbon footprints may be due to possession and use of several fuel inefficient cars instead of travel by mass transit buses for their work activities. Academic staff had more purchasing power due to higher wages and could afford to pay more for luxury stuff and home facilities as well as possession of cars, all of which increased carbon footprints.

Collectively, total carbon footprint per academic staff was 22, 02 tonnes, which exceeds the UK emission standard per capita per annum of 3.06 tonnes by 18.95 tonnes. This implied that 6.20 planets were required for an academic staff of the selected colleges to maintain his/her lifestyle if he/she did not change his/her lifestyle. The non-academics required 5.64 planets to continue with their lifestyle, thus both cadre needed to make lifestyle choices that would lead to significant emission reduction to live within the limits of our only planet, the earth.

3.4 Carbon Footprints of Staff Gender in the Selected Colleges

The carbon footprints of staff of the Colleges selected for this study based on gender is as presented in Table 4. The female staff of the Colleges produced more carbon footprints of 893.20 tonnes/year with food as their major source of carbon footprint generated as shown in

Table 3. Carbon Footprints of staff Cadre in study Colleges of University of Agriculture, Makurdi, Nigeria

Cadre	Category	No of Respondents	Total carbon footprints (Tonnes/year)	Percentage footprints (%)	Carbon footprints per respondent (Tonnes/year)	No of Planets required per Cadre
Academic	Food	40	397.40	45.14	9.94	6.19
	Home	40	277.80	31.55	6.95	
	Travel	40	135.70	15.41	3.39	
	Stuff	40	69.50	7.89	1.74	
	Total	40	880.40	100.00	22.02	
Non-Academic	Food	40	406.10	50.00	10.15	5.64
	Home	40	234.30	28.85	5.88	
	Travel	40	106.90	13.16	2.67	
	Stuff	40	64.90	7.99	1.62	
	Total	40	812.20	100.00	20.32	

Source: Field work, 2017, * Emission Standard per capita per annum = 3.06 tonnes

Table 4. Carbon Footprints of male and female staff in the selected Colleges

Gender	Category	No of respondents	Total carbon footprints (Tonnes/year)	Percentage footprints (%)	Carbon footprints per respondent (Tonnes/year)	No of planets required per college
Female	Food	40	400.50	44.84	10.01	
	Home	40	301.30	33.70	7.53	
	Travel	40	89.90	10.06	2.25	6.30
	Stuff	40	101.50	11.36	2.54	
	Total	40	893.20	100.00	22.33	
Male	Food	40	391.60	48.99	9.79	
	Home	40	211.10	26.41	5.28	
	Travel	40	116.90	14.62	2.92	5.50
	Stuff	40	79.80	9.98	2.00	
	Total	40	799.40	100.00	19.99	

Table 4. They generated 44.84% from food consumption followed by home with 301.30 tonnes (33.70%). Travel had the lowest contribution of 89.90 tonnes (10.06%) while stuff contributed a relatively higher value of 101.50 tonnes (11.36%). This indicated that female staff generated more carbon footprints from activities such as cooking, washing, child care, fashion and spending on beauty and grooming products, etc.

Total carbon footprint generated by the females was 22.33 tonnes requiring, additional 6.30 planets to maintain their lifestyles, compared to 2.44 planets from their male counterparts.

4. CONCLUSION

Carbon footprints generation at all levels of study was higher than the UK emission standard per capita per annum required for the earth, implying that if everyone else in the world lived similar lifestyles and they not adopt any change in their lifestyles, we will require more than the earth to live. The food category had the highest amount of carbon generated and this should be prioritized for any emission reduction program among study respondents. In addition to food, the female cadre would need to pay attention on their stuff choices to live within the limits of the earth. The study attributes the high carbon generation above the permissible limit for the earth to low level of awareness or ignorance on the impacts of carbon emissions on the earth and best practices for cutting down emissions. It is therefore suggested that creation of awareness on the impacts of GHG emissions and measures to cut down emissions be urgently pursued in our daily lifestyles and production systems so that we can reduce their contribution to global warming, promoting a healthier earth for today and give

future generations. It is also recommended that each country/region should develop its own carbon footprint calculator in order to have national per capita emission standards that will take into account peculiar lifestyles and practices of respective countries.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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