GESDAV

Journal of Environmental and Occupational Science

available at www.scopemed.org

Original Research

Ecological footprint score in university students of an Indian city

Sonika Raj, Sonu Goel, Manoj Sharma, Amarjeet Singh

Panjab University Pgimer, Chandigarh, India

Received: June 02, 2012

Accepted: June 10, 2012

Published: June 10, 2012

DOI : 10.5455/jeos.20120610031942

Corresponding Author:
Sonu Goel,
PGIMER, Chandigarh, India
sonugoel007@yahoo.co.in

Key words: Ecological Footprint, Global Hectares, Bio capacity

Abstract

Background: The ecological footprint (EF) is a measure of human demand on the Earth's ecosystems. In 2007, world-average EF was 2.7 gha per person as compared to 0.91 gha per person in India. The importance of tracking the environmental performance of nations by EF is obvious in light of the myriad environmental problems like global warming, large-scale deforestation, desertification, loss of biodiversity, and disturbances to major geochemical cycles. Against this background, the present study was done to determine ecological footprint status of students of Panjab University, Chandigarh

Methods: A cross sectional study was done in 100 students of Panjab University, located in northern part of India. A standardized self administered questionnaire, modified according to Indian situations, and pretested was used as a research tool for study. It contained 12 questions in four sub groups addressing EF of food, mobility, shelter, goods and services. The total footprint score of a person was the sum of all subgroup EF scores. WHO EPI Info software for calculating frequencies, percentages and ANOVA.

Results: Mean total footprint was highest in the age group of 17-19 years as compared to other age groups (p=0.001). All the footprint parameters (shelter, food, mobility, goods and services) were more in males as compared to females. EF score of the majority of students was in the range of 6-10.

Conclusions: Ecological Footprint of students of Panjab University, Chandigarh was found to be much higher (5.58) than average Indian Footprint (0.91).

INTRODUCTION

The term 'Ecological Footprint' (EF) was conceptualized by Wackernagel and Rees in 1992 to assess the demands societies place on the regenerative capacity of the biosphere [1]. The ecological footprint is a measure of human demand on the Earth's ecosystems. It compares human demand with Earth's ecological capacity to regenerate resources and provide services [2].The concept of ecological footprint gained attention in UN World Summit on Sustainable Development, at Johannesburg, South Africa in 2002 .EF represents the amount of biologically productive land and sea area needed a) to regenerate the resources a human population consumes and b) to absorb the corresponding waste and render it harmless. The concept of EF is based on the principle that land is a fundamental factor on which all societies depend, since it provides living space, products and services, and a sink for wastes. Productive land is, therefore, a proxy for the demands societies place on the environment.

EF has often been regarded as a reliable indicator of anthropogenic pressure on the environment since it does not ignore tradeoffs among different types of environmental exploitation (e.g., wood vs. plastic consumption) [3] .It can be used as an indicator of sustainability. It is possible to estimate how much of the Earth (or how many planet Earths) it would take to support humanity if everybody lived a given lifestyle.

The EF is calculated, much the same way that is adopted for economic consumption i.e. we need to add up the various forms of consumption in a society – food, housing, transportation, consumer goods, and

services – and the waste it generates. This in-turn is converted into a common metric, similar to economic accounting. Food footprint sums up arable land, pasture, sea space, and land areas. Goods and services footprints were determined based upon waste produced, shelter, and mobility footprints. This also considers average lifestyles, and estimated use of appliances, clothing, electronics, sports equipment, toys, computers, communications equipment, household furnishing, and cleaning products. It also includes services like water, sewage, garbage, telecommunications, education, healthcare, financial services, entertainment, recreation, tourism, military, and other governmental serves. Mobility footprint includes the impacts that result from walking, cycling, taking trains, driving cars, and flying. Shelter footprint comprises of size, type of house, number of members in household, usage of energy conservation measures etc.

Footprint values can be further categorized for Carbon, Food, Housing, Goods and Services, which are converted into a normalized measure of land area called 'global hectares' (gha). In 2007, world-average EF was 2.7 gha per person as compared to 0.91 gha per person in India. With a world-average bio-capacity of 1.8 gha per person, this leads to an ecological deficit of 0.9 (2.7 minus 1.8) gha per person. For India, the ecological deficit is 0.40(bio-capacity of 0.51 against human footprint of 0.91gha/capita) [4]. The importance of tracking the environmental performance of nations by EF is obvious in light of the myriad environmental problems like global warming, large-scale deforestation, desertification, loss of biodiversity, and disturbances to major geochemical cycles [5]. However studies on this aspect are lacking from India.

Against this background, the present study was conducted with an objective to determine ecological footprint status of students of Panjab University, Chandigarh.

METHODS

The present cross sectional study was conducted during 2009 among Panjab University graduate students of Chandigarh, India. A sample size of 100 students was obtained by entering information in WHO-EPI Info software (Type 1 error as 0.05, Type 2 error 0.20; error margin 10; P=0.50 ;Q=0.50). Students pursuing their graduation (regular) course were eligible for participation in the study. Students who were doing their graduation through correspondence (distant learning) or during the evening study hours were excluded from the study. A standard questionnaire was modified according to Indian situations to use it as a research tool for study [5].

For data collection, five departments were selected randomly from Panjab University. Twenty randomly selected students from each department were given EF questionnaire for completion. It had 12 questions in four sub groups addressing EF of food, mobility, shelter, goods and services. The questions focused on type of food eaten, way of transport used, family size and consumption pattern. The total footprint score of a person was the sum of all subgroup EF scores. Written informed consent was obtained from the subjects. Data was analyzed using WHO EPI Info software for calculating frequencies, percentages and ANOVA.

The term ‘productive land area’ or 'global hectares' (gha) is used as a metric, or unit of measurement of ecological footprint [6]. The global hectare (gha) is a measurement of biocapacity of the entire earth - one global hectare is a measurement of the average biocapacity of all hectare measurements of any biologically productive areas on the planet.

Bio-capacity refers to the amount of biologically productive land and water available per person on the planet. Approximately one-quarter of the Earth's surface, just over 11 billion hectares, comprises the total global biocapacity [7]. To calculate the number of hectares available per capita, one adds up the biologically productive land per capita world-wide of arable land, pasture, forest, built-up land and sea space, excluding room for the 30 million fellow species with whom humanity shares this planet.

RESULTS

Table 1 shows the demographic profile of study population with 62 females and 38 males in the age group of 17-30 years. Table-2 shows that the mean total footprint was highest in the age group of 17-19 years as compared to other age groups and difference was found to be statistically significant (p=0.001). All the footprint parameters (shelter, food, mobility, goods and services) were more in males as compared to females. Hostellers were found to had more total ecological footprint than day scholars. All the footprint scores were found to be highest for engineering students followed by law students as compared to other students (p=0.001).Table 3 shows that EF score of the majority of students was in the range of 6-10.

DISCUSSION

The EF is a measure of the consumption of renewable natural resources by a human population. A country's EF is the total area of productive land or sea required to produce all the crops, meat, seafood, wood and fibre it consumes, to sustain its energy consumption and to give space for its infrastructure.

Table 1. Demographic profile of study population (n=100)

Variables	n
Age group (years)	
17-19	28
20-22	32
23-25	28
26-30	12
Gender	
Female	62
Male	38
Residence	
Hostellers	44
Day scholar	56

Table 3. Distribution of Ecological Footprint Scores Among Students

Mean Total EF Score		Frequency (N=100)
2-6		2
6-10		40
10-14		26
14-18		12
18-22		12
22-26		4
26 and above		4
Mean	**SD**	**Range**
13.7	8.82	5.10

Table 2. Mean Footprint scores (acres) of various components as per demographic profile of study population

	Food FP	Shelter FP	Mobility FP	Goods-Services FP	Total FP
Age group(years)					
17-19	3.69	3.44	4.42	7.48	19.0
20-22	3.14	2.93	1.82	3.97	11.8
23-25	3.07	2.86	1.32	3.31	10.57
26-30	3.17	2.65	3.21	4.49	1.35
p-value	0.008*	0.574	0.000*	0.002*	0.001*
Gender					
Female	3.18	2.92	2.52	4.68	13.3
Male	3.45	3.18	2.66	5.08	14.4
p-value	0.085	0.527	0.830	0.669	0.560
Residence					
Hostellers	3.54	3.58	3.21	6.03	16.4
Day scholars	3.08	2.58	2.07	3.89	11.6
p-value	0.003*	0.010*	0.066	0.017*	0.007*
Stream					
Basic Medical Sciences	2.93	2.82	1.48	3.35	10.6
Arts	3.26	2.04	1.38	2.70	13.9
Commerce	3.096	2.91	1.88	3.89	11.7
Engineering	3.69	3.44	4.42	7.484	19.0
Law	4.18	3.53	4.17	6.82	18.7
p-value	0.000*	0.464	0.001*	0.001*	0.000*

*Difference was significant at 0.05 level

The present study shows that the ecological footprints for males and females were not different for any of the four components. This could be due to the fact that in today's modern India, educated youth - both males and females travel more, use more advanced technologies, love lavish lifestyle and consume more beverages and processed food leading to carbon emissions. These findings are in contrast to study conducted by Everitt in Canada [8], Lattham in Sweden [9], Annika Carlsson-Kanyama in Sweden and Riita Räty in Finland[10], where men were found to be worse for the planet than women in terms of EF. However, in a study by Solar in Philippines observed higher EF in females [11].

The mean total EF in present study 5.58 gha was much higher than the national average of 0.91 gha per person. The reason for this could be that our sample was exclusively from university students of Chandigarh. Our study also revealed that students in the age group of 17-19 had the highest mean total EF score as compared to students in older age group. The reason for this may be the fact that the students of this age group have come out of their homes for the first time to study in colleges. They want to enjoy this life to the fullest and with independence. So, they opt for eating out, have processed foods, use more advanced mobiles, go more for outings with their friends on their bikes and cars. All this leads to more carbon emissions. The findings are in contrast to study conducted by Solar in Philippines in 2010 and 2011 on sample of 100 college students and again on 200 students, and it was found that EF had no correlation with age[10].

In our study, hostellers were found to have higher mean EF score in all the parameters as compared to day scholars. This could be probably due to the fact that they had their meals in the mess/canteen where food variety is limited. Fresh fruits and vegetables are seldom available in the university canteen. So they opt for eating out in restaurants/food joints and for that they have to go out. This adds up to more carbon emissions score. In the present study, most of students had higher EF score especially goods and services footprint as they produce more waste, travel more and live in big houses with less energy conservation measures. The reason for this could be the fact that majority of students of University belonged to middle or high socio-economic class. The engineering graduates had the highest mean total footprint score followed by law graduates. The reason for this could be the fact that most of the engineering students were hostellers.

CONCLUSIONS

Ecological Footprint of students of Panjab University, Chandigarh was found to be much higher (5.58) than average Indian Footprint (0.91).Worldwide, there exists 4.7 biologically productive acres per person. Therefore, if everyone lived like them, we would need 2.9 planets.

RECOMMENDATIONS

EF concept should be included in the curricula of school/college. Students need to be made aware of this concept.

KEY MESSAGES

1. EF is powerful tool to measure consumption of renewable natural resources by a human population.
2. The EF of youth population being higher in most studies including the present one indicates that they deplete the natural resources more as compared to older population.
3. EF concept should be included in the curricula of school/college. Students need to be made aware of this concept.

REFERENCES

1. Wackernagel M. Ecological Footprint and Appropriated Carrying Capacity: A Tool for Planning Toward Sustainability. (PhD thesis), Vancouver, Canada: School of Community and Regional Planning 1994.
2. Rees, William E. Ecological footprints and appropriated carrying capacity: what urban economics leaves out".Environment and Urbanization 1992; 4 (2): 121–130
3. Wackernagel, Mathis and William Rees. Our Ecological Footprint: Reducing Human Impact on the Earth. Gabriola Island, B.C: New Society Publishers1996.
4. Redefining the Footprint (footprint 2.0) in Sustainable Development: Principles, Frameworks, and Case Studies, CRC, Routledge 2010.
5. Dholakia R , Wackernagel M. Calculate Your Ecological Footprint: 16 Simple Questions to Assess your use of Nature.
6. Goel S, Patro B, Goel SR. Ecological Footprint: A Tool for Measuring Sustainable Development. International Journal of Environmental Sciences 2011; 2(1): 140-44.
7. Kitzes J, Wackernagel M, Loh J, Peller A, Goldfinger S, Cheng D et al. Shrink and share: humanity's present and future Ecological Footprint. Philos Trans R Soc Lond B Biol Sci. 2008; 363(1491): 467–475.
8. Everitt J. Footprints on Puerto Vallarta: Social Spaces and Environmental Impacts. Working Paper # 2005-12November 2005 Rural Development Institute Brandon University Canada. Accessed from http://www.brandonu.ca/organizations/RDI/publications3.html on Nov 11.2011
9. Johnsson-Latham G. Initial study of lifestyles, consumption patterns, sustainable development and gender: Do women leave a smaller ecological footprint than men? Swedish Ministry of Sustainable Development. Report: April 2006
10. Godoy J .Men's and Women's different impact on climate .Women in Europe for common future news and report. www.ips.org/institutional/documents/crimeandjustice [Access date Nov.20. 2011]
11. Venus A. Solar Gender and Natural Resource Consumption. International Journal of Environmental Science and Development.2011; 2(5):399-401