RESEARCH PAPER | Home Science | Volume : 3 | Issue : 11 | Nov 2013 | ISSN - 2249-555X

Assessment of Carbon Footprints of Rural Households of Vadodara District, Gujarat, India

KEYWORDS: Households, carbon footprints, vadodara, assessment, rural

Dr. Neerja Jaiswal
Associate Professor, Department of Family and Community Resource Management, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda, Vadodara,Gujarat

Ms. Khyati Shah
Research scholar, Department of Family and Community Resource Management, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda, Vadodara,Gujarat

ABSTRACT *Carbon emissions into the atmosphere are a colossal problem that must be handled. The present study was undertaken to assess the carbon footprints of selected rural households of Vadodara district, Gujarat, India.. The study comprised of 180 households from Undera, Dhanora and Koyli villages of Vadodara district, Gujarat, India. The data of the present descriptive research were collected by personal interviewing the homemakers of the households by the investigators on a pre-validated and pre-tested interview schedule. A standard online calculator was used to calculate carbon footprint of the households. Descriptive and relational statistics (frequencies, percentage, mean, and ANOVA) were computed for statistical analyses.. Slightly more than one- half of the households had high primary carbon footprints and majority of the households had low secondary carbon footprints. Majority of the households overall had low total carbon footprints. The statistical findings highlighted that the respondents varied significantly in their carbon footprints due to their personal income(F=3.393 at 0.05 level of significance), family size(F=9.906 at 0.01 level of significance), employment status(t=3.068 at 0.01 level of significance) and type of family(t=3.622 at 0.01 level of significance).The findings of the present research would assist the households to become aware about their activities that contribute carbon dioxide necessitating needed changes in their lifestyle in protecting the mother earth.*

INTRODUCTION

Carbon foot print is one of the humanities greatest challenge and one of the important indicator that the people are in ecological overshoot. Since the carbon footprint is 50 per cent of humanity's overall ecological footprint, reducing carbon footprint is essential to end ecological overshoot (Dev, 2009).

The main contributor to global warming is carbon dioxide which accounts nearly 80 per cent emissions from the developed countries. The gas is released from burning fossil fuel, oil, petrol and natural gas. With the rising population and increasing demand on transport and energy the rate at which carbon dioxide is being released is also accelerating (Dev, 2009).

Dependence on carbon-based energy has also caused a significant built-up of greenhouse gases in the atmosphere. According to the U.S. Department of Energy (DOE), transportation accounts for 33 per cent of carbon dioxide emission and home energy 21 per cent of the nation's carbon dioxide emission. Thus, having an energy efficient home can contribute a lot towards reducing carbon footprint. (Taylor et. al, 2008) Carbon dioxide is an important greenhouse gas because it transmits visible light but strongly absorbs infrared radiation.

Patel (2006) has defined carbon footprint as the amount of carbon dioxide emitted due to the household daily activities from washing a load of laundry to driving a carload to reach the destination.

Carbon footprint can be categorized as primary footprints and secondary footprints. Primary footprint is a measure of the direct emissions of carbon dioxide from fossil fuel that is burnt including domestic energy consumption and transportation. It has a direct control over the emissions. Secondary footprint is a measure of indirect carbon dioxide emissions over the entire lifecycle of the product during their manufacturing and eventual breakdown. (Dev, 2009)

Carbon footprint is often expressed as tons of carbon dioxide or tons of carbon emitted, usually on a yearly basis. A carbon footprint calculator calculates the amount of carbon emitted by an individual, an organization, or a geographic area. (Logan, 2007).

The need to measure green house gas emission has given rise to carbon footprint analysis. This new subject of study crosses a range of disciplines from public policy and city planning to engineering and industry to technology . It has become a new area of research, similar to previous quantification of air pollution, yet different enough to spawn a new approach (Logan, 2007).

The household is a basic micro unit of the nation which can play an important role in protecting environment by curbing the emission of carbon footprints. Since the various household actions command to perform various roles in the house by different family members, their correct and proper practices will reduce the emission of carbon dioxide, if the households are made aware about it. It is expected that rural households emit more carbon dioxide into the atmosphere. The awareness can be created only if the households are assessed about the amount of carbon footprint they release into the atmosphere. In the countryside distances are longer and more transport action is caused by car. The rural households tend to use more energy and more (carbon intensive) solid fuels than urban households in the same income group (ESRI, 2008).

Scholars and academics have just begun to research Carbon emissions, although there has been an enormous spike in interest in the past year. Individual people and international companies are researching their carbon footprint, voluntarily trying to reduce their emissions (Logan, 2007).

It is the major responsibility of the academic institutions to create awareness among the people about the impact of carbon footprints and motivate them educationally to join hands in reducing it. Keeping this in view, the present research is designed.

Volume : 3 | Issue : 11 | Nov 2013 | ISSN - 2249-555X

Carbon footprint studies measure emissions in connecting with certain activities and behaviors that can lead to greater or less carbon emission. Reviewing of the literature highlighted that there are studies been conducted in areas outside India on urban Population aging and future carbon emissions in U.S. (Dalton et. al, 2008), Low Carbon Footprint Electric Lawn Mower (Kamp et. al, 2008), Determinants of Variation in Household Carbon dioxide emissions between and within countries (Kerkhof and Renders,2000). A number of rural researches have also been conducted on energy consumption and renewable energy technologies conducted within and outside India. Assessing the carbon footprints at household level is really a less explored area that requires empirical initiatives by the academicians in order to meet the environment protection goals. With this premise the present research was conceptualized.

The findings of the present research on assessment of carbon footprint of the households can help to measure their carbon footprints and keep track of changes in their daily activities. It can depict how much a particular event or activity contributes to the energy use and carbon dioxide output. It can also help to figure out the needed changes in the lifestyle required by family members in the households.

Objective of the study
To assess the carbon footprints of selected rural households of Vadodara district, Gujarat, India.

Hypothesis of the study
The carbon footprints of the rural households will vary with the personal variables of the respondents (age, educational level, occupational status and personal income) and their family variables (family size, family income and family type).

Delimitation of the Study
The study was limited to rural households of Undera, Dhanora and Koyli villages of Vadodara district, Gujarat, India only.

METHODOLOGY
The research design of the present study was descriptive in nature. The study comprised of 180 households from Undera, Dhanora and Koyli villages of Vadodara district, Gujarat, India. The data were collected by personal interviewing the homemakers of the households by the investigators on a pre-validated and pre-tested interview schedule. A standard online calculator was used to calculate carbon footprint of the households. Descriptive and relational statistics (frequencies, percentages mean, ANOVA & "t" test) were computed for statistical analysis.

RESULTS AND DISCUSSIONS
Demographic Data: The mean age of the respondents was 43.2 years. A review of overall picture states that more number of the respondents was middle aged. While reviewing the educational level of the respondents, it was found that more number of the respondents (30.0 per cent) were educated till higher secondary level... The findings revealed that slightly more than one- half of the respondents (51.1per cent) were employed. A further probe about the nature of employment elicited that more than one-half of the respondents (55.0 per cent) were engaged in service. The respondents were found working in banks, in schools as teacher and as peon. Nearly one-fourth of the respondents (26.1 per cent) were self employed as they were involved in making snacks and stitching cloths. 14.1 per cent of the respondents were engaged in daily wages in the nearby farms. The analysis of the personal income of the respondents revealed that 44.6 per cent of the respondents had their personal monthly income above Rs. 3500 per month. The mean personal monthly income of the respondents was Rs.2765.7. The findings very manifestly revealed that majority of the respondents (81.1per cent) had medium sized family.

The family data of the respondents on the type of the family revealed that joint families (60 per cent) were comparatively more than the nuclear families in which the respondents resided.. The mean monthly family income of the respondents was Rs.13,913.8 /-.

Information regarding Cooking Fuel, Electricity, Transportation and Waste of the Household.
Consumption of LPG:. In general, the households consumed LPG in the range of 14.2 kgs to 28.3 kgs per month and between 28.4 liters to 56.71 liters annually.. The mean cylinder consumed by the households approximately lasted one month 8 days. The households were using LPG for cooking the food and sometimes for heating the water too.

Consumption of wood: The rural households were found using wood for heating the water in winter season.. More number of rural households (38.30 per cent) were found consuming 801 Kgs to 1350 kgs of wood in a year for heating water. The mean wood consumed by the households per year was 0.221 metric tons annually.

Use of Electricity: The findings of the study elicited that the households were using the electricity for lighting and in operating the household electrical appliances. Among the various lighting fixtures used by households, Fluorescent tubes were being used by all. Majority of the households were also found using incandescent bulbs that consumes more energy. Only nearly one-fourth of the households were wise enough to use CFLs.

The mean unit consumed by the households in two months was 155 KWHS. While analyzing the electricity units consumed per annum it is found that nearly 51.7 percent of the households consumed it is the range of 600.1 to 960 KWHS.

Mode of transportation: While analyzing the data on mode of transportation of the households, it was found that slightly less than two-third of the households (65.55%) were found using diesel bus as public transport. Majority of the households used scooty (100 cc) as private transport .

Distance traveled (in kms) and petrol used per 100 Kms using private transport:. On an average the households travelled 482.83 kms in a month. It also covered data on the petrol consumed by the households per 100 Kms. The findings from this data revealed that on an average 2.53 liters of petrol was being consumed by the household for travelling 100 Kms. in their private vehicle.

Cost incurred for cooking fuel, electricity and transportation: It is very interesting to note that 42.55 per cent of the household who were using wood as a fuel to heat the water and sometimes for cooking were not spending a single rupee on it. They were procuring wood from the nearby farms surrounding their house. The findings further also elicited that majority of the respondents were spending Rs.300 or less per month on LPG and electricity. 47.48 per cent of the respondents spent Rs. 601 and above per month on petrol. While comparing all the fuels, the highest amount was found to be incurred by the household per month on petrol as compared to LPG, wood and electricity.

Generation of household waste, segregation of household waste and Quantity generated by them:. The findings revealed that all the households were generating bio-degradable household food waste. The paper, plastics, clothing and shoes were also reported to be generated by all the households as compared to other non-biodegradable and toxic types of household waste.

All the households were segregating the bio-degradable household waste, paper, clothing, shoes, aluminum, steel canes, rubber and paints before disposing them. The findings further pointed that the highest quantity of household wastes

Volume : 3 | Issue : 11 | Nov 2013 | ISSN - 2249-555X

was generated regarding garden waste and paper. A higher percentage of the households generated garden waste and paper equal to or more than 26 Kgs in a year. The mean waste generated by the households was 7.5 Kgs annually.

Waste disposal practices of the households: The findings revealed that one-half of the households were giving the bio-degradable household waste to the private sweepers. Surprisingly one-half of the households reported to throw the household food waste outside their house. The garden waste was being burnt by majority of the households. The waste like rubber, paints, fertilizer, containers, batteries were thrown by majority of the households outside their house. Clothing, aluminum and steel can were being sold by majority of the households.

Carbon footprints of the household: Slightly more than one-half of the households had high primary carbon footprints and majority of the households had low secondary carbon footprints. Majority of the households overall had low total carbon footprints (Table 1).

Testing of hypothesis: The results of 'statistically findings highlighted that the households did not differ significantly in their carbon footprints due to their age, education and their family income. However, the findings further showed that the carbon footprints of the household significantly varied with their personal income (F=3.93 at 0.05 level of significance) and family size (F=9.906 at 0.01 level of significance). The findings of the't' test revealed that the respondents differed significantly in their carbon footprints with that of their employment status (t=3.068 at 0.01 level of significance) and type of family (t=3.622 at 0.01 level of significance).

CONCLUSIONS

On the basis of the means of "t" test, the conclusions can be drawn that the larger sized households, and the respondents having their income in the range of Rs. 2500 to Rs. 3500 per month had comparatively higher carbon footprints .It can further be concluded that the joint families and the families where the homemakers were employed also had higher carbon footprints. Overall majority of the households had low total carbon footprints.

Table 1: Distribution of the households according to their carbon footprints

Carbon footprints of Households (in metric tons)	f	%
Primary carbon footprints		
High (2.39 -4.04)	86	47.80
Low (0.72 -2.38)	91	52.20
Total	180	100.00
Secondary carbon footprints		
High (40-79)	20	11.12
Low (2-39)	160	88.88
Total	180	100.00
Total carbon footprints		
High (40.36-77.80)	27	15.00
Low (2.89-40.35)	153	85.00
Total	180	100.00

RECOMMENDATION

It is recommended that the similar research studies be conducted on a wider scale as the findings of the same would assist the households to become aware about their activities that contribute carbon dioxide in the environment necessitating needed changes in their lifestyle in protecting the mother earth.

REFERENCE

• Anderson M. (2007). Reducing Your Footprint: A Handbook for Reducing Household Carbon Dioxide Emissions. The University of Maine. Cited at http://www.umaine.edu/ nrc/Carbon Foot printing/Carbon Footprint Support Page.htm | • Barret J. and Wiedmann T. (2007). A comparative carbon footprint analysis of onsite construction and offsite manufactured house. University of York. UK. Cited at http:// www.censa.org.uk/docs/ISA-UK_Report_07-04_OSM_House .pdf | • Dev V. (2009). Carbon Footprint of Textiles. Cited at http://www.domainb.com /environment/20090403_carbon_footprint.html | • Druckman, Angela, Jackson and Tim. (2005). The carbon footprint of UK households 1990-2004: a socio economically disaggregated, quasi- multi- regional input-output model. Cited at http://www.upo.es/econ/IIOMME08/index .php | • Dalton, M., O'Neil, B. and Prskawetz, A. (2008). Population aging and future carbon emission in U.K. Cited at www.iiasa.ac.at/Research/PCC/pubs/Dalton_etal_EE2008.pdf | • ESRI. (2008). Ignoring Rural Realities: The Implications of Carbon Tax for Rural Ireland. Cited at www.irishrurallink.ie/.../IRL%20Briefing%2009.01 %20Carbon%20Tax% 20and%20Rural%20Ireland.doc | • Kamp K., Sharpe D., Williams J. (2008). Low Carbon Footprint Electric Lawn Mower Cited at http://www.docstoc.com/docs/30942400/LCFELMV2-Low-Carbon-Footprint-Electric-Lawn-Mower-Version-2 | • Kerkhof A. C., Renders M. J. and Moll H. C. (2000). Determinants of Variation In Household Carbon Dioxide Emission Between and Within Countries. University of Groningen. Netherland. Cited at http://www.sciencedirect.com/science?_ob=Article URL&_udi=B6V2W-4VFBYDP-5&_user=10&_coverDate=04%2F30%2F2009&_rdoc=1&_fmt= high&_orig=search&_sort=d&_docanchor=&view=c&_searchStrId=1324354003&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=fdff30a81f0488ced7df9504162c403b | • Logan E. (2007). An Exploration of the Structure and Development of Carbon Footprint Analysis. Cited at http://www.spp.gatech.edu/faculty/WOPRpapers/ Logan.WOPR.pdf | • Lam B. (2008). Opinion paper: carbon footprint. Miami southridge APES (Advanced placement environmental science). Cited at http://www. fairchildgarden.org/uploads/docs/Education/Challenge/2009/Opinion Papers/ Carbon Footprint - Hon Mention Miami Southridge Senior High.pdf | • Patel M. (2006). A Definition of 'Carbon Footprint. ISA-UK research report. Cited at http://www.censa.org.uk/docs/ISA-UK_Report_07-01_carbon_footprint.pdf.. | • http://www.carbonfootprint.com/calculator.aspx.2009. |