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Poverty and Gender Oriented Vulnerabilities to Food and Water Scarcity in Touroua, Cameroon

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ABSTRACT This paper analyses the vulnerability of different income groups and gender to food and water shortages caused by deforestation and based on population perceptions. Data was obtained through the random administration of 200 questionnaires in the study site. Data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 19 in which Pearson correlation was used. The results show that there is an inverse relationship between income levels and the number of respondents with perceptions of limited access to food and water. This implies that, when incomes are low, the number of respondents with perceptions of limited access to food and water is high and vice versa. As concerns gender, we observe from the data plottings that women are more vulnerable to water and food shortages.

INTRODUCTION

Deforestation is having repercussions on our environmental systems and it is responsible for ecological instability and long run social and economic development problems (Mertens and Lambin 1997). In addition, it has been proven that food and water shortages in the north of Cameroon are mainly caused by deforestation and no rainfall (Epule et al. 2012).In the same way, Misselhorn (2005) supports these views when he argues that rainfall is only seen as a reinforcing factor when food shortages are concerned. Forests are therefore seen as systems that depict aspects of the interactions between the environmental, economic and socio-cultural sub-systems (Armenteras et al. 2010). There is a growing debate that tropical deforestation is increasingly contributing to the global carbon stock, reduced agricultural output, adversely affecting discharge in rivers to name but these (Armenteras et al. 2010; Epule et al. 2012).

The causes of wide scale deforestation have been analyzed in different ways. An earlier study used remote sensing to digitalise the landscape that is lost in Cameroon (Mertens and Lambin 1997) while others have simply described the causes of deforestation without scaling the relative contribution of the various factors (Carr et al. 2006; Vanclay 1993; Zhao et al. 2006). However, more recently, a study that fitted a regression model has shown that population is a pivotal variable causing deforestation in Cameroon (Epule et al. 2011).

In Sub-Saharan Africa in general and Cameroon in particular, the ability of communities to adapt to the effects of deforestation stated above varies with the wealth status and the gender of the people involved (Misselhorn 2005; IPCC 2007; Skeggs 1997). The variation in the ability to adapt between respondents in different income classes and gender brings in the notion of vulnerability. When there is deforestation the soil texture becomes weakened and this reduces soil moisture which affects water supply and food production. This is evident because reduced soil moisture will always have a net effect on crops since they will not have sufficient water for growth. Both food and water supply shortage will create elements of vulnerability to

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segments of the population that cannot easily adapt due to poverty as well as to the roles that are traditionally attached to different gender in domestic resources management (Cutter et al. 2003; Cutter et al. 2000). In general, it is not clear who between males and females and the rich and poor are more vulnerable to food and water scarcity in most African communities in general and in Cameroon in particular because both males and females, rich and poor are involved in the use and consumption of water and food in the study site, a key issue this study wishes to investigate (Blaikie et al. 1994; Enarson and Morrow 1998) (Fig.1). Shortages in these resources will mean covering longer distances to fetch water, fetching unreliable water and working extra hard on the farms to produce very little yields (Skeggs 1997).

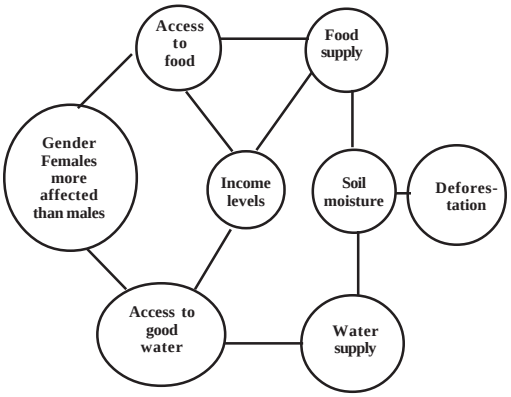

Fig. 1. A schematic representation of the interconnections between gender and income levels on the one hand and access to food and water on the other hand

Many definitions of the word vulnerability have been presented and the discrepancies inherent in the definitions are as a result of the differences in epistemological concentrations (human ecology, political ecology, spatial analysis and seismic issues) (Cutter 1996). However, some scholars have defined vulnerability as the extent to which various classes in society are differentially at risk (Susman et al. 1984). Furthermore, others argue that it has three connotations which are: it refers to a consequence such as famine rather than a cause such as drought; it may include an adverse effect such as maize yields being sensitive to drought or deforestation; households being vulnerable to hunger and water scarcity; in relative terms it may mean the differences within socio-economic or income groups or regions in adapting to food and water shortages (Downing 1999). Furthermore, the lack of access to resources has been described by some authors as material or economic vulnerability (Aysan 1993; Alcantara 2002). A hazard could include famine, drought, floods, and seismic activities inter alia. Vulnerability is a vital concept in hazard studies as it is central in the development of various methods of mitigation. Vulnerability now forms a major indicator used by experts in curbing environmental degradation, population growth problems, poverty and development (Cuny 1983). The latter establishes the importance of this area of study. However, in the context of Cameroon in general and Touroua in particular, this study comes in timely because much of the work on vulnerability in Cameroon has been on the aspects of vulnerability to climate change, mitigation and adaptations(IPCC 2007; Gbeibouo et al. 2010). To the best of our knowledge, this is the first study that uses the methods specified in the methodology below and data from population perceptions to analyze the vulnerability of populations to food and water shortages caused by deforestation. The fact that deforestation or land use change is at the centre of the observed food and water crisis in the region is not questionable as this has been established by Epule et al. (2012) for the Sahel of Cameroon and Olsson and Mryka (2008), Stephenne and Lambin (2001) for the entire Sahel.

The perspectives presented above cut deeply into and beyond the scope of this paper. Just as defined, this study aims at verifying through population perceptions/opinions the extent to which, poverty levels (income levels) and different gender are differentially susceptible to famine (food shortages) and water scarcity.

STUDY AREA AND METHODOLOGY

Study Area

Touroua is a village in the north region of Cameroon (Fig. 2). It is some 52.4 kms from Garoua the Capital of the north region of Cameroon. It is located on latitude 9.08333^0 north of the equator and longitude 12.9667^0 east of the prime

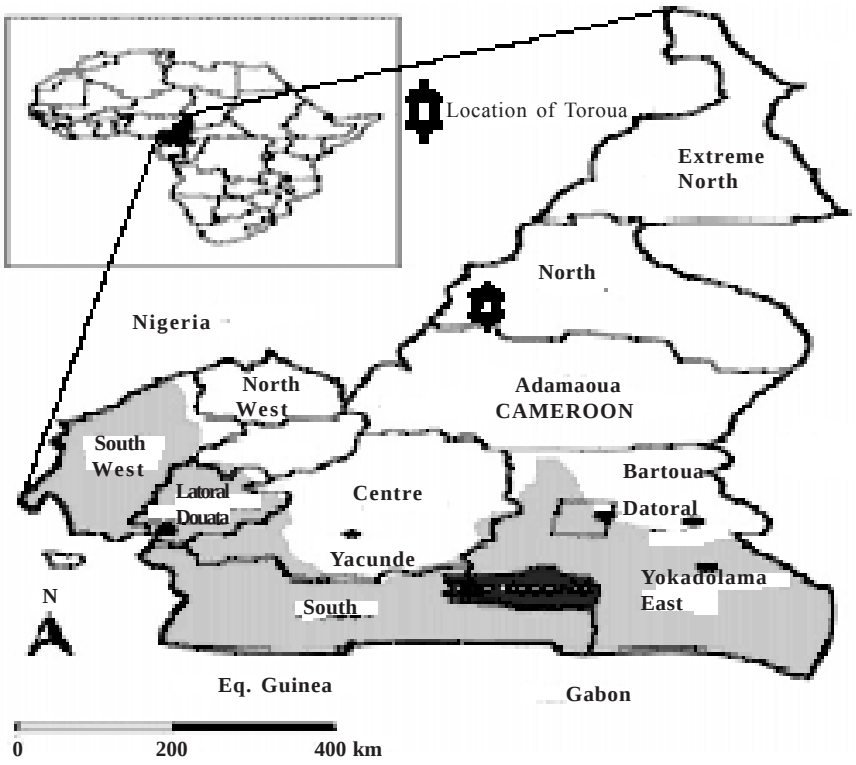

Fig. 2. Map of the North Region of Cameroon locating Touroua with a black star. Touroua is some 52.4 km^2 from Garoua the Capital of the North Region

Source: Modified from Mertens and Lambin (2000) and Epule et al. (2011).

meridian. The village, like most places in the north region of Cameroon has a Sudano-Sahelian climate with annual rainfall totaling about 900-1200 mm (Dounias et al. 2002). The north region of Cameroon is experiencing high rates of deforestation linked principally to high rates of immigration from the Far North region. The north region has a rate of immigration of 5.1 % which is much higher than the 3.2 % that obtains at the national level; this depicts the role of population in explaining deforestation (Njiti and Sharpe 1994; Epule et al. 2011). Therefore, Touroua village was selected because several micro-scale tree planting projects had taken place there and some had failed while some were considered a success, a subject for another study. The aim however for this current project is to analyze aspects of vulnerability already described in detail above.

Data Collection and Analysis

A total of 200 questionnaires were administered; 100 questionnaires to respondents in the Market area reforestation project and another 100 questionnaires to the Outdoor Mosque reforestation project. Only respondents of age 18 years and above were contacted. The questionnaires were designed and structured to meet the objectives of this study and the method of administering the questionnaires was random as specified by (Williman 2006; Bryman 2004).

Data Analysis

The questionnaires were coded using the unique identifiers. This was done on two excel work sheets representing the Market area and the Outdoor Mosque sites. The unique identifiers were set vertically from row three column A

downwards and in each case the unique identifiers ranged from 001-100 and they represent the IDs of the questionnaires. In the case of the three available questions (what is your gender? do you have problems of access to food and water? In what level of income do you belong?), column headers or question IDs were used (A, B and C for the three questions respectively) and they were set from row two and column B running horizontally. The specific responses were further coded based on the number of males coded as A1, number of females coded as A2, number of males with limited access to food and water due to deforestation coded as B1, the number of females with limited access to food and water due to deforestation coded as B2 and their respective income levels coded as C1, C2, C3, C4, C5 and C6 for the < 20 000 cfaf, 20 000-40 000 cfaf, 41 000-60 000 cfaf, 61 000-80 000 cfaf, 81 000-100 000cfaf and the > 100 000 cfaf income groups respectively. The Statistical Package for the Social Sciences (IBM SPSS) statistical analysis software version 19 was used to calculate the frequencies based on the responses. These frequencies were now used to further calculate the bivariate Pearson correlation coefficient (Motulsky 1999). The selection of this quantitative method of analysis was based on the fact that it enables us verify if the number of people (male or female) in different income groups is significantly correlated to the respondents perceptions of their access to food and water. Pearson correlation is fitted by the following equation:

$$r = \Sigma(x-\mu)(y-\mu) D \sqrt{\Sigma(x-\mu)^2 (y-\mu)^2}$$

Where:

r is the Pearson correlation coefficient, x is the number of respondents in the different income groups and y the number of respondents in the different income groups with perceptions of limited access to food and water.μ is the mean of x and y respectively and D is the division. r ranges from: $-1.0 \geq r \leq 1.0$, where: -1.0 to -0.7 strong negative associations, -0.7 to -0.3 weak negative association,-0.3 to +0.3 little or no association, +0.3 to +0.7 weak positive association, +0.7 to +1.0 strong positive association.

RESULTS

For the 100 respondents in the Market area project area we had 44 males and 56 females (Table 1). Here, it is observed that as the income level increases from < 20 000 fcfa to > 100 000 fcfa, there is a fall in the number of respondents with perceptions of problems with access to food and water. There are slight fluctuations which are not strong enough to puncture the overall inverse relationship. In the case of the 100 respondents in the Outdoor Mosque project, the study shows that there are 61 males and 39 females (Table 2).

Table 1: Income levels and gender for the 100 respondents in the Market area survey

Income groups (cfaf)	*Male*	*Female*	*Total*
<20 000	11	14	25
20 000-40 000	10	10	20
41 000-60 000	06	10	16
61 000-80 000	07	12	19
81 000-100 000	08	07	15
>100 000	02	03	05
Total	44	56	100

Table 2. Income levels and gender for the 100 respondents in the Outdoor Mosque area survey

Income groups (cfaf)	*Male*	*Female*	*Total*
<20 000	14	09	23
20 000-40 000	12	07	19
41 000-60 000	09	08	17
61 000-80 000	11	08	19
81 000-100 000	09	04	13
>100 000	06	03	09
Total	61	39	100

When the results for male respondents only for both the Market area and the Outdoor Mosque area are added up, it is observed that we have a total of 105 males (52.5% of the total population of 200) (Table 3). From this number, 68

Table 3: Income levels of all male respondents and number with limited access to food and water in both the Market area and the Outdoor Mosque area

Income groups (cfaf)	*Males*	*Number with limited access to food and water*
<20 000	25	20
20 000-40 000	22	22
41 000-60 000	15	12
61 000-80 000	18	06
81 000-100 000	17	07
>100 000	08	01
Total	105	68

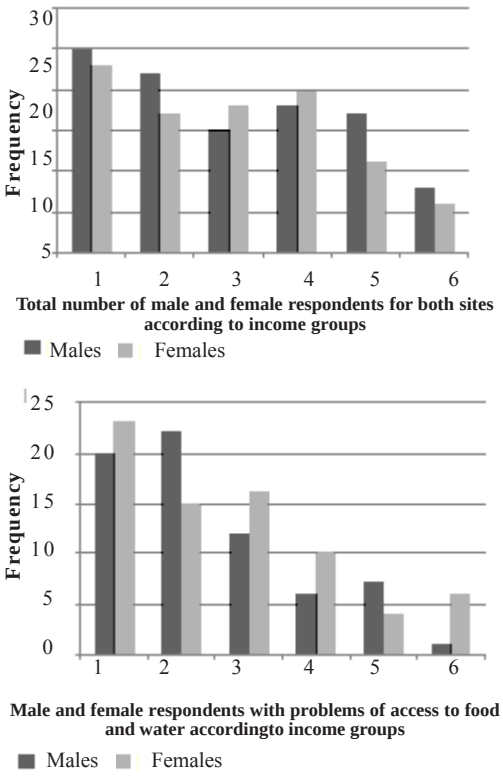

Fig. 3. The figure in the top shows the total number of males and female respondents. It is observed that there are 105 males and 95 females. In the bottom figure it is observed that more females are vulnerable than males as a total of 68 males out 105 are vulnerable to food and water shortages while a total of 74 females out of out of 95 are vulnerable. The generalized trend is that females are more vulnerable

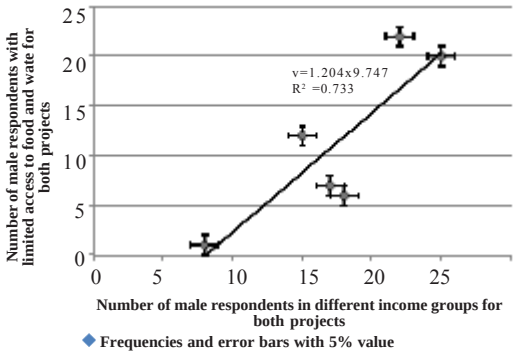

Fig. 4. Scatter plot of the total male respondents and the number of respondents with limited access to food and water due to deforestation. A generally rising graph meaning the number of respondents with limited access to food and water increases with increase in the number of male respondents

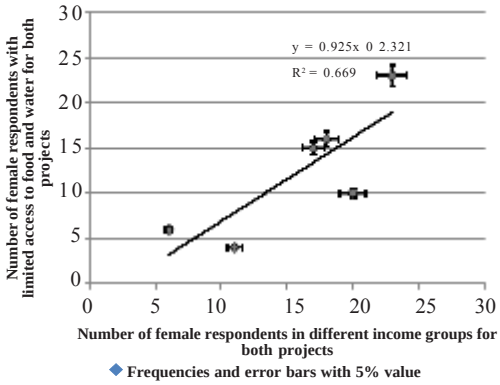

Fig. 5. Scatter plot of total female respondents and the number with limited access to food and water due to deforestation. A generally rising graph meaning the number of respondents with limited access to food and water increases with increase in the total number of female respondents

respondents (34% of the entire population of 200 and 64.5% of the 105 males) are faced with problems of limited access to food and water (Fig 3). As in the above observations, as the income levels rises, the number of respondents in the different income groups falls and so too does the number of respondents with perceptions of problems of access to food and water (Fig. 3). In general, it is observed that when the number of respondents in the different income groups is high, there is a higher number of respondents with problems of access to food and water, this is closely linked to the lower income levels, the slight fluctuations are not sufficient to off-set the general (Fig. 4).

In the case of the number of females in both projects, it is observed that there are 95 females (47.5% of the total population of 200) and of this number, 74 respondents (37% of entire population of 200 and 77.9% of the 95 females) are vulnerable to food and water shortages (Fig. 3). The results here reveal that generally females are more susceptible or vulnerable to food and water shortages (Fig 3). As the number of female respondents falls with increasing income levels, there is a parallel fall in the number of females with limited access to food and water (Table 4). In other words, as the number of respondents in

the various income levels increase, there is an increase in the number of respondents with limited access to food and water, at this same time, income levels will be low, the slight fluctuations are not sufficient to off-set the general linear trend (Fig. 5).

Table 4: Income levels of all female respondents and number with limited access to food and water in both the Market area and the Outdoor Mosque area

Income groups (cfaf)	*Females*	*Number with limited access to food and water*
<20 000	23	23
20 000-40 000	17	15
41 000-60 000	18	16
61 000-80 000	20	10
81 000-100 000	11	04
>100 000	06	06
Total	95	74

Table 5: Income levels of combined male and female respondents and number with limited access to food and water in both the Market area and the Outdoor Mosque area

Income groups (cfaf)	*Total males and females*	*Number with limited access to food and water*
<20 000	48	43
20 000-40 000	39	37
41 000-60 000	33	28
61 000-80 000	38	16
81 000-100 000	28	11
>100 000	14	07
Total	200	142

When the results of male and female respondents for both projects are combined, it is observed that as income levels increase there is a fall in the total number of respondents and the number of respondents with perceptions of limited access to food and water (Table 5). In other words, it can be said that when the number of respondents is high, there is a parallel increase in the number of respondents with perceptions of limited access to food and water with equally low incomes (Fig. 6 and Fig. 7).

In the case of the Pearson correlation calculations, three scenarios have been established (Table 6). Scenario one shows the results for all males in both projects. A correlation coefficient

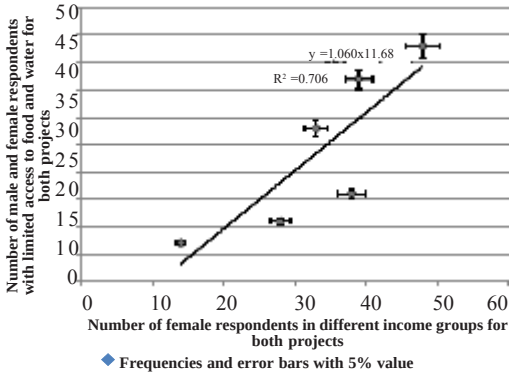

Fig. 6. Scatter plot of total male and female respondents and the number of respondents with limited access to food and water due to deforestation. A generally rising graph meaning the number of respondents with limited access to food and water increases with increases in the total number of male and female respondents

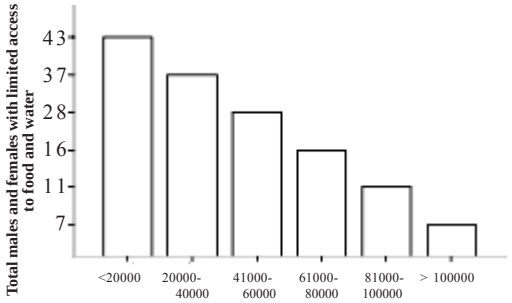

Fig. 7. Shows the inverse relationship that exists between income levels and the total male and female respondents with limited access to food and water. Figure is based on the totals for both projects and males and females as seen on Table 5.

of 0.86 depicts a generally perfect positive correlation between number in different income groups and number with limited access to food and water. In the case of scenarios two, reference is made to all females in both projects. A correlation coefficient of 0.82 also depicts a generally perfect positive correlation between number in different income groups and those with limited access to food and water (Table 6). In scenario three, reference is made to results of both males and females combined for both projects. Here, a perfect positive correlation of 0.84 between number in different income groups and number with limited access to food and water is obtained (Table 6). All these results are at a 0.05 significance level.

Table 6: Pearson Correlation results in three different scenarios between numbers in different income groups and number with limited access to food and water

Outputs	*Scenario 1*	*Scenario 2*	*Scenario 3*
Pearson Correlation (r)	0.856	0.818	0.841
Significance level (sl)	0.05	0.05	0.05
Significant 2-tailed(p)	0.02	0.047	0.036
Number of observations(n)	06	06	06

Scenario 1: Males in both the Market area and Outdoor Mosque projectsScenario 2: Females in both the Market area and Outdoor Mosque projectsScenario 3: Males and females in both projects combined

The overall implications of these results are that both the total number of respondents and the number of respondents with limited access to food and water are significantly correlated, when the number of respondents with low incomes is high, the number of respondents with perceptions of limited access to food and water is equally high (Figs. 4,5,6) .The coefficient of determination (r^2) for all the latter figures is above 60% representing a relatively above average level at which these models reliably explain the observed trends. In other words, when incomes are low, there are more respondents and also more respondents who have problems of food and water and when income levels are high, there are fewer respondents and a lower number of respondents who have problems of limited food and water reduces. It can be said that the poor with low incomes are more vulnerable to the effects of deforestation while those with higher income who are considered richer in relative terms and are less vulnerable. The number of poor respondents is higher than the number of rich ones and the community could be described as a generally poor community with high levels of vulnerability as seen from this sample of 200. In the same way, women are reported to be more vulnerable than men as seen in Figure 3.

The common reasons given by the people why the poor are more vulnerable are linked to the fact that poor people generally do not have the means to be able to purchase food and water in times of famine or water scarcity (droughts). The rich can easily adapt by buying, a capacity which the poor do not have. The low income groups are not only limited in their ability to buy food and water but are mostly farmers who cannot afford fertilizers, improved seeds and machinery, thus, years of low yields are followed by years of reinforced low yields. Women, on the other hand, are said to be vulnerable because from a cultural stand point, the area is an African Muslim community in which women are traditionally responsible for fetching water and food for household consumption. When there is scarcity of food and water, the women suffer more because they have to cover longer distances to fetch water and work longer hours on their farms. The males are traditionally responsible for rearing cattle which leaves women with no options than to walk and work longer hours to fetch water and cultivate crops to get very low yields.

DISCUSSION

The issue of population vulnerability to man-made environmental hazards such as food and water scarcity has been a subject of intense analysis from many papers. It has been argued from a socio-economic or income level stand point that the ability to absorb losses and improve resilience to food and water scarcity varies with wealth or Income levels of those concerned. Wealth enables the communities affected to be able to absorb and recover from loss rapidly due to social safety nets, insurance and entitlement programs. All these wealth related factors place communities in a better position to be less vulnerable (Cutter et al. 2003; Cutter et al. 2000; Burton et al. 1993; Blaikie et al. 1994; Peacock et al. 1997; Hewitt 1997; Platt 1999).

In addition, the World Food Program (WFP) supports this view point when it argues that the poor masses in Yemen have lower accessibility to food and water. There is a close relationship between food insecurity and poverty, some households are said to be food insecure because of poverty, insecure and vulnerable people belong to the poorest households and malnutrition and lack of access to good drinking water are all caused by poverty. However, the report also holds that, some rich households are also found with problems of food insecurity while some poor household do not; this was however in reference to fewer households and therefore, the majority of the households support the

poverty- food security and water hypothesis (WFP 2009).

From a developed world developing world perspective, the capacity to survive and recover from the repercussions of man-made hazards such as famine and food shortages is argued to be controlled by the socio-economic conditions of social groups or individuals in the developing and developed countries. In other words, vulnerability is differentiated by social groups in most natural and man-made hazards. About 70 % of people in developing countries are more vulnerable than in developed countries (Martine and Guzman 1999).

From a gender stand point, it has been argued that women appear to be more vulnerable. This is seen as women can have more difficulties recovering from man-made hazards such as famine and water scarcity than men. This high level of vulnerability has been associated to the fact that women have family care responsibilities which ties them more to issues such as providing food and water for their families. This has also been attributed to sector specific employment and wage differentials in which women are generally paid lower wages than men (Blaikie et al. 1994; Enarson and Morrow 1998; Enarson and Scanlon 1999; Morrow and Phillips 1999; Hewitt 1997).

In Vietnam, women have also been found vulnerable to declines in water and food supplies. Between 2001 and 2007, 500 000 hectares of land was lost to industrial parks in Vietnam and the resultant food declines had negative impacts on women who were described as the hardest hit. The reason advanced for this high level of female vulnerability was linked to the fact that women are less able to take advantage of new employment opportunities (mobility of labour) (Jones and Anh 2010). The effects of climate change and deforestation are similar; they may include famine, water scarcity and rising temperatures inter alia. According to the United Nations (UN 2007), in many of these situations, women in developing countries have been found more vulnerable than men. The primary reason for this gender oriented vulnerability is linked to the fact that women constitute a majority of the world's poor masses and are more dependent on natural resources that are threatened by climate change and deforestation.

CONCLUSION

This study has quantitatively evaluated the relative vulnerability of the rich and the poor on the one hand and males and females on the other to the two principal effects of deforestation (Food and water shortage). Overall, women and lower income groups are more vulnerable while the number of vulnerable is significantly correlated to the number of respondents per income group. The application of population perceptions and Pearson correlation techniques are vital in determining population vulnerability to the effects of deforestation. This approach remains vital because it can often be said that this or that segment of society is vulnerable to food and water scarcity but such conclusions will make little or no meaning if we cannot test the validity of such statements empirically. Again, the use of population perceptions gives us an inside into the sufferer's perception of the problem which in most cases reflects what really obtains on the ground. In Africa where data on such issues is difficult to come by, such sampled studies create a good framework for policy makers.

It is necessary to consider these results in relative terms and not in absolute terms. The results are based on a sample of 200 respondents and human behavior remains uncertain as reflected in perceptions. Poverty itself is a complex issue that may not be weighted by income levels only. Whatever the weaknesses, the sample size and the uncertainties in human decision making do not hamper these results since models remain a way of thinking. Ford (1999) said, "The important question is not 'Is the model valid?' but 'Is the model useful?" We urge more improvements in the sample size, prognostic studies into the future, and evaluations of the behavior of the age variable on a broad scale and comparison of the relative vulnerability accounted for by deforestation and climate change.

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