Nat Hazards (2013) 65:2147–2159
DOI 10.1007/s11069-012-0467-z

ORIGINAL PAPER

Understanding indigenous people's perception on climate change and climatic hazards: a case study of Chakma indigenous communities in Rangamati Sadar Upazila of Rangamati District, Bangladesh

Md. Nazmul Huda

Received: 13 February 2012 / Accepted: 18 October 2012 / Published online: 31 October 2012

Abstract This study explores the relationship between perception on climate change as well as climatic hazards and socio-demographic characteristics such as age, gender, occupation, exposure to mass media, amount of land, education, and income. Following simple random sampling technique, a total of 384 households were sampled from Rangamati Sadar Upazila of Bangladesh and were interviewed through a predesigned semistructured questionnaire. The findings of the study reveal that a substantial number of respondents (61 %) perceive that climate is changing moderately over the years. The bivariate results indicate that age, gender, education, occupation, income, amount of land, and access to mass media are significantly associated with perception on climate change as well as climatic hazards. In addition, age, education, and exposure to mass media are also found as significant predictors of climate change perception. Education has been found as the single best predictor.

Keywords Chakma indigenous people · Socio-demographic factors · Climate change · Climatic hazards · Perception

1 Introduction

Climate change is best viewed as a threat multiplier which exacerbates environmental, social, and economic challenges on a global scale. Research reports indicate that **c**limate change has attracted much attention in recent decades, not only because of the globally unparalleled persistence of anomalously low rainfall (Tarhule and Lamb 2003; Mengistu 2011), but also because of the low economic capacity of the affected countries to address the devastating impacts of climate change (Shahid 2010a). As a result of these ravaging impacts of climate change, extreme climate variability, such as drought, is frequently accompanied by ecological decline, decimation of livestock herds, widespread food scarcity, mass migration, and great loss of human life in Africa (Tarhule and Lamb 2003).

Md. N. Huda (✉)
The Green University of Bangladesh, Dhaka, Bangladesh
e-mail: nazmulsoc2008@gmail.com

Asia is also vulnerable to these impacts of climate change. During the period from 1975 to 2006, it was the most disaster-afflicted region in the world and had about 89 % of the people affected by disasters, 57 % of total deaths, and 44 % of the economic damage (Asian Development Bank 2010). Again, the region faces formidable environmental and socioeconomic challenges in its effort to protect valuable natural resources. In Asia, land and ecosystems are being degraded, thereby threatening the food security of this continent. In addition, water and air quality in this region are deteriorating while continued increases in consumption and associated waste have contributed to the exponential growth in the region's existing environmental problems (United Nations Framework Convention on Climate Change 2007). Furthermore, the region is highly subjected to natural hazards, such as the 2004 Indian Ocean Tsunami and the super cyclone Sidr in 2007 in Bangladesh which exceeded previous records in terms of its coverage and wind velocity (Shahid 2010b).

Bangladesh is one of the most vulnerable countries in the world to climate change (Intergovernmental Panel on Climate Change 2007). Low elevation, abundant rivers, and marine climate make Bangladesh prone to climatic hazards like flood, sea level rise, tropical cyclone, and storm surge, etc., that undermines the development activities of the country. Recurring disaster is jeopardizing present gains and putting future developments at risk. The sectors that are extremely vulnerable at present and potentially at the risk of graving threat in future are, among others, agriculture, livestock and forest resources, human settlement, human health, and biodiversity (Seal and Baten 2011). These vulnerabilities pose a serious impediment to the process of economic development of Bangladesh since it has fewer resources to adapt socially, technologically, and financially with regard to climate change impacts and vulnerabilities (United Nations Framework Convention on Climate Change 2007; Shahid 2010a).

A significant number of Chakma indigenous people have been living in Rangamati District of Bangladesh. The most devastating impacts of climate change in Rangamati and other Hill Tract Districts are severe; they include changes in the monsoon, decreased rainfall, high temperature, flash floods, hailstorms, increased environmental damage, loss of arable land, (Irfanullah and Motaleb 2011) depletion of household assets, increased untimely rainfall, increased biodiversity loss, depletion of wildlife and other natural resource base, decline in forest resources, decline in soil conditions, changing livelihood systems, etc. Cultivation has already been affected; indigenous people are not getting good crop production because of irregular rainfall and sometimes very heavy rainfall, or no rain at all. It has become a big problem for them and people here are already among the most marginalized. Their livelihoods depend on natural resources that are directly affected by climate change (Salick and Byg 2007).

Though indigenous people are very successful at preventing deforestation and managing natural environment, they are rarely considered for participation in academic discussion, policy formulation, public discourses, and researches on climate change. Most researches on indigenous people's perception of climate change issues were conducted in the developed countries of the world (Salick and Byg 2007). Only a few noteworthy researches have been carried out so far to study the people's perception on climate change and climatic hazards in Bangladesh. Rahman et al. (2011) studied the general people's perception on the magnitude of environmental problems in Bangladesh focusing on climate changes. Seal and Baten (2011) conducted a study in three districts of Bangladesh namely Shariatput, Sirajgonj, and Gaibandha to evaluate people's perception relating to the magnitude and impacts of different hazards such as flood, riverbank erosion, salinity intrusion, and water scarcity in agricultural production. Irfanullah and Motaleb (2011) examined whether indigenous people in Bangladesh were aware of any changes in timing,

frequency, and intensity of climate-related hazards. Anik and Khan (2012) evaluated climate-related perception and identified various adaptation strategies in the low lying areas of northeastern Bangladesh.

In Rangamati, extreme events such as hotter summer, decreasing rainfall, and untimely rainfall exacerbate the pressures on agricultural production, natural resources, and the environment. In order to address the challenges posed by climate change and to enhance policy toward tackling the challenges that climate change poses to Chakma indigenous people, it is important to evaluate their perception on climate change and climatic hazards, which vary by their background characteristics. Some notable studies evaluated the association between socio-demographic characteristics of the participants and climate change. Dhaka et al. (2010) examined the factors influencing the farmers' perception on climate change. The results of their study revealed that the age, farming experience, and exposures to mass media have a positive and significant relationship with farmers' perception on climate change. Again, Ayanwuyi et al. (2010) studied the association between occupation and climate change as well as its impact on livelihood. The findings of their study demonstrated that respondents involved in food crop production were more knowledgeable of climate change and even its impacts on their livelihood. Furthermore, Hasan and Akhter (2011) conducted a study in Bangladesh to show robust relationship between climate change awareness and some socio-demographic factors of the respondents such as education and exposure to mass media. The results of their study indicated that people who received formal education and had media access were more likely to be aware of the issue of climate change. Thus, the socio-demographic characteristics of the respondents have significant influence upon their perception on climate change that can contribute to policy discussions of it (Bord et al. 1998). Therefore, the following research hypothesis guided this study:

Perception of Chakma indigenous people on climate change and climatic hazards vary by their socio-demographic characteristics such as age, gender, education, occupation, income, ownership of land, and exposure to mass media.

2 Materials and methods

2.1 Overview of the study area

The study area, Rangamati Sadar Upazila (subdistrict), which is a part of Chittagong Hill Tracts (CHTs), is situated in southeastern Bangladesh approximately 340 km southeast of Dhaka, consisting of 1, 24,728 population, of which around 50 % are Chakma indigenous people. Geographically, Rangamati Sadar Upazila of Rangamati District is located between 22°30′ and 22°49′ north latitudes and between 92°04′ and 92°22′ east longitudes and covers approximately 546.48 sq km (Bangladesh Bureau of Statistics 2012). It is characterized by hot and humid summer and cold winter. The climate is characterized by moderately high temperature for about 8 months in the year, maximum temperature is 34.6 °C in summer and minimum 13.4 °C in winter season while annual rainfall is about 3,031 mm (Banglapedia 2011).

2.2 Household surveys

A household survey was conducted in May 2011. A total of 384 households were drawn from Rangamati Sadar Upazila (subdistrict) of Bangladesh following simple random

sampling technique. First of all, voter lists of Chakma indigenous people were collected from the election commission office of Rangamati District in order to gather data from the study area. Then, each participant of this study was picked out using lottery method. Therefore, each participant had the same probability of being chosen. Finally, 384 randomly selected respondents were interviewed through a predesigned semistructured questionnaire.

2.3 Data analysis

Data from the questionnaire were analyzed using the Statistical Package for the Social Sciences (SPSS) software (Version 16). The analysis was carried out at three stages: descriptive statistics, bivariate analyses and multivariate logistic regression. In this study, descriptive statistics were used to examine the participants' socio-demographic characteristics, exposure to mass media, and perception on climate change as well as climatic hazards. The scores on the socio-demographic characteristics, exposure to mass media, and perception on climate change as well as climatic hazards were in frequency and percentage form of categorized responses. In the process of analysis, relationships supporting or refusing the preformulated hypothesis were subjected to statistical tests of significance. Test statistic like Cramer's V was used to measure the magnitude/strength of relationships among the variables. In addition, a binary logistic regression model was employed to explore the possible effects of each predictor variable on climate change perception.

3 Results and discussions

3.1 Socio-demographic characteristics of Chakma indigenous people

A total of 384 respondents were interviewed ranging from 20 to 80 years old. Most respondents were males though a substantial proportion, 30 %, were females. All respondents were recruited from Chakma communities and 68 % of them were married. A substantial proportion of respondents (88 %) had formal education; of them about 32 % attended secondary or higher level schooling.

The occupational structure of the respondents shows that around half, 49 %, are farmers. Next to farming is service, which is the occupation of 32 % respondents. However, only 11 and 8 % are businessmen and students, respectively. In terms of ownership of land, around three-fourths of the participants have <5 acres of land. With respect to the monthly household income, approximately half of the respondents' monthly household income is less than TK. 5,000 (Fig. 1).

3.2 Exposure to mass media

Media has played a role in exposing climate change issues (Hannigan 1995). Access to information through the media is essential to increase indigenous people's knowledge and awareness regarding climate change. This study assesses exposure to media by asking respondents whether they read newspapers, watch television (TV), and listen to radio. However, readership of newspaper and viewership of TV depend on the availability of, and access to, those either at home or in the neighborhood.

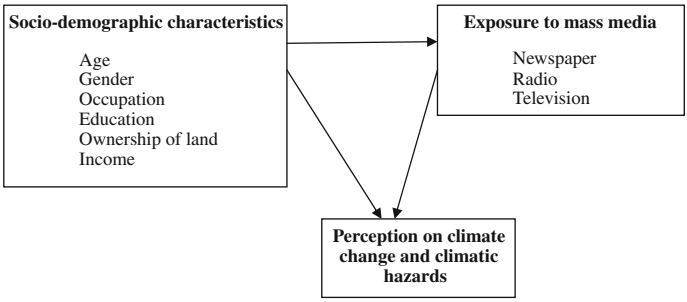

Fig. 1 Conceptual framework of the study

During the time of survey, respondents were asked whether they read newspapers or not. Overall, 28 % respondents replied that they read newspapers. Newspaper readership was sharply higher among the educated respondents. Young indigenous people tended to watch television more compared with respondents of other age groups. The proportion of Chakma indigenous people who had radio exposure was quite high (61 %). Listenership of radio also varies by age groups. It was the highest among the young indigenous people (Tables 1, 2).

3.3 Perception on climate change and climatic hazards

With respect to the perception of climate change, most of the respondents (71 %) agreed that climate is changing as shown in Table 3; of them 61 % opined that climate is changing moderately and it results in various climate-induced natural disasters. This finding is moderately consistent with the baseline study carried out by Practical Action Nepal (2006) and also with the study conducted by Mengistu (2011) on the farmers of Ethiopia. The latter study finds that temperature is increasing in Ethiopia over the last two decades. The findings of the baseline study show that 98 % of the people have perceived a change in climate, of which 95 % have perceived increasing droughts and erratic rainfall as the main indicators. Furthermore, this percentage of climate change perception of the current study is consistent with the studies conducted by Kemausuor et al. (2011) and Dessai and Sims (2010). According to their study, majority of the respondents believe that climate is changing.

On the contrary, with regard to climate change, another study carried out by Letson et al. (2001) suggests that as low as 38 % of the respondents opine that climate has changed over the several years in South America. Again, Anik and Khan (2012) carried out a study in the three villages of Jamalganj upazila under Sunamganj district of Bangladesh where only a few number (10 %) of the respondents reported that they noticed change in the climate since the study was conducted on the farmers, fishermen, and petty businessmen who were mostly uneducated. On the other hand, most of the respondents (88.3 %) were educated in this study as shown in Table 1. Therefore, there is a significant difference between the findings of these two studies.

Considering the issue of hotter summer, majority of the indigenous people (88 %) of the current study reported that summer is becoming hotter moderately. In terms of amount of annual rainfall, a significant number (76 %) of respondents stated that amount of annual rainfall is decreasing every year with varied rainfall anomalies. This percentage of the respondents is consistent with that of the study conducted in Terai regions of Nepal by

Table 1 Socio-demographic characteristics of Chakma indigenous people ($n = 384$)

Socio-demographic characteristics	Number	Percent
Age (in years)		
<30	237	61.7
30–50	78	20.3
>50	69	18
Average age = 35.11 years, SD = 8.12		
Gender		
Male	268	69.79
Female	116	30.21
Marital status		
Married	262	68.22
Unmarried	122	31.77
Educational status		
Having formal education	339	88.3
Not having formal education	45	11.7
Occupational structure		
Farmer	188	48.96
Businessman	42	10.94
Service holder	124	32.29
Student	30	7.81
Ownership of land (in acres)		
<5	291	75.78
>5	93	24.22
Average land = 5.59 acres, SD = 1.11		
Income (in taka)		
<5,000	182	47.4
5,000–10,000	131	34.1
>10,000	71	18.5
Average monthly income = 6,711 taka, SD = 1,256		

Table 2 Exposure to mass media of Chakma indigenous people ($n = 384$)

Exposure to mass media	Number	Percent
Do you read newspaper?		
Yes	108	28
No	276	72
Do you watch television?		
Yes	230	60
No	154	40
Do you listen to radio?		
Yes	235	61
No	149	39

Tiwari et al. (2010). Apart from insufficient rainfall in the study area, 71 % of the study subjects in this study said that rainfall is not occurring timely when it is necessary. Untimely and uneven occurrence of rainfall has led to decrease in crop production per unit

Table 3 Percentages of respondents by perception on climate change and climatic hazards ($n = 384$)

Perception on climate change and climatic hazards	Number	Percent
Perception on whether climate is changing or not		
Yes, climate is changing	273	71
No, climate is not changing	111	29
Perception on whether summer is becoming hotter or not		
Yes, summer is becoming hotter	338	88
No, summer is not becoming hotter	46	12
Perception on whether amount of annual rainfall is decreasing or not		
Yes, amount of annual rainfall is decreasing	292	76
No, amount of annual rainfall is not decreasing	92	24
Perception on whether rainfall is occurring timely or not		
Yes, rainfall is occurring timely	111	29
No, rainfall is not occurring timely	273	71

land in the study area. This finding is consistent with the study conducted by Maharjan et al. (2011) in western Terai of Nepal.

3.4 Association between selected socio-demographic factors and perception on climate change as well as climatic hazards

3.4.1 Association between age, gender, education, occupation, exposure to mass media, income, and perception on climate change

Table 4 shows the statistical association between a set of socio-demographic factors and indigenous people's perception on climate change as well as climatic hazards. The results reveal that age is found to be significantly associated with perception on climate change. It indicates that younger indigenous people are more likely to perceive the changes in climate. Gender is also seen to be significantly related to perception on climate change. The data show that males are more likely to perceive the changes in climate than females. This type of association is consistent with the study conducted by Ishaya and Abaje (2008). Their study comes from a direct field study of 225 indigenous people in five selected villages in Jama'a Local Government Area in the southern part of Kaduna State in Nigeria. The findings of their study suggest that males are more likely to perceive climate change because, compared with females, they have better education and awareness regarding climate change.

Bivariate results of the study suggest that educated indigenous people are more likely to perceive the changes in climate than uneducated indigenous people. The findings also indicate that service holders (e.g., NGO workers) tend to perceive climate change more than other occupational groups. This is because they are educated and they have more access to mass media such as radio, television, and newspaper. Again, perception on climate change is significantly related to another two factors: exposure to mass media and monthly household income. It indicates that indigenous people with higher degree of access to mass media and with higher level of monthly household income are more likely to perceive the changes in climate. This association is consistent with the study conducted by Hasan and Akhter (2011) on the people of Dhaka city, Bangladesh. The findings of their

Table 4 Summary table of Cramer's V values on perception on climate change and climatic hazards by socio-demographic factors

Socio-demographic factors	Perception on climate change and climatic hazards			
	Perception on climate change	Perception on whether summer is getting hotter	Perception on whether rainfall is decreasing	Perception on whether rainfall is occurring when it is necessary
Cramer's V values				
Age	$V = 0.40$***	$V = 0.39$**	$V = 0.19$*	$V = 0.42$***
Gender	$V = 0.25$*	$V = 0.12$	$V = 0.37$***	$V = 0.28$*
Education	$V = 0.26$**	$V = 0.14$	$V = 0.22$	$V = 0.46$***
Occupation	$V = 0.42$***	$V = 0.18$	$V = 0.33$***	$V = 0.26$*
Exposure to mass media	$V = 0.32$**	$V = 0.26$*	$V = 0.42$	$V = 0.10$
Ownership of land	$V = 0.15$	$V = 0.47$**	$V = 0.50$***	$V = 0.50$***
Income	$V = 0.82$***	$V = 0.77$***	$V = 0.59$***	$V = -0.77$***

*** $p = 0.001$; ** $p = 0.01$; * $p = 0.05$

study suggest that people who have access to mass media are more likely to perceive the change in climate.

3.4.2 Association between age, ownership of land, exposure to mass media, income, and perception on hotter summer

Next in significance is hotter summer, which is significantly associated with four socio-demographic variables as shown in Table 4. The study reveals that age is found to have strong association with perception on hotter summer. The bivariate table shows that younger indigenous people tend to perceive hotter summer more than older respondents. Ownership of land is also related to hotter summer perception. The findings suggest that respondents having 1–5 acres of land tend to comprehend hotter summer to greater extent. Mass media is another significant determinant of perception on hotter summer. The study findings indicate that exposure to mass media is positively associated with perception on hotter summer ($V = 0.26$, $p < 0.05$), that is, the more the degree of access to mass media (e.g., radio, television, newspaper, etc.), the more the degree of hotter summer perception. Income is also statistically significant in regard to perception on hotter summer ($V = 0.77$, $p < 0.001$). The crucial reason behind this association is that participants who belong to the higher income group have the greater degree of exposure to various mass media such as radio, television, and newspaper, which make them aware of the issue of hotter summer.

3.4.3 Association between socio-demographic factors and perception on decreasing rainfall

This study finds that perception on decreasing rainfall is significantly related to age ($p < 0.05$). Here, the coefficient ($V = 0.19$) is not strong enough, though significantly related. Data also show that decreasing rainfall perception is more prevalent among young indigenous people than older indigenous people. Gender ($V = 0.37$, $p < 0.001$) and occupation ($V = 0.33$, $p < 0.001$) are also significantly associated with perception on

decreasing rainfall. It means that male indigenous people perceive decreasing rainfall more than female respondents do.

In terms of occupation, farmers tend to perceive decreasing rainfall more than businessmen and students. Similar type of result was found in the study conducted by Deressa et al. (2009) on farmers in Ethiopia. According to their study, farmers have higher level of perception on decreasing rainfall. The reason is that farmers cultivate crops and they can easily apprehend that whether rainfall is decreasing or not. Perception on decreasing rainfall is also associated with ownership of land ($V = 0.50$, $p < 0.001$) and monthly household income ($V = 0.59$, $p < 0.001$), that is, indigenous people with higher level of income and with larger portion of land are more likely to perceive decreasing rainfall. These findings of this study are consistent with the study conducted by Ishaya and Abaje (2008) on indigenous people in Nigeria.

3.4.4 Association between socio-demographic factors and perception on untimely rainfall

The results reveal that age, gender, occupation, ownership of land, education, and income have a positive and significant relationship with indigenous people's perceptions on untimely rainfall. Again, this study finds that age is rigorously associated with perception on untimely rainfall, that is, younger respondents are more likely to perceive that rainfall is not occurring timely. Table 4 also shows that males, compared with females, are more likely to perceive that rainfall is not occurring timely when it is necessary as males are more engaged in agricultural works than females. Occupation has emerged as an important factor of perception on untimely rainfall. The findings show that farmers are more likely to comprehend that rainfall is not occurring timely than those who are engaged in other occupations like business, service, etc. At the same time, respondents having higher portion of land are more likely to perceive untimely rainfall. Moreover, there is a strong association between education and perception on untimely rainfall. Irrespective of gender, respondents without formal education are more likely to perceive untimely rainfall compared with respondents having formal education. The reason is that respondents with higher level of education do jobs in various non-agricultural sectors namely NGO, education, and government sectors, whereas participants with lower level of education or with no education are mostly farmers and petty businessmen who are directly or indirectly involved in agriculture. Therefore, farmers and petty businessmen, compared with respondents of other occupational groups, can easily perceive that rainfall is not occurring timely when it is necessary for their crops. Monthly household income is negatively associated with perception on untimely rainfall, that is, respondents having less monthly household income are more likely to perceive untimely rainfall as they think that timely rainfall can enhance their level of income. They feel the necessity of timely rainfall since their level of income is falling down due to untimely rainfall.

3.4.5 Predicting perception on climate change

To predict the perception on climate change, a binary logistic regression model is developed (Table 5). The dependent variable for the logistic regression model is whether the climate is changing or not. Independent variables included in the model are all the factors that are statistically associated ($p < 0.05$) with perception on climate change. In this model, independent variables with more than two categories are made dummy variables.

Overall, this regression model is statistically significant ($p < 0.004$) with Cox and Snell $R^2 = 0.20$. Of the determinants of climate change perception, age is found to be

significantly associated with perception on climate change and it suggests that younger indigenous people are 1.893 times more likely to perceive the changes in climate than the people with older age.

Regarding the education of the respondents, the results show that Chakma indigenous people with formal education are more likely (OR = 4.863) to perceive the changes in climate than the respondents without formal education. This finding is moderately consistent with the study conducted by Hasan and Akhter (2011). According to the findings of their study, respondents who are educated are sixty times more likely to be aware of climate change compared with the respondents who do not have formal education. Exposure to mass media is another predictor variable that shows significant relationship with perception on climate change. Odds ratio in Table 5 shows that participants who have access to mass media are 2.371 times more likely to perceive the changes in climate compared with indigenous people who do not have any kind of access to mass media.

3.5 Limitations of the study

Since every research has some limitations, this research paper is not an exception to this rule. The researchers experienced some problems in collecting data since it was not easy to

Table 5 Logistic regression of determinants of climate change perception

Determinants of climate change perception	Coefficients	Standard error	Significance	Odds ratio
Age (in years)				
<30				
>30	0.321*	0.231	0.021	1.893
Gender				
Male				
Female	−0.517	0.518	0.831	1.316
Education				
Having formal education				
Not having formal education	1.472**	0.216	0.008	4.863
Occupation				
Farmer				
Non-farmer	0.672	0.129	0.082	0.725
Ownership of land (in acres)				
<5				
>5	−0.492	0.467	0.445	1.573
Income (in taka)				
<5,000				
>5,000	0.793	0.539	0.251	1.932
Exposure to mass media				
Yes				
No	0.529*	0.275	0.023	2.371
Constant	1.538	0.395	0.549	3.236
Cox and Snell $R^2 = 0.203$				
Hosmer and Lemeshow Test: $\chi 2 = 21.47$, $df = 7$, $p = 0.004$				

** and * are significant levels at 1 and 5 %, respectively

collect data from such a hilly place like Rangamati Sadar Upazila (subdistrict). The researchers did not get access to every *para* (similar to village) due to security reasons. Therefore, it was not always possible to interview the randomly selected respondents. In that case, an unavailable respondent was replaced by the next available respondent.

4 Conclusions

Bangladesh is frequently cited as one of the most vulnerable countries to climate change (Venema and Cisse 2004). At the present time, climatic hazards like warmer temperature and decreasing rainfall start performing harshly in this country (Ministry of Environment and Forest of Bangladesh 2008) in general and in Chittagong Hill Districts (CHTs) such as Rangamati in particular. These climatic hazards result in increased ecosystem fragmentation, depletion of wildlife, decline in forest resources, and changes in the livelihood patterns of indigenous people in Rangamati. It is established from this study that a substantial number of Chakma indigenous people are aware of these changes in climate patterns. Data suggest that 61 % of the respondents opine that climate is changing moderately and it results in various climate-induced natural disasters. This study also demonstrates that males are more likely to perceive the changes in climate. Likewise, respondents without formal education are more likely to perceive untimely rainfall compared with respondents having formal education. This is because most of the respondents with higher level of education are engaged in different non-agricultural sectors such as NGOs, education, etc., whereas respondents with lower level of education or with no education such as farmers and petty businessmen are directly or indirectly involved in agricultural works where the impact is more visible. Therefore, they can easily perceive that rainfall is not occurring timely when it is necessary for their crops. With regard to the issue of hotter summer, 88 % respondents report that summer is becoming hotter moderately. In terms of amount of annual rainfall, a significant number of respondents (76 %) feel that the amount of annual rainfall is decreasing every year with varied rainfall anomalies. The bivariate results indicate that indigenous people having more income, higher level of education, and access to mass media are more likely to perceive the changes in climate patterns. Similarly, non-farmer respondents such as teachers as well as NGO workers, males, and younger indigenous people show greater propensity to perceive the changes in climate patterns. In addition, age, education, and exposure to mass media have emerged as significant predictors of climate change perception. Education has been found as the single best predictor.

Chakma communities in Rangamati have very weak approach toward combating climate change and climatic hazards-related problems. Though they are aware of the changes in climate but poverty, widespread ignorance of various adaptation strategies are the major contributing factors to the impacts they experience. In order to mitigate the impacts of climate change in the study area, knowledge and information gap concerning the effects of climate change, lack of information dissemination and awareness calls for immediate action (Ishaya and Abaje 2008). In this respect, the government and the concerned authority may play vital role as facilitators, promoters, encouragers, and guardians regarding the issues of climate change and climatic hazards in the study area.

Acknowledgments At first, the author would like to express his heartfelt gratitude to Dr. Shamsuddin Shahid, associate professor, Department of Hydraulics & Hydrology, University Technology Malaysia, who enriched this study by providing valuable articles and sage advice. Again, the author would like to

acknowledge all Chakma indigenous people from Rangamati District for their cooperation and for providing information regarding perception on climate change and climatic hazards. The author is especially thankful to Jalal Uddin, lecturer of Eastern University, Bangladesh for his guidance and suggestions. The author is also grateful to Barun Chakma for his cordial assistance in field work.

References

Anik SI, Khan MASA (2012) Climate change adaptation through local knowledge in the north eastern region of Bangladesh. Mitig Adapt Strateg Glob Change. doi:10.1007/s11027-011-9350-6

Asian Development Bank (2010) ADB climate change programs: facilitating integrated solutions in Asia and the Pacific. Mandaluyong City, Philippines. http://www.indiaenvironmentportal.org.in/files/adb-climate-change-programs-brochure.pdf. Accessed Jul 2012

Ayanwuyi, Kuponiyi E, Ogunlade FA, Oyetoro JO (2010) Farmers' perception of impact of climate changes on food crop production in Ogbomosho Agricultural Zone of Oyo State, Nigeria. Glob J Hum Soc Sci 10(7):33–40. http://socialscienceresearch.org/index.php/GJHSS/article/view/106/85. Accessed Jul 2012

Bangladesh Bureau of Statistics (2012) Population and housing census 2011: national report. Bangladesh bureau of statistics, Dhaka, Bangladesh. http://www.bbs.gov.bd/WebTestApplication/userfiles/Image/Census2011/Chittagong/Rangamati/Rangamati%20at%20a%20glance.pdf. Accessed Oct 2012

Banglapedia (2011) National encyclopedia of Bangladesh. Asiatic society of Bangladesh, Dhaka

Bord RJ, Fisher A, Connor REO (1998) Public perceptions of global warming: United States and international perspectives. Clim Res 11:75–84

Deressa TT, Hassan RM, Ringler R, Alemu T, Yusuf M (2009) Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. Glob Environ Change 12(3):55–63. http://repository.up.ac.za/bitstream/handle/2263/9270/Deressa_Determinants%282009%29.pdf?sequence=1. Accessed Jul 2012

Dessai S, Sims C (2010) Public perception of drought and climate change in southeast England. Environ Hazards 9:340–357. http://sergiorosendo.pbworks.com/f/Drought+and+CC.pdf. Accessed Feb 2012

Dhaka BL, Chayal K, Poonia MK, Kendra KV (2010) Analysis of farmers' perception and adaptation strategies to climate change. Libyan Agric Res Cen J Int 1(6):388–390

Hannigan JA (1995) Environmental sociology: a social constructionist perspective. Routledge press, London

Hasan Z, Akhter S (2011) Determinants of public awareness and attitudes on climate change in urban Bangladesh: Dhaka as a case. Eur J Soc Sci 21(1):154–162. http://www.eurojournals.com/EJSS_21_1_13. pdf. Accessed Feb 2012

Intergovernmental Panel on Climate Change (2007) (2007) Climate change 2007: impacts, adaptation and vulnerability. In: Parry ML, Canziani OF, Palutikof JP et al (eds) Contribution of working group II to the fourth assessment report of the intergovernmental panel on climate change. Cambridge University Press, Cambridge

Irfanullah HM, Motaleb MA (2011) Reading nature's mind: disasters management by indigenous peoples of Bangladesh. Indian J Tradit Knowl 10(1):80–90

Ishaya S, Abaje IB (2008) Indigenous people's perception on climate change and adaptation strategies in Jema'a local government area of Kaduna State, Nigeria. JGRP 1(8):138–143. http://www.academicjournals.org/JGRP ISSN 2070–1845. Accessed Feb 2012

Kemausuor F, Dwamena E, Plange AB, Baffour NK (2011) Farmers' perception of climate change in the Ejura-sekyedumase district of Ghana. ARPN J Agric Biol Sci 6(10):26–37. http://www.arpnjournals.com/jabs/research_papers/rp_2011/jabs_1011_321.pdf. Accessed Jul 2012

Letson D, Llovet I, Podestá G, Royce F, Brescia V, Lema D (2001) User perspectives of climate forecasts: crop producers in Pergamino, Argentina. Clim Res 19:57–67. http://www.int-res.com/articles/cr2002/19/c019p057.pdf. Accessed Jul 2012

Maharjan SK, Sigdel ER, Sthapit BR, Regmi BR (2011) Tharu community's perception on climate changes and their adaptive initiations to withstand its impacts in western Terai of Nepal. Int NGO J 6(2):035–042. http://www.academicjournals.org/ingoj/fulltext/2011/feb/Maharjan%20et%20al.htm. Accessed Jul 2012

Mengistu DK (2011) Farmers' perception and knowledge of climate change and their coping strategies to the related hazards: case study from *Adiha*, central Tigray, Ethiopia. Agric Sci 2(2):138–145. doi:10.4236/as.2011.22020

Ministry of Environment and Forest of Bangladesh (2008) Bangladesh climate change strategy and action plan 2008. Dhaka, Bangladesh. http://www.sdnbd.org/moef.pdf. Accessed Jul 2012

Practical Action Nepal (2006) Report on baseline information: jugedi khola watershed. Kathmandu

Rahman MS, Haque MM, Khan MBK (2011) Perception on climate change: an exploratory study on urban citizens. Eur J Econ Fin Admin Sci 31:17–30

Salick J, Byg A (2007) Indigenous peoples and climate change. Tyndall centre for climate change research, Oxford, U.K. http://www.ecdgroup.com/docs/lib_004630823.pdf. Accessed Oct 2012

Seal L, Baten MA (2011) Reckoning climate change: local peoples' perception on the impacts of climate change in south-central and northern Bangladesh. Unnayan Onneshan report. http://unnayan.org/reports/climate/Recokning_Climate_Change_2011.pdf. Accessed Feb 2012

Shahid S (2010a) Probable impacts of climate change on public health in Bangladesh. Asia Pac J Public Health 22(3):310–319. doi:10.1177/1010539509335499

Shahid S (2010b) Trends in extreme rainfall events of Bangladesh. Theor Appl Climatol 104:489–499. doi:10.1007/s00704-010-0363-y

Tarhule A, Lamb P (2003) Climate research and seasonal forecasting for West Africans: perceptions, disseminations, and use? Bull Am Meteorol Soc 84:1741–1759. doi:http://dx.doi.org/10.1175/BAMS-84-12-1741

Tiwari KR, Awasthi KD, Balla MK, Sitaula BK (2010) Local people's perception on climate change, its impact and adaptation practices in Himalaya to Terai regions of Nepal. Himalayan research papers archive. http://repository.unm.edu/bitstream/handle/1928/11324/Tiwari%20et%20al_Local%20people%E2%80%99s%20perception%20on%20Climate%20Change.pdf. Accessed Jun 2012

United Nations Framework Convention on Climate Change (2007) Climate change: impacts, vulnerabilities and adaptation in developing countries. Bonn, Germany. http://unfccc.int/resource/docs/publications/impacts.pdf. Accessed Feb 2012

Venema HD, Cisse M (2004) Seeing the light: adapting to climate change with decentralized renewable energy in developing countries. International Institute for Sustainable Development, Winnipeg