The nexus between the perception of climate change and disciplinary backgrounds among university students in Bangladesh

1. Introduction

The perceptions and beliefs about climate change are very multifaceted, diverse and unpredictable (Whitmarsh, 2011). Climate change perception or belief varies in terms of socio-demographic dimensions, communities and regions across the globe (Dunlap & Jacques, 2013; Fabiyi & Oloukoi, 2013, Atiqul Haq & Ahmed 2017)). For example, a study on 558 undergraduates in Florida found that 'climate change beliefs and risk perceptions are multi-facial and complex and are shaped by individuals' attitudes and beliefs' (Carlton & Jacobson, 2013). However, it is also delineated that climate change perception is locally situated (Bunce et al. 2010; Speranza et al. 2010; Battaglini et al. 2009; Byg & Salick, 2009; Brody et al. 2008). Therefore, the understanding of climate change is influenced by the knowledge, shaped by cultural and ecological contexts and socio-demographic characteristics (Haq & Ahmed, 2017). People are considered as good natural observers of their local environment (Salick et al. 2009; Turner et al. 2009).

There are enormous debates locally and internationally regarding the causes of climate change. For instance, climate change is caused by human activities (Dunlap & Jacques, 2013; Islam et al. 2013; Couzin, 2007). Moreover, Shi et al. (2016) found that majority people believe that climate change is mainly caused by human activities. On the other hand, people also consider that climate change is a consequence of man's sins (Abegunde, 2016; Debala et al. 2015; Haq & Ahmed, 2017). Shahid (2012) demonstrated that Bangladesh experienced climate change likely: rising temperature and rainfall, dramatic changes in rainfall patterns, and severe extreme weather events are occurring now and then.

The education, related with climate change, at the university level is a great concern of climate literacy (Climate Literacy Network, 2011). A study conducted on Nigerian university graduates concluded that graduates from the departments of environmental sciences have more class experience on climate change compared with the students from humanities and other faculties (Ayanlade & Jegede, 2016). The climate change related knowledge could be developed through formal and informal ways. But informal attainment could be very costly and life threatening,in a sense that anticipated loss and damage of lives and assets would have been experienced through extreme climatic events. Developing knowledge of climatic change through formal means such as introducing and integrating the components of climate change into the undergraduate or tertiary education curriculum would be effective. Acquiring such

knowledge informally derives from previous exposure to this information from the media, the web, and each graduate's everyday experience and exposure to the surrounding climate. Many graduates might experience extreme climatic events like flood, cyclone, drought etc. in their daily life. In Bangladesh, undergraduate students of all public universities come mostly from the different parts of Bangladesh. Therefore, the everyday weather and experience of extreme climatic events of students' hometown might be an issue developing their climate change concern and perception. However, key lessons on climate change issues should be taught in the form of an interdisciplinary approach, since climate change might affect nearly all sectors of human activities (Fischer et al. 2005; Ebi et al. 2006). Higher education, therefore, plays a massive role in educating students (Wachholz et al. 2014; Santoset al. 2016) where universities can do research to sort out the local and regional solutions of the global climate change problem (Leal Filho, 2010). There are many studies on climate change perception conducted on high school students (Rahman et al., 2014), on indigenous people (Huda, 2013; Kabir et al. 2016), and on household level in Bangladesh . There are several studies on university students to know a range of social aspects of Bangladesh (Ferdows & Ahmed, 2015; Islam et al.,2017; Kabir et al.,, 2018; Munshi et al., 2018; Rana et al. 2015; Shahiduzzaman et al.,, 2017; Sultana et al.,2016) but there is no study evident on climate change perception of university students. But there are some studies on climate change perception of university students conducted in Iran (Salehi et al., 2016), Portugal, Mexico and Mozambique (Morgado et al., 2017), Greece , Jordan (Almanasyeh & Shehadeh, 2013), Ethiopia (Nigatu et al., 2014), USA (Keles et al.,2016), and South Africa (Mugambiwa & Dzomonda, 2018). Thus, this study is intended to know the students' perception of climate change across the disciplines at the Shahjalal University of Science and Technology (SUST), Sylhet, Bangladesh. It is evident in some studies that science, agriculture and natural resources students perceive a better understanding of climate change than the students from humanities, engineering, business & hotel management (Beck et al., 2013; Mugambiwa & Dzomonda, 2018). This study, therefore, expected that the climate change perception will vary from one discipline to another discipline among the students of SUST. This study also incorporates some other socio-demographic and cultural factors to know how these things also shape the climate change perception along with their disciplinary backgrounds. Based on the findings of the significant variation of climate change perception, this study may suggest introducing and integrating climate change related courses to the discipline which does not have any environment related courses. That may help the students to understand climate change, learn and do research more about climate change related issues.

2. Literature reviews

2.1. Gender and Environmental Perception

It is found that environmental behavior, knowledge and concern vary from men to women (Shi et al. 2016; McCright, 2010). A study, for example, in Germany and the UK found women more concerned about climate change than that men (Shi et al. 2016). Several studies concluded climate change as risk where higher responses came from women than men (Finucane et al. 2000; McCright, 2010; Smith & Leiserowitz, 2012; Zia & Todd, 2010; Carlton & Jacobson, 2013). Haq (2013) demonstrated the association of gender and environmental degradation on indigenous people of Bangladesh and found higher environmental awareness among women. Haq and Ahmed (2017) demonstrated a contradictory perception of climate change between men and women. To say, more men than women perceived climate change as human-induced, while, in contrast, more women than men believe climate change as the God's wishes as well as the punishment of sinful activities.

2.2 Religious Views and Environmental Concern

The comprehension of climate change impacts is incorporated with religious participation (Schipper & Lisa, 2010), however, religion can influence the climate change perception (Carr et al. 2012). Haq and Ahmed (2017) included two religious' groups-Muslims and Hindus-in Bangladesh to highlight the climate change perception. They concluded that the causes of climate change vary from Muslims to Hindus-most of the Hindu respondents' support climate change as human induced, whereas, most of the Muslim hold religious beliefs in terms of the causes of climate change.

2.3 Resident and its Pertinent to Environmental Consciousness

People who experienced adverse impacts of climate change in their local areas-air pollution and heat island effects (Younger et al. 2008), sea level rise and storm surges (Kleinosky et al. 2006), specific threat (Slovic & Weber, 2002)-are more likely to perceiving climate change as risk. The level of concern of respondents varies and this depends on whether they live in urban or rural areas and the location of their tertiary institutions (Ayanlade & Jegede, 2016).

2.4 Involvement in environmental organization and climate change perception

A study in Swaziland by using Multinomial Logistic Regression (MNL) regarding adaptation choices to climate change, it is revealed that preference of adaptation choices to climate change was influenced by being a member of social group (Shongwe et al. 2014). Furthermore, they claimed that farmer's unions, organizations and cooperatives play role as resource center for information. Thus, involvement in environmental organization may provide as a resource center of information regarding climate change, which, in turn, will shape their perception as well.

2.5 Climate change related disciplinary knowledge and climate change perception

Though it is complex demonstrating the effects of several varieties of knowledge on climate change perception, this perception may be shaped by several dimensions of knowledge (Shi et al. 2016). It is

found that climate change perception is influenced by science literacy (Kahan et al. 2012). Tober et al. (2012) distinguishes climate specific literacy and science literacy where they claimed that there may not have the similar effects on climate change perception. They also found that higher levels of climate change would be incorporated with the higher climate change risk perceptions (Stevenson et al. 2014). Furthermore, worldviews play a crucial role determining climate change risk perception (Kahan et al. 2012; Smith & Leiserowitz, 2012). It is evident in a study that science, agriculture and natural resources faculty had significantly greater perceived knowledge than engineering, business & hotel management, and education & educational outreach faculty. However, in terms of climate change concern, liberal arts and other faculty had significantly greater concern than engineering, and business & hotel management faculty' (Beck et al. 2013). It is found that students from the Faculty of Science and Agriculture have a better understanding of climate change compared with students from the Faculty of Health Sciences and the Faculty of Humanities (Mugambiwa & Dzomonda, 2018).

Education level is found both positively and negatively incorporated with climate change concern (Hamilton, 2011); however, education is related with climate change knowledge (Smith et al. 2014; Taylor et al. 2014). A study in Africa found that education influences climate change perception (Abegunde, 2016). Higher education was incorporated with less perceived risk because of climate change (O'connor et al. 1999). In contrast, having a university degree induces the perception of global warming (Agho et al. 2010). Education influences the pro-environmental behavior, to say, educated are more likely taking a significant action against personal consumption-consuming less meat and water (Kim & Moon, 2012). Barr (2007) concluded that education regarding environmental knowledge plays a significant role in shaping environmental behavior. Mobley et al. (2010) demonstrated that reading nature-based literature is likely to increase one's level of general environmental knowledge, which may influence environmental values and behaviors.

3. Methodology

3.1 Location of the study and Research Group

This study was conducted on the students of Shahjalal University of Science and Technology (SUST), Sylhet. There are 41 public universities in Bangladesh where SUST is one of them. Moreover, SUST is the first science and technology public university in Bangladesh. Followed by SUST, there are total 9 science and technology public universities in Bangladesh. Apart from public universities, there are 103 private universities and 3 international universities (http://www.ugc.gov.bd/en). This study included only SUST as it is the pioneering science and technology public university of Bangladesh. There were 26 departments under the 6 school of sciences-Agricultural and Mineral Sciences, Applied Sciences and

Technology, Life Sciences, Management and Business Administration, Physical Sciences, and Social Sciences-in SUST when the study was conducted. Data was collected from the final year (4th year) undergraduate students of each department. The Bachelor's degree is a 4 years degree divided by 2 semesters in each year. This study selected 4th year students since they are senior students who might complete climate change, environment, and disaster related courses, if their discipline offered. We didn't include master's students as doing master's degree isn't mandatory and many students do master's degree from another university. Data was collected by 8 postgraduate research students enrolled in different schools (4 from Social Sciences and 4 from Other Sciences).

3.2 Sample and Data Collection Technique

According to the admission circular of SUST, the total number of undergraduate students admitted in the session 2013-14 was 1463 and the students were admitted in the 25 enlisted department (http://www.dhakatimes.net/sust-admission-sust-edu/). At present, there are 27 departments and 9262 students in SUST but this study didn't include any affiliated colleges and institutions (https://www.sust.edu/about). However, this study tried to include 40-50% of 4th year undergraduate students from each department during the data collection period. The data were collected between second half of 2016 and first half of 2017. It was quite difficult to get students from all departments at the same time because examinations for each department don't hold concurrently. We couldn't access to the students of many department when they sit for examination. Moreover, when the examinations were over, many students went to visit family or to travel. In that case, we had to wait until the next semester started. The sample for this study was 650 (44.42%) from the 25 departments and sample was assigned proportionately considering the total number of students admitted in each department (see **Table 1**).

Table 1. Sample and population of this study

Schools	Department	Total admitted	Students as Sample
Agricultural and Mineral Science	Forestry and Environmental Science	55	24
Total	1	55	24

Applied Sciences and Technology	Architecture	30	13
	Chemical Engineering and Polymer Science	50	21
	Civil and Environmental Engineering	50	21
	Computer Science and Engineering	60	26
	Electrical and Electronic Engineering	35	15
	Food Engineering and Tea Technology	40	16
	Industrial and Production Engineering	50	21
	Petroleum and Mining Engineering	35	15
Total	8	350	148
Life Sciences	Biochemistry and Molecular Biology	30	13
	Genetic Engineering and Biotechnology	35	15
Total	2	65	28
Management and Business Administration	Business Administration	70	30
Total	1	70	30
Physical Sciences[*]	Chemistry	65	28
	Mathematics	80	34
	Physics	65	28
	Statistics	80	34
	Geography and Environment	40	17
Total	5	330	132
Social Sciences	Anthropology	65	28
	Bangla	70	30
	Economics	65	28
	English	70	30
	Political Studies	65	28
	Public Administration	65	28
	Social Work	65	28
	Sociology	65	28

Total	8		530	228
Reserved for freedom fighters, disable and indigenous people			63	

This study collected data through self-administered questionnaire survey (Mugambiwa & Dzomonda, 2018). When the students were gathered together in the classroom, questionnaires were distributed to them after introducing the research objectives and some key concepts. Students were instructed how to fill up the questionnaire. Students raised their questions if they had any confusion.

Different courses taught in the undergraduate level were shortlisted from the 2013-14 syllabus using the three keywords-climate change, environment and disaster. We prepared a list of climate change, environment and disaster related courses were offered across the disciplines along with the total number of courses offered in the undergraduate level.

Measurement and Analysis

This study seeks to know the climate change perception of university students across the different disciplines. Therefore, it considers temperature, rainfall, and the causes of climate change to measure the climate change perception. This study includes several explanatory variables to know the effect of these on the perception of changes in temperature and rainfall, and the causes of climate change (see **Table 2**). To know the effects, three multinomial logistic regression models was incorporated. There are several requirements-sample size determination, membership category, and variable selection for the model (Gbetibouo, 2008)- which were met before initializing the analysis of multiple linear regression.

Dependent variables

Multinomial logistic regression (MNL) modeling approach was used to explore the relationships between the perceived changes in temperature, rainfall and the causes perceived of climate change against a set of explanatory variables (**Table 2**). The influence of the explanatory variables in the model on the outcome is summarized using odds ratios (OR) which is the ratio of the odds of an outcome level relative to a reference outcome level ('frequent fluctuation' for the temperature and rainfall model; 'both human induced and religious beliefs' for the causes of climate change model).

Independent variables

Independent variables were selected based on theoretical relevance, experience, parsimony and model fit. As it is demonstrated that climate change perception is influenced by biosocial and socio-cultural factors

(Hartter et al. 2012), wherefore, perceptions of climate change may vary based on gender (Haq & Ahmed, 2017; Hartter, 2010; McCright, 2010), age (Zahran et al. 2006), amount of formal education (Maddison, 2007). As status in society may influence the climate change perception (Wolf & Moser, 2011), biosocial factors-age, gender (both inherently biological) and religion (inherently cultural)-were taken into consideration in this study. Furthermore, concern about climate change tends to be higher for people who are urban female, and with higher levels of education. For this reason, socio-cultural factors including years of schooling (education), residential records of extreme weather events; disciplinary background (school of sciences), and environmental knowledge factors (involve in environmental organization and completing environment or climate change related courses) were accounted for by including them in the multinomial logistic regression model.

Table 2. Description of variables used to create a logistic regression model for the perceived changes in temperature, rainfall and the causes of climate change

Variables	Description	% (N)
Outcome variables	Specifying the changes in temperature perceived	

A. Perceived changes in temperature
 	
    1 Increasing
    2 Decreasing
    3 Frequent fluctuation
		86 (560)
		2 (13)
		12 (77)

B. Perceived changes in rainfall
    1 Increasing
    2 Decreasing
    3 Frequent Fluctuation
	Specifying the perceived changes in rainfall	24 (156)
		42 (273)
		34 (221)

C. Perceived causes of climate change
    1 Human induced
    2 Religious perception
    3 Both
		60 (390)
		24 (156)
		16 (104)

Explanatory variables		

a. Gender
    Male
    Female
	(Male=0; Female=1)	63 (410)
		37 (240)

b. Religion Muslim		77 (501)

Others	(Others [Hindu and Buddhist]=0; Muslim=1)	23 (149)
c. Local areas (origin area) faced any EWE? No Yes	(No=0; Yes=1)	28 (182) 72 (468)
d. Number of EWE experienced 1-4 5-8 Didn't experience any events	(1-4=1; 5-8=2; Didn't experience=3)	50 (325) 24 (156) 26 (169)
e. Involvement in environmental organization No Yes	(No=0; Yes=1)	89 (579) 11 (71)
f. Completed Environment/CC courses No Yes	(No=0; Yes=1)	73 (475) 27 (175)
g. School of sciences (discipline) Social Sciences Other	(Social sciences=1; Other=0)	31 (228) 69 (422)

Results

Climate change: the context of Bangladesh

In this study, respondents were asked about the climate change issues in Bangladesh (see **Table 3**). It is revealed that almost all the respondents (98%) think that climate is changing in Bangladesh. Climate change includes changes in temperature, changes in rainfall, and the occurrences of extreme weather events. It is illuminated that 94% respondents think that temperature is increasing in Bangladesh while 6% think that temperature isn't changing at all. They were also asked to specify the changes in temperature. Here, 86% think that it is increasing along with 2% claim as decreasing, and 12% claim as fluctuating temperature. In terms of rainfall, 96% respondents believe that rainfall is changing and 4% doesn't think so. They specified changes in rainfall: increasing rainfall by 24%, decreasing rainfall by 42%, and fluctuation of rainfall by 34%. During survey, respondents were also asked whether they think

that extreme weather events-flood, cyclone, drought, tornadoes, heavy storms, sea level rise, river erosion etc. are the results of climate change or not. These weather events are delineated as extreme when these events influence local livelihoods, agriculture, water supply, health etc. and when it accelerates vulnerability of affected people. However, 96% respondents think that extreme weather events are occurring due to the adverse impacts of climate change in Bangladesh. In this study, we asked the respondents to identify whether their locality (District) faces of faced any extreme weather events. It is elucidated that 72% respondents mentioned that their localities face extreme weather events while 28% respondents said that they didn't experience any extreme weather events in their areas.

Table 3: Notions of climate change in Bangladesh

	Percent (N)
Climate is changing	
Yes	98 (637)
No	2 (13)
Temperature change	
Yes	94 (611)
No	6 (39)
Changes in temperature	
Increasing	86 (559)
Decreasing	2 (13)
Fluctuation	12 (78)
Rainfall change	
Yes	96 (624)
No	4 (26)
Changes in rainfall	
Increasing	24 (156)
Decreasing	42 (273)
Fluctuation	34 (221)
Extreme weather events are the results of climate change	
Yes	96 (624)
No	4 (26)

Areas faces/faced extreme weather events	
Yes	72 (468)
No	28 (182)
Do you know the cause of climate change?	
Yes	97 (631)
No	3 (19)
Can you specify the cause?	
Human activities	60 (390)
Religious view	24 (156)
Both	16 (104)

Climate change in Bangladesh: the causes

Table 3 shows that 97% respondents claim they know the reasons of climate change when they were asked to specify the reasons of climate change. We divided these reasons into two categories, such as human induced climate change and religious views of climate change. Human induced perspective includes increasing population pressure, deforestation, increasing vehicles, increasing industries etc. Contrarily, religious views include climate change as a wish of God and it is the consequences of sinful activities. **Table 3** reveals that 60% consider climate change happens due to human activities. They think that people are destroying living environment through cutting trees, dredging rivers, withdrawing sands from rivers, constructing industries, using carbon emitted vehicles etc. It is also found that 24% respondents think that climate change occurs to punish the people who are doing sinful activities. They think that people are not praying regularly, they are disobeying the rules or religion, they kill people and animal, women are coming out from home etc. Lastly, 16% respondents supported both human activities and religious views as the causes of climate change.**Socio-demographic Dimensions and Climate Change Perception**

Table 4. Socio-demographic dimensions and climate change perception

Socio-demographic variables	Causes of climate change N (%)			Total
	Human induced	Religious perception	Both human cause and religious perception	

Gender				
Male	64 (262)	21 (86)	15 (62)	410 (100)
Female	55 (132)	28 (67)	17 (41)	240 (100)
Religion				
Islam	59 (296)	23 (115)	18 (90)	501 (100)
Others	63 (94)	25 (37)	12 (18)	149 (100)
Involve in environmental organization*	44 (31)	32 (23)	24 (17)	71 (100)
Yes	62 (359)	23 (133)	15 (87)	579 (100)
No				
Climate change course	60 (105)	22 (39)	18 (31)	175 (100)
Yes	60 (285)	24 (114)	16 (76)	475 (100)
No				
Areas faced EWEs*	64 (300)	20 (94)	16 (75)	468 (100)
Yes	51 (93)	32 (58)	17 (31)	182 (100)
No				
School*	63 (144)	24 (54)	13 (30)	228 (100)
SS	60 (253)	22 (93)	18 (76)	422 (100)
Others				

* Significant at 5% level of significance

Gender and climate change perception

Table 2 shows that 63% respondents are male and 37% are female. When students were asked about the reasons of climate change in the Bangladesh, 40% male and 21% female consecutively highlighted their perception towards human induced climate change-deforestation, population pressure, increasing vehicles and industries etc. Moreover, 13% male and 10% female revealed that climate change is the wish of God and it is happening due to the sinful activities against the religion: telling lies, doing immoral things, killing animals and peoples etc. However, 9% male and 6% female exposed both human induced and religious claims about the causes of climate change. However, this explanation isn't supported by statistically significant evidence such as chi square doesn't show any statistically variation (>0.05) of climate change perception across the gender (**Table 4**).

Religious background and climate change perception

This study finds three religious' groups: Islam, Hindu and Buddhist. Table 3 describes that 46% respondents of Islam, 13% of Hindu, and 2% of Buddhist think climate change as human induced. Besides, 18% respondents from Islam, 6% from Hindu believe climate change as a religious fact, particularly it is the wish of Allah or Bagavan, and climate change is to punish the people who are involved in sinful activities. Moreover, 14% from Islam and 3% from Hindu perceive that climate change is due to human activities and it is the wish of Allah or Bagavan. Succinctly, it is delineated that more respondents from Islam than other perceive climate change as the wish of Allah or a religious matter. However, *the chi square (p>0.05) doesn't signify that climate change perception of respondents vary with distinctive religious groups*.

Involvement in environmental organization and climate change perception

In this study it was sought whether the students' involvement in environment organization can influence or not the climate change perception. Table 1 show that 11% students are involved in different environmental organization. Those who are involved in environmental organization among them 44% attribute human cause, 32% attribute religion, and 24% attribute both causes (see **Table 4**). On the other hand, 89% students who are not involved in any NGOs related with environment but think that climate change is happening due to human activities (62%). We found a little bit variation of climate change perception basis on whether they are engaged in any NGOs or not (**Table 4**). Particularly, those who are not engaged in any NGOs, some of them (20%) attributed religious perception toward the climate change and both human cause and religious viewpoint (14%) as the reasons of climate change. Thus, basis on chi square results (p<0.05) we can say that *climate change perception varies across the participation of environmental organization.*

Climate change related course and the climate change perception

In the graduation syllabus many environmental or climate change related courses are taught. Students were asked through the self-administered questionnaire, whether they have completed climate change, environment and disaster related courses. 27% students reported that they have completed climate change, disaster or environment related courses. Therefore, 60% students think climate change is human induced, 24% think it is the religious fact, and 16% attribute both causes. On the other hand, 24% and 16% argued human cause and religious perception as the reason of climate change who didn't complete any climate change related courses. However, we cannot claim statistically (p>0.05) that *doing climate change related courses will lead the variation of causes of climate change.*

Residence and climate change perception

In this study, 72% respondents mentioned that their home district faced extreme weather events (**Table 2**). In this study, extreme weather event includes floods, cyclones, tornadoes, drought, river erosion, sea

level rise etc. **Table 4** shows that 64% students attributed that their areas are facing extreme weather events and think that these extreme weather events are occurred due to human activities. Moreover, 20% students claimed that their areas faced extreme weather events, but they attributed religious perception towards the climate change. It is also exposed that 51% and 32% mentioned that their areas are not facing extreme weather events, but they think that climate change is a human induced and a religious fact respectively. It is statistically revealed ($p<0.05$) that climate change perception varies with the perception of extreme weather events happen in the local area (see **Table 4**). The respondents were asked how many extreme weather events they had experienced. **Table 2** show that 50% students experienced 1 to 4 devastating extreme weather events in their locality. Moreover, 24% students experienced 5 to 8 extreme weather events in their local areas.

Respondents were asked to specify the extreme weather events they have experienced in their local areas (home district) where they brought up from the childhood. **Table 5** shows that 24% students are from different parts of Sylhet division. Sylhet division is identified as flood affected and stormy area by 75% and 25% respondents respectively. Moreover, this study included 18% students from different parts of Dhaka division. Dhaka division, particularly, is reckoned as vulnerable to flood by 34%, cyclone by 11%, drought by 10%, river erosion by 22%, and the last 22% remark that it faces heavy storm. This study surveyed 11% students of different parts of Chittagong division. The Chittagong division, therefore, is identified as vulnerable to flood (32%), cyclone (28%), drought (13%), heavy storm (20%), and river erosion (7%). Khulna, where Mangrove forest is centered, has affected by cyclone (60%), flood (9%) and drought (31%). This study surveyed 11% students who are from the different localities of Mymensingh. The localities of this division have been affected by flood (63%) and river erosion (37%). This study found 7% and 4% students from Rajshahi and Rangpur division respectively, while, all the surveyed students of the both division identified their localities as drought vulnerable. Barisal is also described as flood (55%) and cyclone (45%) affected area.

Table 5. Extreme weather events faced by specified division (according to the responders)

Name of Division	Percentage of students from each division who identified the division vulnerable to EWEs % (N)	Types of extreme weather events (EWEs)	% (N)
Sylhet	24 (156)	Flood	75 (117)
		Heavy storms	25 (39)

Dhaka	18 (117)	Flood	34 (40)
		Cyclone	11 (13)
		Drought	10 (12)
		Heavy storms	22 (26)
		River erosion	22 (26)
Chittagong	15 (98)	Flood	32 (31)
		Cyclone	28 (27)
		Drought	13 (13)
		Heavy storm	20 (20)
		River erosion	7 (7)
Khulna	10 (65)	Cyclone	60 (39)
		Flood	9 (6)
		Drought	31 (20)
Mymensingh	11 (71)	Flood	63 (45)
		River erosion	37 (26)
Rajshahi	7 (46)	Drought	100 (46)
Rangpur	4 (26)	Drought	100 (26)
Barisal	11 (71)	Flood	55 (39)
		Cyclone	45 (26)
Total	100% (650)		

* We can include a map for the disaster occurred in each division.

Disciplinary Background and Climate Change Perception

This study included students of all department of SUST to know the variation of climate change perception. Respondents from Applied Sciences argued the climate change is human induced (16%), religious perception (6%), and both human cause and religious viewpoint (4%). More respondents from Life Sciences support that climate change is a religious fact (3%) rather than human induced cause (2%). It is found that respectively 16%, 4%, and 6% respondents from Physical Sciences mentioned that climate change is human induced, a matter of religion, and both human fact and religious fact. Most of the respondents from Social Sciences (22%) claimed human induced climate change while 5% claimed about the religious perception. But the fact is revealed that is more respondents from Social Sciences (8%) in compared with other disciplines mentioned about the religious perspective in terms of the reasons of

climate change. Most of the respondents from Agricultural and Mineral Sciences (4%) argued that climate change occurs due to the human cause and the wish of God. In here, we cannot observe any noticeable results from Management and Business Administration discipline as this discipline covers only one department along with the few respondents in this study. However, it is remarkable that we can notice the statistical variation of climate change perception of different faculties. Hypothesis testing conclude that (p<0.05) *climate change perception vary with different disciplinary background of respondents.*

Association of socio-demographic variables and changes in temperature perception

To highlight the effects of explanatory variables on the perceived changes in temperature, rainfall and the perceived causes of climate change, three MNL models were developed while the explanatory variables were same for the all models. The MNL analysis regarding the perceived changes in temperature indicated that effects of gender, involvement in environmental organization and completed environment or climate change related courses were found statistically significant (P<0.05) (**Table 6**).

However, the variables-years of schooling, religion, experienced extreme weather events in local areas, number of events experienced, and school of sciences-were found non-significant in terms of predicting perception of temperature changes. Anyway, the likelihood ratio statistics as indicated by chi-square=74.105 were found to be highly significant at 1% level of significance, suggesting strong explanatory power of the model. It is important to note that the estimated coefficients should be compared with the base category of frequent fluctuation any of the two perceived changes in temperature.

Explanatory variables	Overall significance of the variable (p)	Group/Reference	Increasing		Decreasing	
			Coefficient (Odds ratio)	p	Coefficient (Odds ratio)	p
Gender	$.005^{**}$	Female	.826 (2.283)	$.002^{*}$	.085 (1.089)	$.917^{ns}$
Religion	$.711^{ns}$	Others	.196 (1.217)	$.514^{ns}$	-.327 (.721)	$.722^{ns}$
Local areas faced EWE	$.727^{ns}$	No	-.607 (.545)	$.422^{ns}$	-.031 (.969)	$.993^{ns}$
Number of EWE experienced	$.561^{ns}$	1 vs 3	.897 (2.453)	$.238^{ns}$	-1.406 (.245)	$.674^{ns}$
		2 vs 3	.957 (2.605)	$.241^{ns}$	-19.725 (2.713E-009)	
Involvement in Environmental Organization	$.044^{*}$	No	.893 (2.442)	$.023^{*}$	-.189 (.828)	$.880^{ns}$
Environment of CC courses completed	$.006^{**}$	No	-1.082 (.339)	$.003^{*}$	-.260 (.771)	$.836^{ns}$
School of Sciences	$.374^{ns}$	Other Sciences	.209 (1.232)	$.447^{ns}$	1.123 (3.075)	$.190^{ns}$
Observation used	644					

#Reference level=Frequent fluctuation; pseudo R^2=19%; **=Highly significant; *=Significant; ^{ns}=No significant.

Table 6. Parameter estimates from the multinomial logistic regression model of the perceived changes in temperature

Different levels of perception were found to have shown different odds for a unit change in various explanatory variables (**Table 6**). Furthermore, the two perceived changes have responded to varying odds to different explanatory variables used in the analysis. For instance, the perceived levels of increasing temperature are influenced significantly by gender, involvement in environmental organization and completing environment or climate change related courses (P<0.05). There has been a greater likelihood to be male responders (odds ratio 2.283) perceiving temperature as increasing. Moreover, the relative risk of being in the group where students were involved in environmental organization and thereupon activities compared with those who were not involved likely would be 2.442 times more likely perceiving temperature as increasing when the other variables in the model are held constant. Meanwhile, there has been a greater probability to be included in the referent group-frequent fluctuation-for those who didn't complete environment or climate change related courses under their discipline or elsewhere. That means, it is more likely considering temperature as frequently fluctuated by the students who didn't complete environment or climate change related courses. Besides these explanation, the rest of the explanatory variables (such as years of schooling, religion, number of events experienced, and school of sciences) except the variable 'whether local areas faced or not any extreme weather events' were found to have positive effects increasing the perception of temperature as increasing with the change of unit in the aforementioned explanatory variables, though these changes are not significant statistically (P>0.05). However, the perception toward decreasing temperature isn't found to be influenced by any variables since there were few cases of responses on the decreasing temperature.

Association of Socio-demographic variables and changes in rainfall perception

The model regarding the perceived changes in rainfall is explained significantly by years of schooling, gender, religion, involvement in environmental organization, and school of sciences (**Table 7**). However, rest three variables-experienced extreme weather events in local areas, number of events experienced, and environment or climate change related courses completed-were found non-significant statistically (P>0.05) though these variables demonstrate positive effects on increasing and decreasing rainfall perception. The expected risk of reporting the rainfall as increasing compared with frequent fluctuation is lower for the students having less years of schooling. However, there has been positive strong association evolved in the two variables determining the rainfall as decreasing. For instance, involvement in environmental organization increases the chance of selecting rainfall as increasing (odds ratio 2.029). Furthermore, the relative risk ratio of switching from other sciences to social sciences is 1.763 for being in the increasing rainfall vs frequent fluctuation. The expected risk of belonging in the increasing rainfall group is higher for students who are from social sciences compared with their counterparts who are from other sciences.

On the other hand, the perception toward decreasing rainfall is influenced significantly by five variables- years of schooling, gender, religion, involvement in environmental organization and school of sciences- out of nine explanatory variables. Following the same trend of increasing rainfall, it is revealed that the expected risk of claiming the rainfall as decreasing is lower for the students who have completed less years of schooling or who have lower educational level. Anyway, the relative risk ratio of switching from female to male is 1.808 for being in the decreasing rainfall vs frequent fluctuation. To say, the expected risk of belonging to the decreasing rainfall group is higher for the male students than female students. In terms of religion, the relative risk ratio of switching from others to Muslim is 2.034 for being in the decreasing rainfall vs frequent fluctuation. That is, the relative risk of being in the Muslim group compared with others would be 2.034 times more likely perceiving rainfall as decreasing when the other variables in the model are held constant. Moreover, the involvement in environmental organization increases the likelihood of perceiving rainfall as decreasing where odds ratio is 2.209. Finally, the relative risk ratio of switching from other sciences to social sciences is .640 for being in the decreasing rainfall vs frequent fluctuation. That is, the expected risk of staying in the decreasing rainfall group is lower for students from social sciences compared with their other sciences counterparts.

Explanatory variables	Overall significance of the variable (p)	Group/Reference	Increasing		Decreasing	
			Coefficient (Odds ratio)	p	Coefficient (Odds ratio)	P
Gender	$.009^{**}$	Female	.068 (1.070)	$.761^{ns}$	.592 (1.808)	$.005^{**}$
Religion	$.011^{*}$	Others	.244 (1.276)	$.324^{ns}$	.710 (2.034)	$.003^{**}$
Local areas faced EWE	$.176^{ns}$	No	.650 (1.915)	$.277^{ns}$	-.552 (.576)	$.411^{ns}$
Number of EWE experienced	$.224^{ns}$	1 vs 3	.695 (2.003)	$.259^{ns}$	.444 (1.558)	$.516^{ns}$
		2 vs 3	1.133 (3.106)	$.081^{ns}$	.389 (1.476)	$.582^{ns}$
Involvement in Environmental Organization	$.026^{*}$	No	.707 (2.029)	$.044^{*}$	.793 (2.209)	$.015^{*}$
Environment of CC courses completed	$.589^{ns}$	No	.157 (1.170)	$.550^{ns}$	-.113 (.893)	$.637^{ns}$
School of Sciences	$.000^{**}$	Other Sciences	.567 (1.763)	$.011^{*}$	-.447 (.640)	$.036^{*}$
Observation used	634					

#Reference level=Frequent fluctuation; pseudo R^2=19%; **= Highly significant; *= Significant; ^{ns}= No significant.

Table 7. Parameter estimates from the multinomial logistic regression model of the perceived changes in rainfall

Association of Socio-demographic variables and causes of climate change

The MNL analysis regarding the perceived causes of climate change indicated that effects of gender, involvement in environmental organization and school of sciences were found statistically highly significant (P<0.05). Anyway, the likelihood ratio statistics as indicated by chi square 55.943 were found to be highly significant at 1% level of significance which suggest strong explanatory power of the model. It should be noted that the estimated coefficients are compared with the referent group both human cause and religious perception of climate change.

The perceived causes of human induced climate change are influenced significantly (P<0.05) by the variables that explained the model. For instance, there has been greater likelihood of being male students perceiving climate change as human induced (odds ratio 1.376). The perception of climate change as human induced is higher for the students who had experienced extreme weather events in their local areas (odds ratio 1.631). It is revealed that involvement in environmental organization leads to the higher perception (odds ratio 2.427; P<0.05) of considering climate change as human induced while the religious perception of climate change is not influenced by this variable at all (P=.783). Finally, the relative risk of being in the social sciences discipline compared with other sciences would be 1.976 times more likely considering human induced climate change when the other variables in the model are held constant. Succinctly, comparatively more male-involved in different environmental activities-from social sciences perceived climate change as human induced.

Meanwhile, the religious perception of climate change is influenced by two variables-gender and school of sciences. The relative risk ratio of switching from female to male is .877 for being in the religious perception vs both human induced and religious perception of climate change. In other words, the expected risk of reporting the religious perception of climate change is lower for male students compared with female students. Like previous explanation, school of sciences play crucial role determining the religious perception of climate change. For example, there has been a greater likelihood of including students from social sciences perceiving religious facts of climate change. To sum up, more female students from social sciences than from other sciences revealing their perception of climate change to religious issues.

Explanatory variables	Overall significance of the variable (p)	Group/Reference	Human Induced CC		Religious Beliefs	
			Coefficient (Odds ratio)	P	Coefficient (Odds ratio)	P
Gender	.048*	Female	.319 (1.376)	.030*	-.131 (.877)	.018*
Religion	.340ns	Others	-.409 (.665)	.159ns	-.387 (.679)	.234ns
Local areas faced EWE	.021*	No	.489 (1.631)	.011*	.759 (2.136)	.385ns
Number of EWE experienced	.727ns	1 vs 3	.906 (2.475)	.267ns	.522 (1.685)	.554ns
		2 vs 3	.665 (1.945)	.427ns	.290 (1.337)	.750ns
Involvement in Environmental Organization	.009**	No	.887 (2.427)	.012*	.105 (1.110)	.783ns
Environment of CC courses completed	.290ns	No	.181 (1.198)	.507ns	.469 (1.599)	.136ns
School of Sciences	.019*	Other Sciences	.681 (1.976)	.006**	.557 (1.745)	.047*
Observation used	650					

#Reference level=both human induced and religious beliefs; pseudo R^2=19%; **=Highly significant; *=Significant; ns=No significant.

Table 8. Parameter estimates from the multinomial logistic regression model of the perceived causes of climate change

Discussions

This study delineated the perceived changes in climate change, temperature and rainfall. Almost all the participated students perceive climate change is prevailed in Bangladesh. This study finds that the temperature in Bangladesh is increasing which is reported by 86% students. The perceived changes in rainfall vary. Majority of the students (42%) perceived the decreasing rainfall. Similarly, approximately one-third (34%) students perceived the fluctuation of rainfall. The increasing pattern of temperature and fluctuation of rainfall in Bangladesh are evident in other studies (Rahman & Lateh, 2017; Shahid, 2009; Shahid, Harun, & Katimon, 2012; Shahid et al., 2016). The perception of changes in temperature and rainfall also go with the local voices (Haq & Ahmed, 2017; Kabir et al., 2016).

The perceived levels of increasing temperature are influenced significantly by gender, involvement in environmental organization and completing environment or climate change related courses. Most of the male students who are also engaged in environmental organization and completed environment, climate change and disaster related courses perceive the temperature as increasing. On the other hand, the students not engaged in any environmental organization perceived the temperature as fluctuated. The model regarding the perceived changes in rainfall is explained significantly by gender, religion, involvement in environmental organization, and school of sciences. More students from Social Sciences and who are involved in environmental organization perceived the rainfall as increasing. More male Muslim students from Other Sciences perceived the rainfall as decreasing.

Comparatively more male-involved in different environmental activities-from Social Sciences perceived climate change as human induced. Almost two-third (64%) male students of this study supports human induced climate change (see **Table 4**). As belonging to a social group influences the choices (Shongwe, Masuku, & Manyatsi, 2014), this study reveal that male students engaged in environmental organization believe climate change as a result of human activities. Engaged in environmental organization might lead the scientific explanation of climate change by the male students (Jacobs & Simpkins, 2005). More female students from Social Sciences than from Other Sciences revealing their perception of climate change to religious issues. **Table 4** shows that a few more female than male emphasized the religious perception in terms of the causes of climate change. This finding supports the study of Haq and Ahmed (2017) where the authors find more women than men tagging the causes of climate change with religious beliefs.

In terms of climate change concern, however, liberal arts and other faculty had significantly greater concern than engineering, and business & hotel management faculty (Beck et al. 2013). This study finds the variation of the perceived causes of climate change across the disciplines. Particularly, more students from Social Sciences than Other Sciences perceive climate change because of human activities. **Table 9** (

see **Appendix A**) shortlisted the courses offered across the disciplines. **Table 9** (see **Appendix A**) shows that School Social Sciences comprise of 8 departments which offer 6 courses out of 425 courses related to climate change, disaster, and environment. On the other hand, Other School of Sciences are Agricultural and Mineral Science, Applied Sciences and Technology, Life Sciences, Management and Business Administration, and Physical Sciences.

This study finds that only 27% completed environment, disaster or climate change related courses (see **Table 2**) but completing these courses doesn't shape their climate change perception (see **Table 4**). However, the students completed these courses are claiming the temperature 'increasing' (see **Table 6**). The 17 departments from Other Sciences offered only 26 courses are termed with 'disaster', environment' and 'climate change' (see **Table 9**). There are 10 departments-Computer Science and Engineering, Electrical and Electronic Engineering, Food Engineering and Tea Technology, Industrial and Production Engineering, Business Administration, Mathematics, Physics, Statistics, Bangla, and Political Studies-which don't offer any courses related to disaster, environment, and climate change.

It is statistically evident that the experience of extreme weather events in the home district of students influence the climate change perception. Most of the students (64%) who had experienced extreme weather events in their home district perceived the climate change as human induced. On the other hand, religious perception of climate change is incorporated with the one-third students (32%) who hadn't experienced any events in their localities (see **Table 4**). Thus, the experience of extreme weather events in localities determine the climate change perception (see **Table 8**). This study, therefore, marked the all divisions in Bangladesh based on the types of extreme weather events happened different parts of Bangladesh. It is, finally, suggested that localities influence the climate change perception and concern (Ayanlade & Jegede, 2016; Kleinosky, Yarnal, & Fisher, 2007; Younger, Morrow-Almeida, Vindigni, & Dannenberg, 2008).

Conclusions

The perception of climate change of students is delineated by the changes in temperature and rainfall, causes of climate change, and considering the extreme weather events as the results of climate change. The students perceived that temperature is increasing, rainfall is decreasing, and extreme weather events (extreme temperature and rainfall, flood, cyclone, sea level rise, salinity, tornado etc.) are the direct and indirect impacts of climate change. Similarly, 72% responders of the study mentioned their home districts where they born and grown up are vulnerable to different extreme weather events. In terms of the causes of climate change, most of the responders perceived it as human induced.

Perceived changes in temperature are determined by gender, involvement in environmental organization, and completion of environment/climate change related courses. For example, male students involving in

environmental organization perceived the temperature as increasing. Moreover, the perceived changes in rainfall are determined by gender, age, years of schooling, involvement in environmental organization, and school of sciences. To say, students from social sciences along with the involvement of environmental organization perceived the rainfall as increasing. In terms of the causes of climate change, comparatively male students from Social Sciences involving in environmental organization perceived climate change as human induced. On the other hand, more female students from Social Sciences compared with Other Sciences perceived the religious views of climate change. This study suggests further research including more samples and populations from different public and private universities of Bangladesh.

References

Hamilton LC (2011) Education, politics and opinions about climate change evidence for interaction effects. Climate Change 104(2):231–242. doi:10.1007/s10584-010-9957-8.

Finucane ML, Slovic P, Mertz CK, Flynn J, Satterfield TA (2000) Gender, race, and perceived risk: the "white

male" effect. Health Risk Soc 2(2):159–172. doi:10.1080/713670162

McCright AM (2010) The effects of gender on climate change knowledge and concern in the American public.

Popul Environ 32(1):66–87. doi:10.1007/s11111-010-0113-1

Smith N, Leiserowitz A (2012) The rise of global warming skepticism: exploring affective image associations in

the United States over time. Risk Anal 32(6):1021–1032. doi:10.1111/j.1539-6924.2012.01801.x

Zia A, Todd AM (2010) Evaluating the effects of ideology on public understanding of climate change science:

How to improve communication across ideological divides? Public Underst Sci 19(6):743–761. doi:10.1177/

09636625509357871

Younger M, Morrow-Almeida HR, Vindigni SM, Dannenberg AL (2008) The built environment, climate change,

and health: opportunities for co-benefits. Am J Prev Med 35(5):517–526. doi:10.1016/j.amepre.2008.08.017

Kleinosky LR, Yarnal B, Fisher A (2006) Vulnerability of Hampton Roads, Virginia to Storm-Surge Flooding

and Sea-Level Rise. Nat Hazards 40(1):43–70. doi:10.1007/s11069-006-0004-z

Slovic P, Weber EU (2002) Perception of risk posed by extreme events. in risk management strategies in an

uncertain world. Palisades, NY

Smith N, Leiserowitz A (2012) The rise of global warming skepticism: exploring affective image associations in

the United States over time. Risk Anal 32(6):1021–1032. doi:10.1111/j.1539-6924.2012.01801.x

Kahan DM, Peters E, Wittlin M, Slovic P, Ouellette LL, Braman D, Mandel G (2012) The polarizing impact of

science literacy and numeracy on perceived climate change risks. Nat Clim Chang 2(6):1–4, Retrieved from

http://www.nature.com/doifinder/10.1038/nclimate1547

Tobler C, Visschers VHM, Siegrist M (2012) Consumers' knowledge about climate change. Clim Chang 114(2):

189–209. doi:10.1007/s10584-011-0393-1

Stevenson, K. T., Peterson, M.N., Bondell, H.D., Moore, S.E., & Carrier, S.J. (2014). Overcoming skepticism with education: interacting influences of worldview and climate change knowledge on perceived climate change risk among adolescents. Climatic Change, 126:293–304. DOI 10.1007/s10584-014-1228-7

Shongwe, P., Masuku, M.B., Manyatsi, A.M. (2014). Factors Influencing the Choice of Climate Change Adaptation Strategies by Households: A Case of Mpolonjeni Area Development Programme (ADP) in Swaziland. Journal of Agricultural Studies, Vol. 2, No. 1. Pp 86-98.

Dunlap, R. E., & Jacques, P. J. (2013). Climate change denial books and conservative think tanks: Exploring

the connection. American Behavioral Scientist, 57(6), 699–731.

Fabiyi, O. O., & Oloukoi, J. (2013). Indigenous knowledge system and local adaptation strategies to flooding

in coastal rural communities of Nigeria. Journal of Indigenous Social Development, 2(1), 1–19.

Salick, J., & Byg, A. (2007). Indigenous peoples and climate change. Oxford: A Tyndall Centre Publication.

Tyndall Centre for Climate Change Research.

Smith, W. J, Jr., Liu, Z., Safi, A. S., & Chie, K. (2014). Climate change perception, observation and policy

support in rural Nevada: A comparative analysis of Native Americans, non-native ranchers and farmers and mainstream America. Environmental Science and Policy, 42, 101–122.

Taylor, A., de Bruin, W. B., & Dessai, S. (2014). Climate change beliefs and perceptions of weather-related

changes in the United Kingdom. Risk Analysis,. doi:10.1111/risa.12234.

Abegunde, A.A.. (2016). Local communities' belief in climate change in a rural region of Sub-Saharan Africa. Environ Dev Sustain. DOI 10.1007/s10668-016-9816-5

Dunlap, R. E., & Jacques, P. J. (2013). Climate change denial books and conservative think tanks: Exploring

the connection. American Behavioral Scientist, 57(6), 699–731.

Islam, M., Barnes, A., & Toma, L. (2013). An investigation into climate change scepticism among farmers.

Journal of Environmental Psychology, 34, 137–150.

Couzin, J. (2007). Opening doors to native knowledge. Science, 315, 1518–1519.

Debela,N., Mohammed, C., Bridle, K.., Corkrey, R., and McNeil, D. (2015). Perception of climate change and its impact by smallholders in pastoral/agropastoral systems of Borana, South Ethiopia. SpringerPlus, 4:236. DOI 10.1186/s40064-015-1012-9

Carlton, S.J., Jacobson, S.K. (2013). Climate change and coastal environmental risk perceptions in Florida. Journal of Environmental Management 130, pp. 32-39.

Brody SD, Zahran S, Vedlitz A, Grover H (2008) Examining the relationship between physical vulnerability

and public perceptions of global climate change in the United States. Environ Behav 40(1):72–95

Battaglini A, Barbeau G, Bindi M, Badeck FW (2009) European winegrowers's perceptions of climate change

Impact and options for adaptation. Reg Environ Chang 9:61–73

Byg A, Salick J (2009) Local perspectives on a global phenomenon - climate change in Eastern Tibetan villages. Glob Environ Chang 19:156–166

Bunce M, Rosendo S, Brown K (2010) Perceptions of climate change, multiple stressors and livelihoods on

marginal African coasts. Environ Dev Sustain 12:407–440

Speranza CI, Kiteme B, Ambenje P, Wiesmann U, Makali S (2010) Indigenous knowledge related to climate

variability and change: insights from droughts in semi-arid areas of former Makueni District, Kenya.

Climate Change 100:295–315

Salick J, Fangb Z, Byg A (2009) Eastern Himalayan alpine plant ecology, Tibetan ethnobotany, and climate

change. Glob Environ Chang 19(2):147–155.

Turner WR, Oppenheimer M, Wilcove DS (2009) A force to fight global warming. Nature 462:278–279.

Agho K, Stevens G, Taylor M, Barr M, Raphael B (2010) Population risk perceptions of global warming in

Australia. Environ Res 110:756–763

O'Connor RE, Bord RJ, Fisher A (1999) Risk perceptions, general environmental beliefs, and willingness to

address climate change. Risk Anal 19(3):461–471

Shi, J., Visschers, V.H.M., Siegrist, M., and Arvai, J. (2016). Knowledge as a driver of public perceptions about climate change reassessed. NATURE CLIMATE CHANGE, VOL 6, DOI: 10.1038/NCLIMATE2997.

Climate Literacy Network. 2011 "Meeting the Urgent Need for Climate Literacy." Last Modified July 27. http://cleanet.org/cln/index.html.

Ayanlade, A., Jegede, M. O. (2016). Climate Change Education and Knowledge among Nigerian University Graduates. American Meteorological Society, vol 8, pp 265-473.

Leal Filho, W. (Ed) (2010), Universities and Climate Change – Introducing Climate Change at University Programmes, Springer, Berlin, ISBN: 978-3-642-10750-4.

Wachholz, S., Artz, N. and Chene, D. (2014), "Warming to the idea: university students' knowledge and attitudes about climate change", International Journal of Sustainability in Higher Education, Vol. 15 No. 2, pp. 128-141, doi: 10.1108/IJSHE-03-2012-0025.

Santos, P.T., Bacelar-Nicolau, P., Pardal, M.A., Bacelar-Nicolau, L. and Azeiteiro, U.M. (2016), "Assessing student perceptions and comprehension of climate change in Portuguese higher education institutions", in Leal Filho, W., Adamson, K., Dunk, R., Illingworth, S., Azeiteiro, U.M. and Alves, F. (Eds), Implementing Climate Change Adaptation in Cities and Communities Integrating Strategies and Educational Approaches, 1st ed., Springer, pp. 221-236, ISBN: 978-3-319-28591-7, ISBN: 978-3-319-28589-4, doi: 10.1007/978-3-319-28591-7_12.

Ayanlade, A., & Jegede, M. O. (2016). Climate Change Education and Knowledge among Nigerian University Graduates. *Weather, Climate, and Society*, *8*(4), 465–473. https://doi.org/10.1175/WCAS-D-15-0071.1

Haq, S. M. A., & Ahmed, K. J. (2017). Does the perception of climate change vary with the socio-demographic dimensions? A study on vulnerable populations in Bangladesh. *Natural Hazards*, *85*(3), 1759–1785. https://doi.org/10.1007/s11069-016-2664-7

Jacobs, J. E., & Simpkins, S. D. (2005). Mapping leaks in the math, science, and technology pipeline. *New Directions for Child and Adolescent Development*, *2005*(110), 3–6. https://doi.org/10.1002/cd.145

Kabir, M. I., Rahman, M. B., Smith, W., Lusha, M. A. F., Azim, S., & Milton, A. H. (2016). Knowledge and perception about climate change and human health: findings from a baseline survey among vulnerable communities in Bangladesh. *BMC Public Health*, *16*(1), 266. https://doi.org/10.1186/s12889-016-2930-3

Kleinosky, L. R., Yarnal, B., & Fisher, A. (2007). Vulnerability of Hampton Roads, Virginia to Storm-Surge Flooding and Sea-Level Rise. *Natural Hazards*, *40*(1), 43–70. https://doi.org/10.1007/s11069-006-0004-z

Rahman, M. R., & Lateh, H. (2017). Climate change in Bangladesh: a spatio-temporal analysis and simulation of recent temperature and rainfall data using GIS and time series analysis model. *Theoretical and Applied Climatology*, *128*(1–2), 27–41. https://doi.org/10.1007/s00704-015-1688-3

Shahid, S. (2009). *Spatio-Temporal Variability of Rainfall Over Bangladesh During the Time Period 1969-2003* (SSRN Scholarly Paper No. ID 1674429). Rochester, NY: Social Science Research Network. Retrieved from https://papers.ssrn.com/abstract=1674429

Shahid, S., Harun, S. B., & Katimon, A. (2012). Changes in diurnal temperature range in Bangladesh during the time period 1961–2008. *Atmospheric Research*, *118*, 260–270. https://doi.org/10.1016/j.atmosres.2012.07.008

Shahid, S., Wang, X.-J., Harun, S. B., Shamsudin, S. B., Ismail, T., & Minhans, A. (2016). Climate variability and changes in the major cities of Bangladesh: observations, possible impacts and adaptation. *Regional Environmental Change*, *16*(2), 459–471. https://doi.org/10.1007/s10113-015-0757-6

Shahjalal University of Science & Technology. (n.d.). Retrieved August 19, 2018, from https://www.sust.edu/about

Shongwe, P., Masuku, M. B., & Manyatsi, A. M. (2014). Factors Influencing the Choice of Climate Change Adaptation Strategies by Households: A Case of Mpolonjeni Area Development Programme (ADP) in Swaziland. *Journal of Agricultural Studies*, *2*(1), 86–98. https://doi.org/10.5296/jas.v2i1.4890

Younger, M., Morrow-Almeida, H. R., Vindigni, S. M., & Dannenberg, A. L. (2008). The Built Environment, Climate Change, and Health. *American Journal of Preventive Medicine*, *35*(5), 517–526. https://doi.org/10.1016/j.amepre.2008.08.017

Almanasyeh, N., & Shehadeh, N. (2013). Perception of first year students at the University of Jordan to climate change. *Dirasat: Human and Social Sciences, 40*(2), 315-323.

António Almeida, Beatriz García Fernández, & Emeterio, G. S. (2016). Assessment of pre-service teachers' knowledge of the impact of livestock production on global warming: a comparative study between Portugal and Spain. *International Journal of Environmental Studies 73*(6), 939-953.

Ayanlade, A., & Jegede, M. O. (2016). Climate Change Education and Knowledge among Nigerian University Graduates. *Weather, Climate, and Society, 8*(4), 465-473. doi: 10.1175/WCAS-D-15-0071.1

Beck, A., Sinatra, G., & Lombardi, D. (2013). *Leveraging Higher-Education Instructors in the Climate Literacy Effort Factors Related to University Faculty's Propensity to Teach Climate Change*.

Ferdows, J., & Ahmed, S. M. Z. (2015). An empirical investigation of information skills among undergraduate students at Dhaka University. *Library Review, 64*(4-5), 274-284. doi: 10.1108/LR-11-2014-0132

Gbetibouo, G. A. (2008). Understanding farmers' perceptions and adaptations to climate change and variability: The case of the Limpopo Basin, South Africa (Vol. 15(8)): International Food Policy Research Institute (IFPRI).

Haq, S. M. A., & Ahmed, K. J. (2017). Does the perception of climate change vary with the socio-demographic dimensions? A study on vulnerable populations in Bangladesh. *Natural Hazards, 85*(3), 1759-1785. doi: 10.1007/s11069-016-2664-7

Haque, M. A., Yamamoto, S. S., Malik, A. A., & Sauerborn, R. (2012). Households' perception of climate change and human health risks: A community perspective. *Environmental Health, 11*(1), 1. doi: 10.1186/1476-069x-11-1

Huda, M. N. (2013). 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. *Natural Hazards, 65*(3), 2147-2159. doi: 10.1007/s11069-012-0467-z

Islam, S., Nowrin, S., & Mostofa, S. K. M. (2017). Knowledge sharing pattern among the arts faculty students of Dhaka university: A survey. *DESIDOC Journal of Library and Information Technology, 37*(4), 243-248. doi: 10.14429/djlit.37.4.9952

Kabir, A., Miah, S., & Islam, A. (2018). Factors influencing eating behavior and dietary intake among resident students in a public university in Bangladesh: A qualitative study. *PLoS ONE, 13*(6). doi: 10.1371/journal.pone.0198801

Kabir, M. I., Rahman, M. B., Smith, W., Lusha, M. A. F., Azim, S., & Milton, A. H. (2016). Knowledge and perception about climate change and human health: findings from a baseline survey among vulnerable communities in Bangladesh. *BMC Public Health, 16*(1), 266. doi: 10.1186/s12889-016-2930-3

KeleȘ, Ö., Gilbertson, K. L., & Uzun, N. (2016). Cognitive structures of university students about environmental education, climate change and consumption concepts. *Asia-Pacific Forum on Science Learning & Teaching, 17*(2), 1-17.

Morgado, F., Bacelar-Nicolau, P., Rendon von Osten, J., Santos, P., Bacelar-Nicolau, L., Farooq, H., . . . Azeiteiro, U. M. (2017). Assessing university student perceptions and comprehension of climate change (Portugal, Mexico and Mozambique). *International Journal of Climate Change Strategies and Management, 9*(3), 316-336. doi: 10.1108/IJCCSM-08-2016-0123

Mugambiwa, S. S., & Dzomonda, O. (2018). Climate change and vulnerability discourse by students at a South African university. *2018, 10*(1). doi: 10.4102/jamba.v10i1.476

Munshi, S. A., Mostafa, M. G., & Alam, M. M. (2018). Uses of social networking sites among postgraduate students at university of Rajshahi, Bangladesh: A study. *DESIDOC Journal of Library and Information Technology, 38*(1), 34-40. doi: 10.14429/djlit.38.1.11466

Nigatu, A. S., Asamoah, B. O., & Kloos, H. (2014). Knowledge and perceptions about the health impact of climate change among health sciences students in Ethiopia: a cross-sectional study. *BMC Public Health, 14*(1), 587. doi: 10.1186/1471-2458-14-587

Rahman, S. M. A., Tasmin, S., Uddin, M. K., Islam, M. T., & Sujauddin, M. (2014). Climate Change Awareness among the High School Students: Case Study from a Climate Vulnerable Country. *2014, 1*(1). doi: 10.11113/ijbes.v1.n1.4

Rana, M., Sayem, A., Karim, R., Islam, N., Islam, R., Zaman, T. K., & Hossain, G. (2015). Assessment of knowledge regarding tuberculosis among non-medical university students in Bangladesh: A cross-sectional study. *BMC Public Health, 15*(1). doi: 10.1186/s12889-015-2071-0

Salehi, S., Nejad, Z. P., Mahmoudi, H., & Burkart, S. (2016). Knowledge of global climate change: view of Iranian university students. *International Research in Geographical & Environmental Education, 25*(3), 226-243. doi: 10.1080/10382046.2016.1155322

Shahiduzzaman, M., Korban Ali, M., & Rafiqul Islam, M. (2017). Factors influencing the academic performance of undergraduate students of private universities in Bangladesh: Modeling Approach. *Human Evolution, 32*(1-2), 43-55. doi: 10.14673/HE2017121028

Sultana, M., Alam Mahumud, R., Razzaque Sarker, A., & Mahmud Hossain, S. (2016). Hand hygiene knowledge and practice among university students: Evidence from private universities of Bangladesh. *Risk Management and Healthcare Policy, 9*, 13-20. doi: 10.2147/RMHP.S98311

Whitmarsh, L. (2011). Scepticism and uncertainty about climate change: Dimensions, determinants and change over time. *Global Environmental Change, 21*(2), 690-700.

Appendix A

Table 9. Courses offered across the disciplines of SUST

Schools	Department	Number of total courses offered	Number of environment or climate change related courses (session 2013-2014)	Name of the offered courses	Name/semester of the year the courses offered	Major/Minor
Agricultural and Mineral Science	Forestry and Environmental Science	78	6	1.Introduction to Forestry and Environmental Science 2.Environmental Anthropology 3.Forest and Environmental Economics 4.Environmental pollution and climate change 5.Forest and Environmental policy, law and administration 6.Environmental impact assessment and auditing	1/1 2/2 3/1 4/1 4/2 4/2	Major Minor Major Major Major Major
Total	**1**	78	6			
Applied Sciences and Technology	Architecture	71	2	1.Ecology and Environment 2.Disaster Management	1/2 4/1	Major Major
	Chemical Engineering and Polymer Science	70	1	1.Environmental Engineering	4/2	Major
	Civil and Environmental Engineering	85	7	1.Introduction to Ecology and Environment 2.Environmental Sanitation and Solid Waste Management 3.Environmental Pollution control Engineering 4. Environmental Pollution control Engineering Sessional 5.Environmental Impact Assessment 6.Disaster Management and Earthquake Engineering	1/1 2/2 3/1 3/1 3/2 4/1 4/2	Major Major Major Major Major Major

				7.Environmental Design Sessional		
	Computer Science and Engineering	67	0			
	Electrical and Electronic Engineering	68	0			
	Food Engineering and Tea Technology	90	0			
	Industrial and Production Engineering	74	0			
	Petroleum and Mining Engineering	75	1	1.Environmental Engineering	4/2	Major but Optional
Total	8	600	11			
Life Sciences	Biochemistry and Molecular Biology	63	1	1.Environmental Biochemistry	3/2	Major
	Genetic Engineering and Biotechnology	71	2	1.Environmental Biotechnology 2.Environmental Biotechnology Lab	2/2 2/2	Major Major
Total	2	134	3			
Management and Business Administration	Business Administration	54	0			
Total	1	54	0			
Physical Sciences	Chemistry	68	1	1.Environmental Chemistry	3/2	Major
	Mathematics	59	0			

	Physics	45	0			
	Statistics	52	0			
Total	Geography and Environment	55	5	1.Introduction to Geography and Environmental thoughts and concepts 2. Introduction to Human Geography and Environment 3.Environmental and Social Impact Assessment 4.Environmental Management 5.Environmental Analysis	1/1 1/2 4/1 4/2 4/2	Major Major Major Major Major
	5	279	6			
Social Sciences	Anthropology	53	1	1.Environment and Culture	4/2	Major
	Bangla	47	0			
	Economics	51	1	1.Economics of Environment and Energy	3/1	Major
	English	51	1	1.Introduction to Geography and Environment	2/1	Minor
	Political Studies	53	0			
	Public Administration	52	1	1.Environmental Management	4/1	Major
	Social Work	59	1	1.Climate Change and Disaster Management	4/1	Major
	Sociology	59	1	1.Sociology of Environment	3/2	Major
Total	8	425	6			
Total number of courses offered in the session 2013-2014		1570	32			