



Effect of climate change in Meghalaya as perceived by the scientists of Krishi Vigyan Kendra, Meghalaya, India

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Abstract: A study was conducted to assess the adverse effect of climate change as perceived by the scientists of Krishi Vigyan Kendra, Meghalaya. Data were collected from 25 scientists by questionnaire method in the month of October, 2012 to January, 2013. For this purpose five important components viz. Environment, Hill agriculture and allied, Human and animal health, Forest and wildlife and Hydrology and water resources were identified and presented to the scientists in pairs, in 10 possible combinations, and the scientists were requested to select one component from each pair separately which would be more adversely affected, than the other component due to climate change. For analysis of data the method of Paired Comparisons was followed. It was found that due to climate change Hill agriculture and allied may be severely damaged with highest scale value of 1.513 followed by hydrology and water resources (0.629), environment (0.418), forest and wildlife (0.029) and least affected component is Human and animal health (0.00). The findings revealed that Hill agriculture will be most adversely affected due to climate change in Meghalaya. One of the main reasons is practising of *jhum* cultivation. Therefore, the scientists and the government of Meghalaya may adopt some necessary steps for controlling *jhum* cultivation.

Keywords: Climate change, Krishi Vigyan Kendra, Paired comparisons

INTRODUCTION

Climate change has been recognized as the foremost environmental problem of the 21st century and has become a subject of considerable debate. It is predicted to lead to adverse, irreversible impact on earth and the ecosystem as a whole (Sasmita and Mohanty, 2009). Climate change will directly affect the agricultural production, water resources, natural ecosystem, biodiversity, animal and human health. The Indian Network for Climate Change Assessment (INCCA) report warns of impact such as sea level rise, increase in cyclonic intensity, reduced crop yield in rainfed crops, stress on livestock, reduction in milk productivity, increases flooding and spread of malaria (Mondal, 2013).

The North Eastern Region of India is expected to be highly prone to the consequences of climate change because of its geo-ecological fragility, strategic location vis-à-vis the eastern Himalayan landscape and international borders, its trans-boundary river basins and its inherent socio-economic instabilities. Environmental security and sustainability of the region are and will be greatly challenged by these impacts. The region falls under high rainfall zone with subtropical type of climate. Droughts and floods are the adverse climatic conditions arising out of deficit and excess rainfall, respectively. Drought assumes significance mainly in rainfed conditions like in North East India. Unprece-

dent drought like situation affected very adversely the whole North East Region in recent years. Floods are equally devastating in the region. The increasing melting of glaciers in Himalayas is of great concern for the region (Deepika and Pasricha, 2010).

Based on the recommendation of the Education Commission (1964-66), consideration / review by the Planning Commission and Inter-Ministerial Committee, and further recommendation by the committee headed by Dr. Mohan Singh Mehta appointed by ICAR in 1973 the idea of establishment of Farm Science Centre (Krishi Vigyan Kendra) was evolved. The first Krishi vigyan kendra (KVK), on a pilot basis, was established in 1974 at Pondicherry under the administrative control of the Tamil Nadu Agricultural University, Coimbatore, in 1976-77.

At present there are five KVKs in five different districts of Meghalaya and these are: KVK Jaintia Hills, KVK East Khasi Hills, KVK West Khasi Hills, KVK Ri Bhoi and West Garo Hills. A total of 29 scientists of different disciplines are working in this KVKs. The present study was conducted to assess the effect of climate change as perceived by scientists of KVK in Meghalaya.

MATERIALS AND METHODS

Sampling design: The present study was conducted on

Table 1. Sampling method.

Districts	Number of KVK scientists	Sampling Method
Jaintia Hills	5	Total enumeration
East Khasi Hills	5	Total enumeration
West Khasi Hills	5	Total enumeration
West Garo Hills	5 out of 7	Random sampling
Ri Bhoi	5 out of 7	Random sampling
TOTAL	25	

the scientists of 5 KVK located in 5 districts of Meghalaya to assess their perception on impact of climate change. Data were collected from 25 scientists by questionnaire method. The questionnaire were distributed to the scientists in the month of October 2012 and the filled in questionnaire were collected in the month of January, 2013.

Projected impact of climate as perceived by the scientists of KVK: The projected impact of climate change is likely to affect environment, agriculture and allied sectors, forest and wild life, hydrology and water resources, etc in the North East India. These five important components were identified and presented to the scientists in pairs, in 10 possible combinations. The sub-components of these five components are presented below.

Environment: Sub components were: 1.Increase of temperature 2.Emission of green house gas 3.Landslide 4.Drought 5.Natural disaster like occurrence off flood, drought, storm, cold waves etc. 6. Cyclone and super cyclone 7.Hail stone 8. Change of biodiversity

10.Change of monsoon

Hill agriculture and allied: Sub components were: 1.Production and productivity of field crop 2. Horticulture crops 3. Cropping pattern 4. Farming system 5. Food security 6. Inland fisheries 7. Cost of cultivation 8. Animal production 9. Dairy production etc.

Human and animal health: Sub components were: 1.Spread of water borne and airborne diseases 2. More outbreaks of deadly diseases 3. Breeding space for different insect vectors and pathogen

Forest and wildlife: Sub components were: 1.Deforestation 2. Occurrence of massive forest fire 3. Migratory birds 4. Survival of wild life

Hydrology and water resources: Sub components were: 1.Availability of ground water for irrigation 2. Water for domestic and industrial purpose.

Climate change can adversely affect all these components and sub components more or less. To assess the effect of climate change as perceived by the scientists of KVK, the method of Paired Comparisons (Edwards,1969) was adopted. For this purpose the five components were presented to the scientists of KVK in pairs, in 10 possible combinations. The scientists were requested to select one component from each pair which they consider will be more adversely affected than the other due to climate change. The ten pairs are presented below:

- | | |
|---------------------------------|-----------------------------------|
| (A) Environment | (A) Environment |
| (B) Hill Agriculture and allied | (C) Human and Animal health |
| (A) Environment | (A) Environment |
| (D) Forest and Wildlife | (E) Hydrology and water resources |

Table 2. F-matrix of 5 components relating to climate change judged by 25 respondents (scientists of KVK).

Components	Environment (A)	Hill agriculture and allied (B)	Human and animal health(C)	Forest and wildlife (D)	Hydrology and Water resources(E)
Environment	-	20	10	11	11
Hill agriculture and allied	5	-	6	1	5
Human and animal health	15*	24	-	20	18
Forest and wild-life	14	24	5	-	22
Hydrology and Water resources	14	20	7	3	-

*To be understood as 15 scientists preferred Environment to Human and animal health i.e. Environment will be more affected than Human and animal health and so on.

Table 3. P-matrix corresponding to the F-matrix.

Components	Environment (A)	Hill agriculture and allied (B)	Human and animal health (C)	Forest and wildlife (D)	Hydrology and Water resources(E)
Environment	0.500	0.800	0.400	0.440	0.440
Hill agriculture and allied	0.200	0.500	0.240	0.040	0.200
Human and animal health	0.600	0.960	0.500	0.800	0.720
Forest and wildlife	0.560	0.960	0.200	0.500	0.880
Hydrology and Water resources	0.560	0.800	0.280	0.120	0.500
SUMS	2.420	4.020	1.620	1.900	2.740

Table 4. Re-arranged P -matrix.

Components	Human and Animal Health (C)	Forest and Wildlife (D)	Environment (A)	Hydrology and Water Resources (E)	Hill agriculture and allied (B)
Human and Animal Health (C)	0.500	0.800	0.600	0.720	0.960
Forest and Wildlife (D)	0.200	0.500	0.560	0.880	0.960
Environment (A)	0.400	0.440	0.500	0.440	0.800
Hydrology and Water Resources (E)	0.280	0.120	0.560	0.500	0.800
Hill agriculture and allied (B)	0.240	0.040	0.200	0.200	0.500
SUMS Z	1.620	1.900	2.420	2.740	4.020

Table 5. Z-matrix; hierarchy of 5 components relating to climate change.

Components	Human and Animal Health (C)	Forest and Wildlife (D)	Environment (A)	Hydrology and Water Resources (E)	Hill agriculture and allied (B)
Human and Animal Health (C)	0.00	0.842	0.253	0.583	1.751
Forest and Wildlife (D)	-0.842	0.000	0.151	1.175	1.751
Environment (A)	-0.253	-0.151	0.000	-0.151	0.842
Hydrology and Water Resources (E)	-0.583	-1.175	0.151	0.000	0.842
Hill agriculture and allied (B)	-0.706	-1.751	-0.842	-0.842	0.000
SUMS Z	-2.384	-2.235	-0.292	0.765	5.186
MEAN Z	-0.476	-0.447	-0.058	0.153	1.037
(Add largest negative deviation)	0.476	0.476	0.476	0.476	0.476
RANK (scale value) R	5 th	4 th	3 rd	2 nd	1 st

(B) Hill Agriculture and allied (B) Hill Agriculture and allied
(C) Human and animal health (D) Forest and Wildlife

(B) Hill Agriculture and allied (C) Human and Animal health

(E) Hydrology and water resources (D) Forest and wildlife

(C) Human and Animal health (D) Forest and wildlife

(E) Hydrology and water resources (E) Hydrology and Water resources

Method of paired comparisons: Thurstone developed the law of comparative judgement which provides rationale for the ordering of stimuli along a psychological continuum. It is a psychological scaling method and makes possible the quantitative investigation of all kinds of values and subjective experiences (Edwards,1969). In this method, the stimuli (items, statement or variables) are presented in pairs in all possible combinations and the respondents are asked to select one stimulus over the other from each pair, which is judge as more favourable. This is known as Method of Paired Comparisons. This method also provides an estimate of the distances between each of the stimuli, in comparison to the stimulus with least preference, whose scale value is (arbitrarily) brought down to the level of ‘zero’. If there are n stimuli, the number of pairs which may be obtained are n (n-1)/2.

RESULTS AND DISCUSSION

The climate change will adversely affect all the components in North East as perceived by the scientists of

KVK of Meghalaya. Table 2. shows the frequencies corresponding to the number of times that each stimulus is judged more favourable than the other. Table-3. gives the proportion of times the column stimulus is judged more favourable than the row stimulus. Table 4. shows the stimulus having the smallest column at the left and that with the highest at the right. From Table-4.(Z-matrix) it was found that Hill Agriculture and Allied (B) will be affected most severely due to climate change and it has been ranked 1st(highest scale value 1.513) among the five components. The main reason is most of the Hill agriculture are rainfed in nature and majority of the farmers in North East Region and Meghalaya in particular practise jhum cultivation which is very much dependent on climatic factors (Ramakrishnan,1990)

The next component which will be affected most by climate change is Hydrology and water Resource (E) having scale value of (0.629) and ranked 2nd. Even though Meghalaya is well known for being the wettest place on earth it still faces problem of water scarcity and drought. Since most of the farmers in Meghalaya still practise jhum cultivation which is totally dependent on rainfall therefore hydrology and water resources play a very important role. Loss of mountain snowpack reduces the amount of water available for irrigation downstream, while earlier spring snowmelt affects the timing.

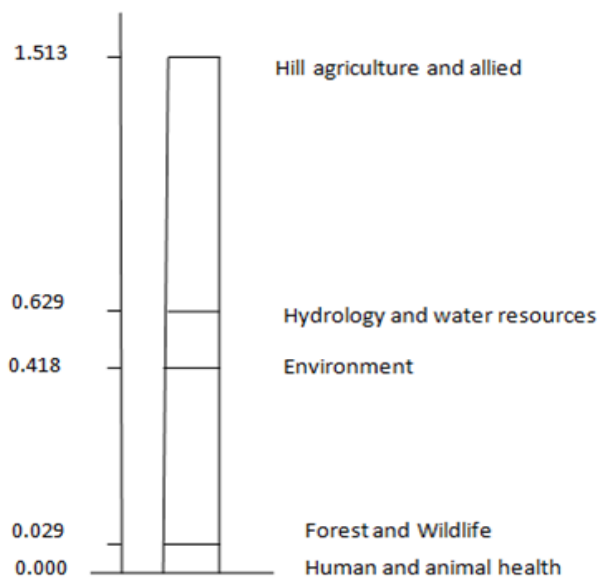


Fig. 1. Bar diagram showing hierarchy of the five components relating to climate change.

The next component which will be affected by climate change is Environment (A) having a scale value of (0.418) and ranked 3rd. Rising temperatures and shifting precipitation patterns due to climate change also have an impact on the environment where animals, birds, insects, and plants thrive by affecting the timing of lifecycle events, such as bud bursts, leaf drop from trees, pollination, reproduction, bird migration and also helps in the growth of noxious weeds which competes with crops for nutrition uptake thereby reducing the yield. But according to the perception of scientists of CRRRI (Cuttack), environment will be affected most severely due to climate change and it has been ranked 1st (Mondal and Thokchom, 2014). These differences of perception between the scientists of CRRRI, Cuttack and scientists of KVK of North-East are due to geographical and agro-climatic variations.

The next component which will be affected by climate change is Forest and wild life (D) having a scale value of (0.029) and ranked 4th. Many tree species are adapted to particular temperature and moisture conditions. As these conditions change, habitats become unsuitable for saplings to grow, and animal, birds and insect species attempt to migrate. Because trees are so long-lived, the effects may not be noticeable for many years. However, species of birds, animals and plants that grows only in certain areas are slowly diminishing due to unfavourable climatic condition caused by global warming and climate change. Rising temperature also contributes to forest wild fire which causes a lot of destruction to both plants and animal at large.

The last component taking the 5th ranked which will be least affected by climate change is Human and animal

health (C) having a scale value of (0.00). The scale value (0.00) does not indicate absence of variables. The component "Human and animal health" had got some scale value. But its scale value had been brought down to arbitrary zero according to rules of interval scale. As the climate changes, the risk of injury, illness, and death from the resulting heat waves, wildfires, intense storms, and floods rise. Climate change greatly influences some of the most deadly and widespread diseases affecting people across the world. Insect vectors such as mosquitoes which is able to multiply in stagnating waters in tanks, and sewers and even a small rise in temperature favours its reproduction, thereby facilitating the spread of diseases like Malaria and Dengue fever (Sumana *et al.*, 2006). Climate change also has an impact on animal health whereby causing spread of waterborne and airborne pathogen which can survive and thrive more in rising temperature.

Conclusion

The findings revealed that Hill agriculture will be most adversely affected due to climate change in Meghalaya followed by hydrology and water resource, environment, forest and wild life; and human and animal health. One of the main reason is practising of *jhum* cultivation. So, the scientists and the government of Meghalaya may adopt some necessary steps for controlling *jhum* cultivation and emphasis should be given on orchard and plantation crops instead of *jhumming* and should adopt necessary measures to mitigate the adverse effect of climate change on agriculture and human and animal health.

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