

Impact of Climate Change as Perceived by Scientists of Central Rice Research Institute, Cuttack, Odisha

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ABSTRACT

A study was conducted to assess the perception on climate change and its effect on environment as perceived by the scientists of Central Rice Research Institute, Cuttack. Data were collected from 40 scientists by questionnaire method in the month of October to December, 2011. For this purpose important five sectors viz. environment, agriculture and allied, coastal zone, forest and wild life, hydrology and water resources were identified and presented to the scientists in 10 pairs. The scientists were requested to mark 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 were followed. It was found that due to climate change the environment will be severely damaged as perceived by the scientists of CRRI followed by agriculture and allied sector, coastal zone, hydrology and water resources and forest and wild life.

Key words : Climate change; Paired comparisons.

Climate change is a periodic modification of Earth's climate brought about as a result of changes in the atmosphere as well as interactions between the atmosphere and various other geologic, chemical, biological and geographic factors within the Earth system. The Intergovernmental Panel on Climate Change (IPCC) was created in 1988. It was set up by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) as an effort by the United Nations to provide the governments of the world with a clear scientific view of what is happening to the world's climate. The United Nations Framework Convention on Climate (UNFCCC) was opened for signature at the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro (known by its popular title, the Earth Summit). On June 12, 1992, 154 nations signed the UNFCCC that upon ratification committed signatories, governments to a voluntary "non-binding aim" to reduce atmospheric concentrations of greenhouse gases with the goal of "preventing dangerous anthropogenic interference with earth's climate system". These actions were aimed primarily at industrialized countries, with the intention of stabilizing their emissions of greenhouse gases at 1990 levels by the year 2000; and other responsibilities would be incumbent upon all UNFCCC parties.

Climate change has enormous implications for Indian agriculture, natural resources, livelihood and food security. 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.

Central Rice Research Institute (CRRI), Cuttack, a pioneering Institute of Indian Council Agricultural Research has 5 divisions in the discipline

of Crop Improvement, Crop Production, Protection, Biochemistry, Plant Physiology and Environmental Sciences (BPES) and Social Extension Communication and Training. At present there are 77 scientists are working at CRRI, Cuttack. The CRRI has conducted climate resilient in rice crop and developed drought tolerance rice variety, Sabhagi dhan and salinity resistance varieties namely, CR Dhan 402 and CR Dhan 403 (Mondal 2013). The present study was conducted with the following objective.

To study the impact of climate change as perceived by scientists of Central Rice Research Institute, Cuttack, Odisha.

METHODOLOGY

Climate change is likely to affect environment, agriculture and allied sectors, forest and wildlife, coastal zone, hydrology and water resources etc. For the present investigation the five parameters viz. Environment, Agriculture and allied sectors, Forest and Wildlife, Coastal zone, Hydrology and Water resources have been selected to assess the impact of climate change.

The sub components of these five parameters are presented below :

A) Environment

Sub-components :

i) Temperature increases, ii) Emission of GHG, iii) Melting of polar ice, iv) Natural disaster like occurrence of flood, drought, storm, cold wave, etc., v) Cyclone and super cyclone, vi) Hailstone, vii) Changes of biodiversity, viii) Change of monsoon.

B) Agriculture and allied sectors

Sub-components:

i) Production and productivity of field crops, ii) Horticultural crops, iii) Cropping pattern, iv) Farming system, v) Food security, vi) Inland fisheries, vii) Cost of cultivation, viii) Animal production, ix) Dairy production etc.

C) Coastal Zone**Sub-components:**

i) Rising sea level, ii) Inundation of coastal islands, iii) Mangroves, iv) Increasing coastal salinity, v) Affecting human settlement, vi) Coastal ecosystem, vii) Displacement, viii) Coastal tourism, ix) Ocean acidification, x) Ocean diversity.

D) Forest and wildlife**Sub-components:**

i) Deforestation, ii) Occurrence of massive forest fire, iii) Migratory birds, iv) Survival of wildlife.

E) Hydrology and water resources**Sub-components:**

i) Availability of ground water for irrigation, ii) Water for domestic and industrial purpose.

Climate change can adversely affect all these components and sub-components more or less. In order to identify the extent of damage of these 5 components, the Method of Paired Comparisons (Edwards 1969) was followed. For this purpose the 5 components are presented to the scientists of CRRI in pairs, in 10 possible combinations (i.e. in 10 pairs, $5 \times 5 - 1/2 = 10$). The scientists were asked to select one component over the other from each pair separately which they consider will be more adversely affected due to climate change. The method of "complete data" was followed as there was no Pij value equal to or greater than 0.99 or equal to or less than 0.01 in the P-matrix table.

The ten pairs are presented below :

A) Environment	A) Environment
B) Agriculture and allied sector	C) Coastal zone
A) Environment	A) Environment
D) Forest and wildlife resources	E) Hydrology and water resources
B) Agriculture and allied sector	B) Agriculture and allied sector
C) Coastal zone	D) Forest and wildlife
B) Agriculture and allied sector	C) Coastal zone
E) Hydrology and water resources	D) Forest and wildlife
C) Coastal zone	D) Forest and wildlife
E) Hydrology and water resources	E) Hydrology and water resources

The present study was conducted from the scientists of CRRI, Cuttack, Odisha by the questionnaire method. The set of questionnaires are distributed to all the scientists of CRRI in the month of October 2011 and the filled in questionnaires were

collected from the scientists in the month of November and December, 2011. Out of seventy seven scientists only forty scientists responded within the stipulated period of time. The responses of seven scientists have not been accepted for analysis of data due to incomplete information.

The 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, statements 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 judged as more favourable. Because the stimuli are presented in pairs and one stimulus is compared over the other, this is known as the method of paired comparisons. This method of psychological scaling 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'.

RESULTS AND DISCUSSION

The climate change will adversely affect all the five components more or less as perceived by the scientists of CRRI. It is found from the Table 4 (Z-matrix) the environment will be affected most severely due to climate change as perceived by the scientists of CRRI and it has been ranked 1st (scale value- 0.798). The scientists of CRRI perceived that due to climate change temperature, emission of gases, melting of polar ice, occurrence of cyclone and super-cyclone will increase. Change of monsoon and occurrence of flood, drought, storm will also be expedited due to climate change.

The 2nd parameter viz. agriculture and allied sector will be affected most due to climate change as perceived by the scientists of CRRI since it has been ranked 2nd (scale value- 0.758).

The climate change will also have an adverse impact on the coastal zone by rising the sea-level, inundating the coastal islands, mangroves, increasing coastal salinity and affecting human settlement as perceived by the scientists of CRRI and ranked 3rd (scale value- 0.453).

Due to climate change the parameter hydrology and water resources will also be affected as perceived by the scientists and it was ranked 4th (scale value- 0.408).

The last parameter forest and wildlife which ranked 5th (scale value-0.000) does not indicate that it will not be affected by climate change. According to the method of paired comparisons, the value of forest and

Table 1
F-matrix of five components of climate change judged by 33 scientists of CRRI.

	Environment (a)	Agriculture and allied sector (b)	Coastal zone (c)	Forest and wildlife (d)	Hydrology and water resources (e)
Environment (a)	_____	12	11	9	14
Agriculture and allied sector (b)	21*	_____	17	3	11
Coastal zone (c)	22	16	_____	11	19
Forest and wildlife (d)	24	30	22	_____	17
Hydrology and water resources (e)	19	22	14	16	_____

**To understand as 21 scientists preferred environment to agriculture and allied and so on.*

Table 2
P-matrix: Corresponding to the F-matrix.

	Environment (a)	Agriculture and allied sector (b)	Coastal zone (c)	Forest and wildlife (d)	Hydrology and water resources (e)
Environment (a)	0.500	0.363	0.333	0.272	0.424
Agriculture and allied sector (b)	0.636	0.500	0.515	0.090	0.333
Coastal zone (c)	0.666	0.484	0.500	0.333	0.575
Forest and wildlife (d)	0.727	0.909	0.666	0.500	0.515
Hydrology and water resources (e)	0.575	0.666	0.424	0.484	0.500
SUM	3.104	2.922	2.438	1.679	2.347

Table 3
Rearrange P-matrix: Smallest to highest column.

	Forest and wildlife (d)	Hydrology and water resources (e)	Coastal zone (c)	Agriculture and allied sector (b)	Environment (a)
Forest and wildlife (d)	0.500	0.515	0.666	0.909	0.727
Hydrology and water resources (e)	0.484	0.500	0.424	0.666	0.575
Coastal zone (c)	0.333	0.575	0.500	0.484	0.666
Agriculture and allied sector (b)	0.090	0.333	0.515	0.500	0.636
Environment (a)	0.272	0.424	0.333	0.363	0.500
SUM	1.679	2.347	2.438	2.922	3.104

Table 4
Z-matrix: Ranking of five components on the basis of severity of damage due to climate change.

	Forest and wildlife (d)	Hydrology and water resources (e)	Coastal zone (c)	Agriculture and allied sector (b)	Environment (a)
Forest and wildlife (d)	0.000	0.038	0.429	1.335	0.604
Hydrology and water resources (e)	-0.040	0.000	-0.192	0.429	0.189
Coastal zone (c)	-0.432	0.189	0.000	-0.040	0.429
Agriculture and allied sector (b)	-1.341	-0.432	0.038	0.000	0.348
Environment (a)	-0.607	-0.192	-0.432	-0.350	0.000
SUM Z	-2.420	-0.397	-0.157	1.374	1.570
MEAN Z (dividing by 5)	-0.484	-0.079	-0.031	0.274	0.314
Add largest negative deviation	+0.484	+0.484	+0.484	+0.484	+0.484
Rank (Scale value) R	(0.000) 5th	(0.408) 4th	(0.453) 3rd	(0.758) 2nd	(0.798) 1st

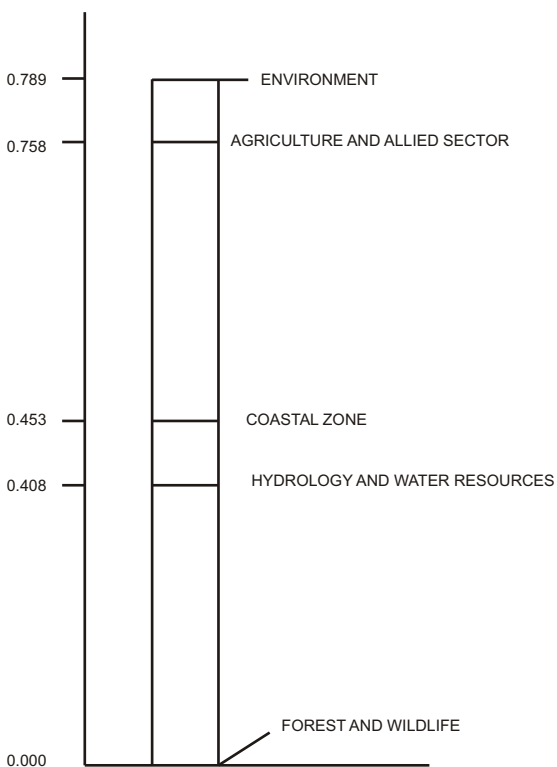


Fig. 1: Bar diagram showing the different parameters which affect climate change as perceived by the scientists of CRRI.

wildlife has been brought down to arbitrary zero and it is the last and 5th parameter which will also be affected by the climate change.

CONCLUSION

Climate change will adversely affect all the 5 parameters but according to the scale value, the environment alongwith its sub-components will be most severely affected due to climate change followed by agriculture and allied sectors, coastal zone, hydrology and water resources and forest and wildlife as perceived by the scientists of CRRI, Cuttack, Odisha.

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