CRIDA : HYDERABAD

Answer to the provisionally admitted Starred question for the Rajya Sabha - D.No. 2562

(a). whether it is a fact that water crisis is constantly deepening in the country due to global warming?

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(b). whether it is also fact that possibility of increasing global temperature from 0.3 to 4.8 degree Celsius by the end of 21st century and of arising grave crisis of drought, water and food has been expressed in the recent report of the Inter-government panelof the United nations on the climate change; and

- According to the recent IPCC AR5 working group-1 report, the globally averaged combined land and ocean temperature data show an increase of 0.89^{o}C over the period 1901-2012. In the Northern Hemisphere, 1983–2012 was likely the warmest 30-year period of the last 1400 years.

- Increase of global mean surface temperatures for 2081–2100 relative to 1986–2005 is projected to likely be in the ranges derived from the concentration-driven CMIP5 model simulations, that is, 0.3°C to 1.7°C (RCP2.6), 1.1°C to 2.6°C (RCP4.5), 1.4°C to 3.1°C (RCP6.0), 2.6°C to 4.8°C (RCP8.5). The Arctic region will warm more rapidly than the global mean, and mean warming over land will be larger than over the ocean (very high confidence) The scenarios and projected ranges of temperatures are provided in the table below;

		2046–2065		2081–2100	
Variable	**Scenario**	mean	*likely* range [c]	mean	*likely* range [c]
Global Mean Surface Temperature Change (°C) [a]	RCP2.6	1.0	0.4 to 1.6	1.0	0.3 to 1.7
	RCP4.5	1.4	0.9 to 2.0	1.8	1.1 to 2.6
	RCP6.0	1.3	0.8 to 1.8	2.2	1.4 to 3.1
	RCP8.5	2.0	1.4 to 2.6	3.7	2.6 to 4.8
		mean	*likely* range [d]	mean	*likely* range [d]

*IPCC WGII AR5 Summary for Policymakers, 2014

- The study also says that surface temperature change will not be regionally uniform, and there is very high confidence that long-term mean warming over land will be larger than over the ocean and that the Arctic region will warm most rapidly.
- Changes in the global water cycle in response to the warming over the 21st century will not be uniform. The contrast in precipitation between wet and dry regions and between wet and dry seasons will increase, although there may be regional exceptions

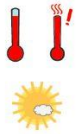
- It is also observed that the extreme events like droughts and extreme rainfall events etc will be increasing in future (table)

Phenomenon and direction of trend	Likelihood of further changes	
	Early 21st century	Late 21st century
Warmer and/or fewer cold days and nights over most land areas	*Likely* {11.3} – –	*Virtually certain* {12.4} *Virtually certain* *Virtually certain*
Warmer and/or more frequent hot days and nights over most land areas	*Likely* {11.3} – –	*Virtually certain* {12.4} *Virtually certain* *Virtually certain*
Warm spells/heat waves. Frequency and/or duration increases over most land areas	Not formally assessed (b) {11.3} – –	*Very likely* {12.4} *Very likely* *Very likely*
Heavy precipitation events. Increase in the frequency, intensity, and/or amount of heavy precipitation.	*Likely* over many land areas {11.3} – –	*Very likely* over most of the mid-latitude land masses and over wet tropical regions {12.4} *Likely* over many areas *Very likely* over most land areas
Increases in intensity and/or duration of drought	*Low confidence* (g) {11.3} – –	*Likely (medium confidence)* on a regional to global scale (h) {12.4} *Medium confidence* in some regions *Likely* (e)
Increases in intense tropical cyclone activity	*Low confidence* {11.3} – –	*More likely than not* in the Western North Pacific and North Atlantic (j) {14.6} *More likely than not* in some basins *Likely*
Increased incidence and/or magnitude of extreme high sea level	*Likely* (l) {13.7} – –	*Very likely* (l) {13.7} *Very likely* (m) *Likely*

*IPCC WGII AR5 Summary for Policymakers, 2014

- IPCC - AR5 study also expressed with high confidence that there is an increased risk of drought related water and food shortage causing malnutrition

Asia

Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Increased riverine, coastal, and urban flooding leading to widespread damage to infrastructure, livelihoods, and settlements in Asia (*medium confidence*) [24.4]	• Exposure reduction via structural and non-structural measures, effective land-use planning, and selective relocation • Reduction in the vulnerability of lifeline infrastructure and services (e.g., water, energy, waste management, food, biomass, mobility, local ecosystems, telecommunications) • Construction of monitoring and early warning systems; measures to identify exposed areas, assist vulnerable areas and households, and diversify livelihoods • Economic diversification		Present Near-term (2030-2040) Long-term (2080-2100) 2°C 4°C	Very low / Medium / Very high
Increased risk of heat-related mortality (*high confidence*) [24.4]	• Heat health warning systems • Urban planning to reduce heat islands; improvement of the built environment; development of sustainable cities • New work practices to avoid heat stress among outdoor workers		Present Near-term (2030-2040) Long-term (2080-2100) 2°C 4°C	Very low / Medium / Very high
Increased risk of drought-related water and food shortage causing malnutrition (*high confidence*) [24.4]	• Disaster preparedness including early-warning systems and local coping strategies • Adaptive/integrated water resource management • Water infrastructure and reservoir development • Diversification of water sources including water re-use • More efficient use of water (e.g., improved agricultural practices, irrigation management, and resilient agriculture)		Present Near-term (2030-2040) Long-term (2080-2100) 2°C 4°C	Very low / Medium / Very high

*IPCC WGII AR5 Summary for Policymakers, 2014

(c). If so, the steps taken by the government to tackle the situations, and

- Under the aegis of Ministry of Agriculture, Government of India, the Indian Council of Agriculture Research (ICAR) has been analyzing the changes in rainfall pattern across the country from time to time. Recognizing the impact of climate variability on agriculture, a network project was initiated during X Plan which was continued during XI Plan. This project helped in understanding the impacts of global warming on productivity of rice, wheat and other crops, livestock and fisheries. Recognizing that the climate change is likely to have a major impact on agricultural and allied sector, the Council has initiated a mega network project, National Initiative on Climate Resilient Agriculture (NICRA) during 2010-11 with an outlay of Rs.350 crores. This scheme will continue during the XII plan with a multi-pronged strategy encompassing strategic research on adaptation and mitigation, demonstration of technologies on farmers' fields and create awareness among farmers and other stake holders. The strategic research aims mainly to evolve crop varieties tolerant to climatic stresses like floods, droughts, frost, inundation due to cyclones and heat waves. Standardization of management practices to reduce emission of greenhouse gases is also envisaged. Mitigation of heat stress on livestock through shelter management and feed supplements is also targeted.
- A study has been conducted under the ICAR- National Initiative on Climate Resilient Agriculture (NICRA) project and the districts (state wise) falling in different vulnerability classes have been presented in the table.1;

- Table 1. Distribution of districts according to the degree of vulnerability (2021-50) in different states

S No	State	Vulnerability					Total
		Very High	High	Medium	Low	Very low	
1	A & N Islands	0	0	0	0	1	1
2	Andhra Pradesh	2	1	1	1	8	13
3	Arunachal Pradesh	0	0	0	5	9	14
4	Assam	1	1	1	7	13	23
5	Bihar	6	15	7	6	3	37
6	Chhattisgarh	0	7	4	5	0	16
7	Dadra & Nagar Haveli	0	0	0	0	1	1
8	Daman & Diu	1	0	0	0	0	1
9	Goa	0	0	0	0	1	1
10	Gujarat	14	6	1	1	3	25
11	Haryana	0	9	6	2	2	19
12	Himachal Pradesh	0	4	2	3	3	12
13	Jammu & Kashmir	0	1	6	3	4	14
14	Jharkhand	3	6	7	2	0	18
15	Karnataka	14	5	0	2	6	27
16	Kerala	0	0	4	7	3	14
17	Madhya Pradesh	14	16	9	4	2	45
18	Maharashtra	12	5	3	6	7	33
19	Manipur	0	0	3	3	3	9
20	Meghalaya	0	0	1	3	3	7
21	Mizoram	0	0	1	7	0	8
22	Nagaland	0	0	0	3	5	8
23	Orissa	0	1	9	14	6	30
24	Pondicherry	0	0	0	0	1	1
25	Punjab	1	4	4	6	2	17
26	Rajasthan	25	6	1	0	0	32
27	Sikkim	0	0	0	2	2	4

28	Tamilnadu	6	5	9	4	5	29
29	Telangana	0	1	2	0	6	9
30	Tripura	0	0	0	0	4	4
31	Uttar Pradesh	12	18	24	14	2	70
32	Uttrakhand	3	4	1	1	4	13
33	West Bengal	1	0	8	3	5	17
	India	115	115	114	114	114	572

- Districts in Rajasthan, Gujarat, Madhya Pradesh, Karnataka, Maharashtra, Andhra Pradesh, Tamilnadu, eastern Uttar Pradesh and Bihar exhibit very high and high vulnerability (Fig 1d). Districts along the west coast, northern Andhra Pradesh, North-Eastern states are relatively less vulnerable.

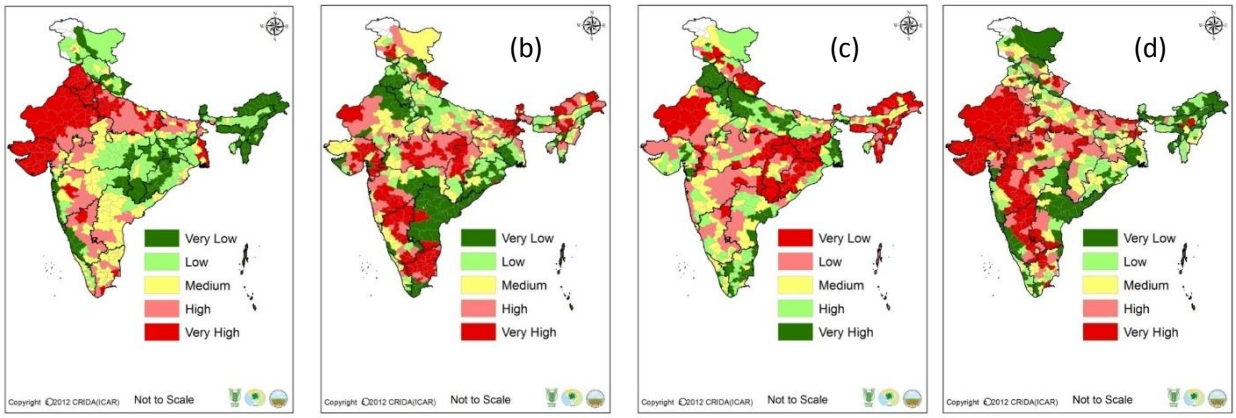


Fig 1. Classification of districts based on (a) sensitivity index (b) exposure index (c) Adaptive capacity index and (d) vulnerability index

Some achievements under NICRA

(d). If not, the reasons there for?