



Climate changes and food security in India

Presented by
Dr.R.Sindhu
IIInd year Postgraduate

CONTENTS

- ▶ Introduction
- ▶ Food security
- ▶ How climate changes affects food security
- ▶ Food production
- ▶ Food access
- ▶ Urban poor
- ▶ Food absorption
- ▶ CCIS
- ▶ National agricultural insurance scheme
- ▶ Soil health card scheme
- ▶ Recommendations
- ▶ Conclusion
- ▶ References

Introduction

- For India, food security continues to be high on its list of development priorities because the country's relatively high rates of economic growth have not led to a reduction in hunger and undernutrition.

GLOBAL HUNGER INDEX

(score on index)

Rank	1992	2000	2008	2016
Argentina (1st)	5.8	5.3	<5	<5
Iran (23rd)	17.5	13.7	8.8	6.7
China (29th)	26.4	15.9	11.5	7.7
Nigeria (84th)	49.5	40.9	33.6	25.5
Bangladesh (90th)	52.4	38.5	32.4	27.1
India (97th)	46.4	38.2	36	28.5

Note: Score ranges from 0 (no hunger) to 100 (the worst);
16 countries are ranked 1 on the index

Source: Global Hunger Index, IFPRI

About 12 Indian states fall under the 'alarming' category of the Global Hunger Index.

- ❖ *India has failed to meet the Millennium Development Goal of halving the proportion of people who suffer from hunger*
- ❖ *Incidence of undernutrition has dropped only marginally from 210.1 million in 1990 to 194.6 million in 2014,*



Shift towards fish & meat → ↑ **Demand for foodgrains**

- ▶ Low Agriculture productivity is the biggest issue.
- ▶ India's cereal yields is much lower compared to other countries.

Country/ Region	Kg per hectare
East Asia & Pacific (developing only)	5,184.0
Central Europe and the Baltics	4,131.1
Sub-Saharan Africa	1,433.5
Europe & Central Asia (all income levels)	3,661.6
Euro area	5,855.4
North America	6,671.0
India	2,961.6
World	3,851.3

	Rice	Wheat	Coarse Cereals	Pulses	Total Foodgrains
1980-81 to 1990-91	2.7	3.4	2.6	2.0	3.0
1990-91 to 2000-01	0.9	1.7	1.3	-0.6	1.7
2000-01 to 2010-11	1.6	1.0	4.1	2.4	1.7
2010-11 to 2014-15	1.6	-1.0	3.1	1.9	1.8

Source: World Bank Database,
<http://data.worldbank.org/indicator/AG.YLD.CREL.KG/countries?display=default>

Source: Reserve Bank of India database,
<https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=16463>

FOOD SECURITY

World Food
Summit,
1996

"Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life."

Food availability

Food
accessibility

Utilization

Stability

How climate changes affects food security?

- ▶ Impacts crops, livestock, forestry, fisheries and aquaculture
- ▶ Cause grave social and economic consequences in the form of reduced incomes, eroded livelihoods, trade disruption and adverse health impacts.



Summer – Drought- heat waves

Monsoon – Floods , Heavy Rains

Winter and severe cold

Milch cow: milk yield goes down in increased heat or cold wave

Poultry: egg yield goes down

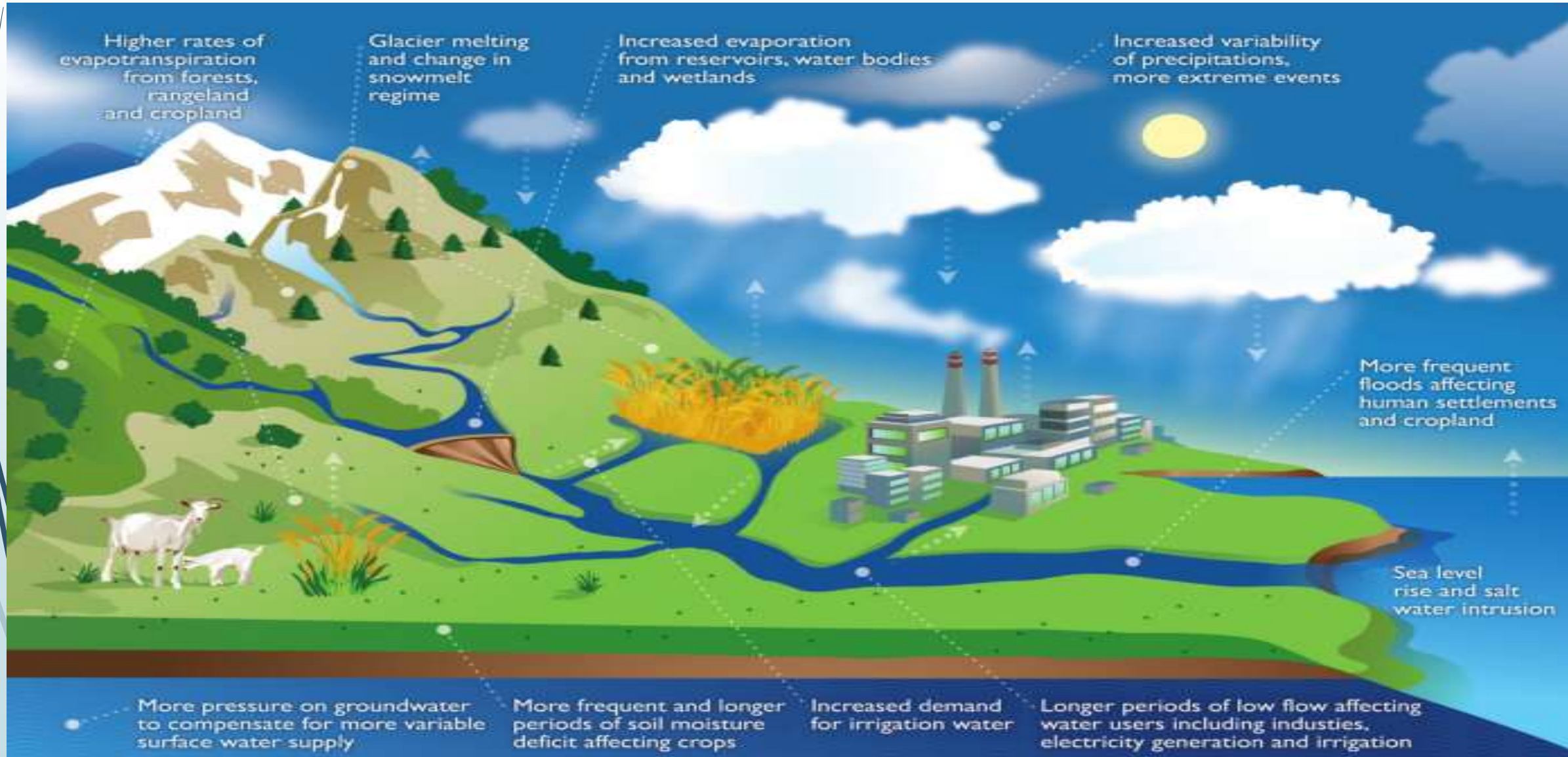
Fisheries: fish catch goes away

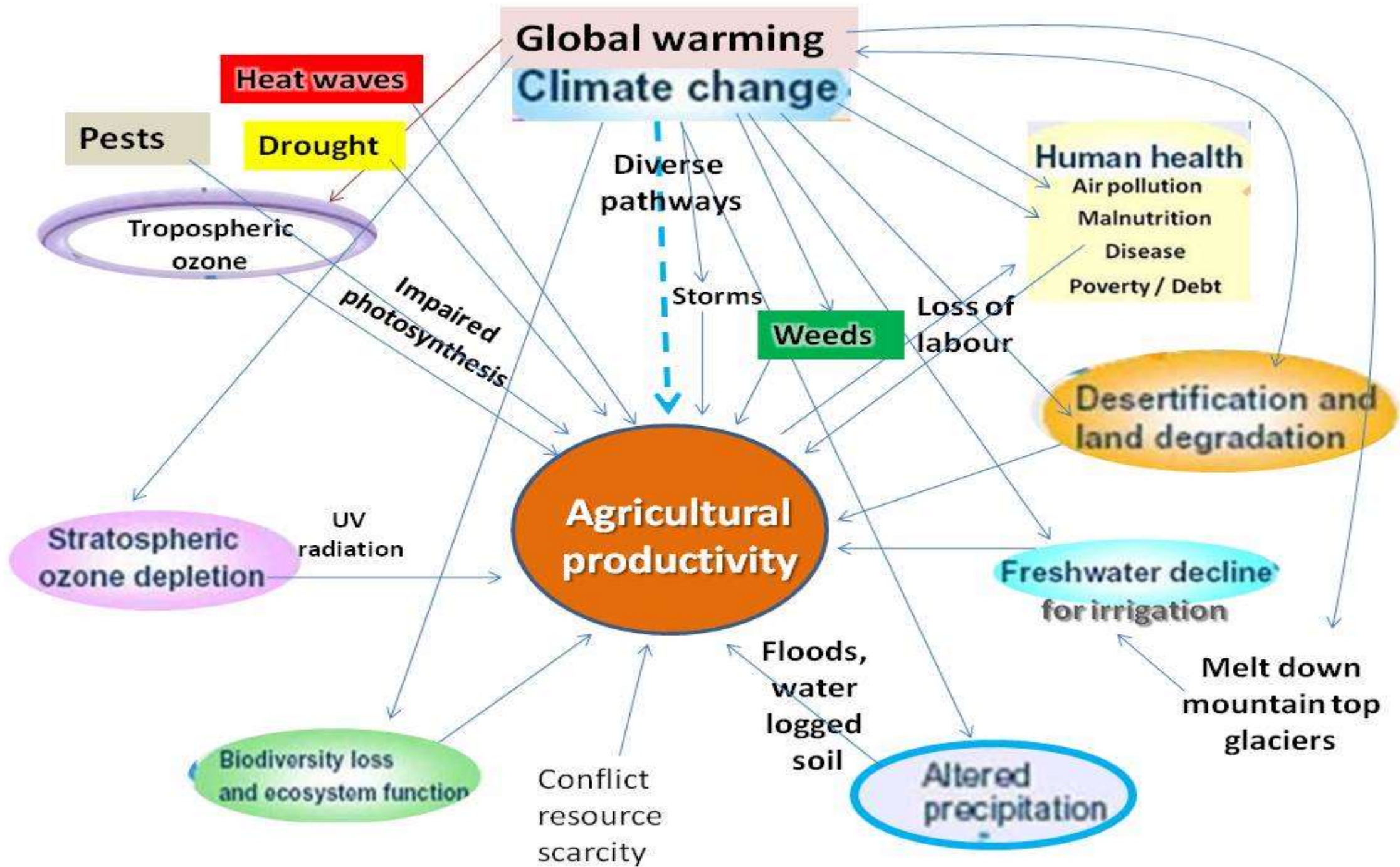
Climate Impact	Human Impact	Over all impact
Sea Level Rise <ul style="list-style-type: none"> • Flooding • Sea surges • Erosion • Salination of land and water 	<ul style="list-style-type: none"> • Loss of land • Drowning, injury • Lack of clean water, disease • Damage to coastal infrastructure, homes, and property • Loss of agricultural lands & Livestock • Threat to tourism, lost beaches • Salinity ingress root – level of crops and trees 	<ul style="list-style-type: none"> • Increase in poverty
Temperature Increase <ul style="list-style-type: none"> • Change in disease vectors • Coral bleaching • Impact on fisheries 	<ul style="list-style-type: none"> • Spread of disease • Changes in traditional fishing livelihood and commercial fishing • Threat to tourism, lost coral and fish diversity 	<ul style="list-style-type: none"> • Decline productivity – overall production <ul style="list-style-type: none"> - Agriculture - Livestock - Fishes
Extreme Weather Events <ul style="list-style-type: none"> • Higher intensity storms • Sea surges • Delayed monsoon • Long interval between rain – spells • Early withdrawal of monsoon 	<ul style="list-style-type: none"> • Dislocation of populations • Contamination of water supply • Damage to infrastructure: delays in medical treatment, food crisis • Psychological distress • Increased transmission of disease • Damage to agricultural lands • Disruption of educational services • Damage to tourism sector • Massive property damage 	<ul style="list-style-type: none"> • Threat to food and health security of hungry million
Changes in Precipitation <ul style="list-style-type: none"> • Change in disease vectors • Erosion 	<ul style="list-style-type: none"> • Outbreak of disease – both in crops and trees & Human beings • Depletion of agricultural soils 	<ul style="list-style-type: none"> • New health problems

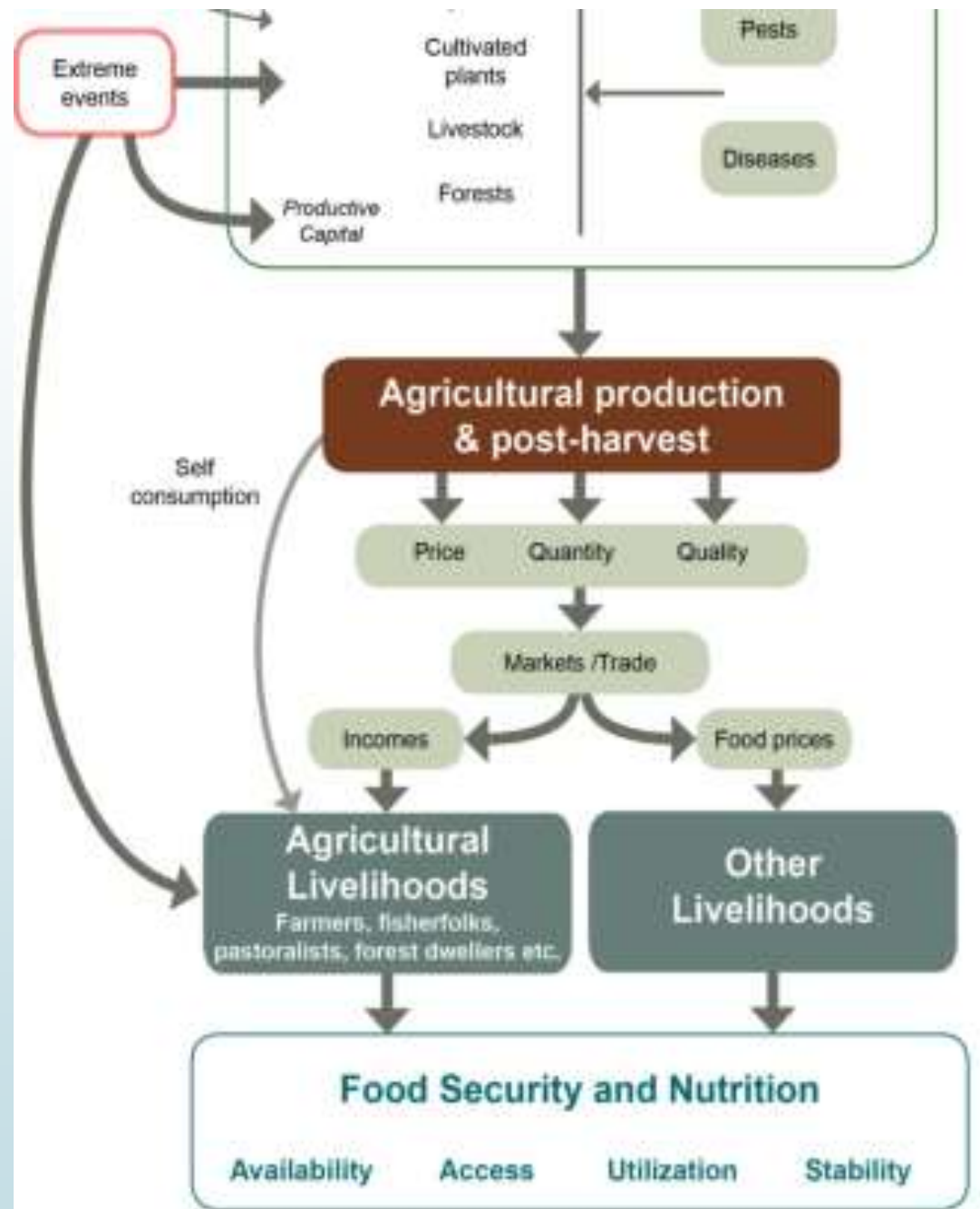
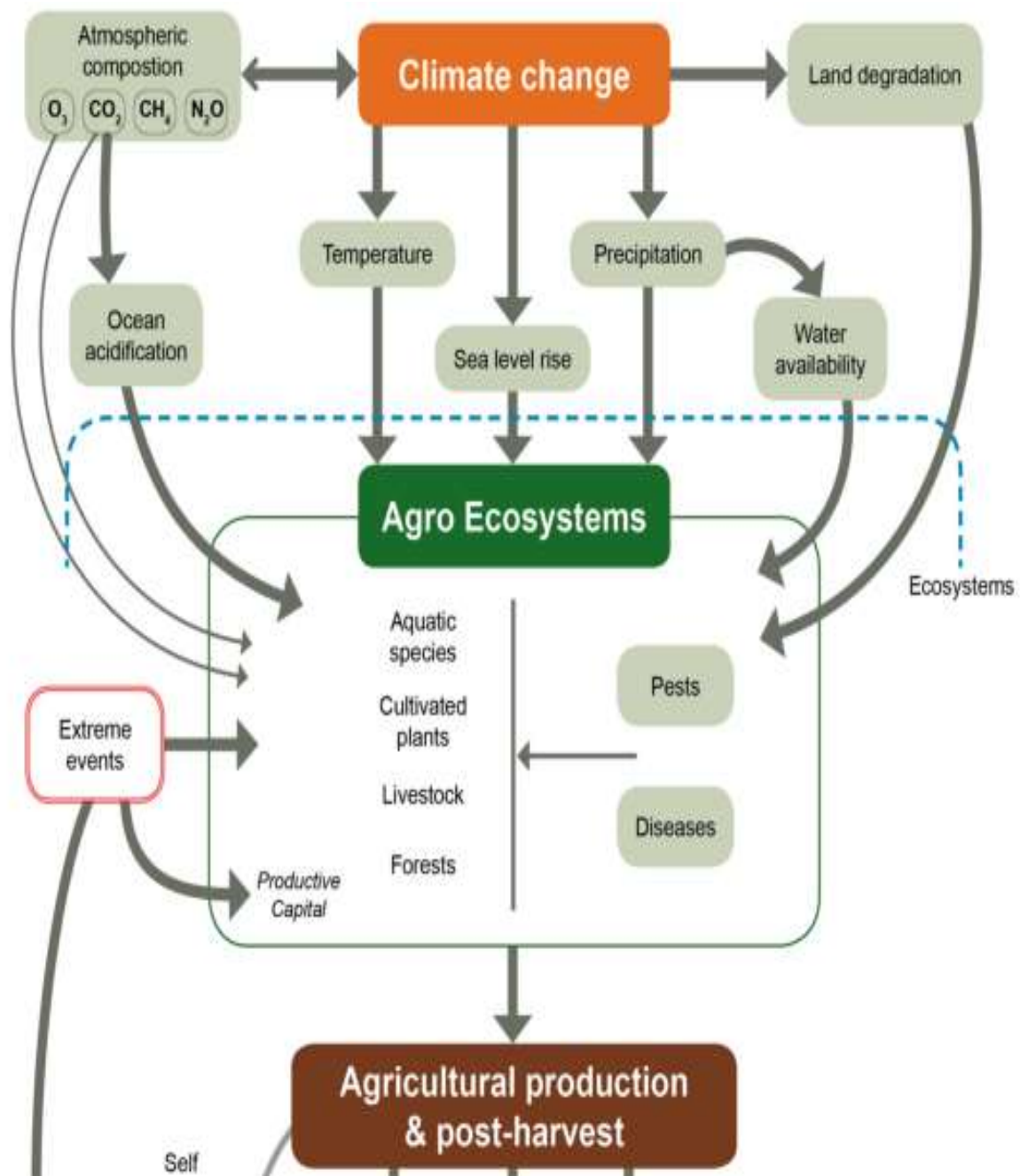
Source: Adapted from Climate Change: tackling the greatest human rights challenge of our time - Centre for International Environmental Law & CARE International – Feb 2015

How climate change affects all the elements of the water cycle and its impact on agriculture

Source: **FAO 2013**







Food production

- ▶ According to World Bank estimates, based on the International Energy Agency's current policy scenario and other energy sector economic models,

For a global mean warming of 4°C , there will be a 10-percent increase in annual mean monsoon intensity and a 15-percent increase in year-to-year variability in monsoon precipitation.

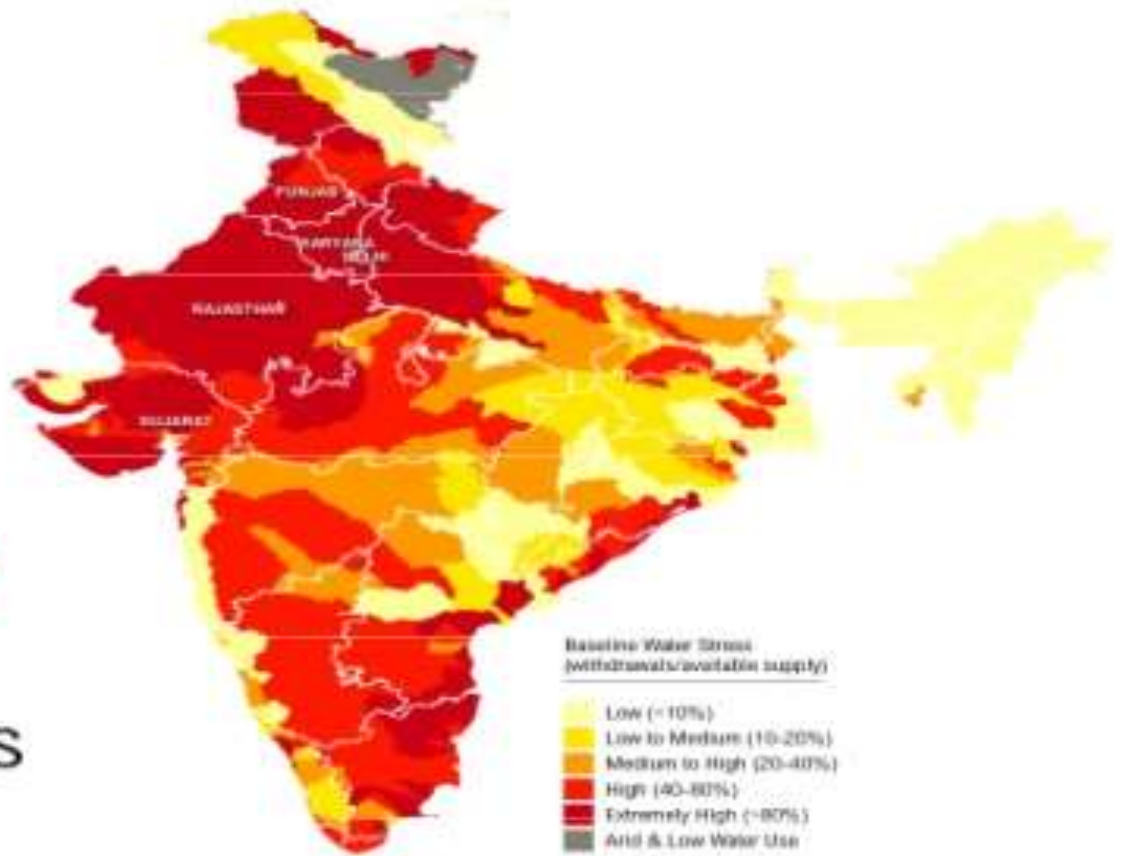
- ▶ World bank 2013 predicts that droughts will pose an increasing risk in the north-western part of India while southern India will experience an increase in wetness.

Cruz et al. (2007)

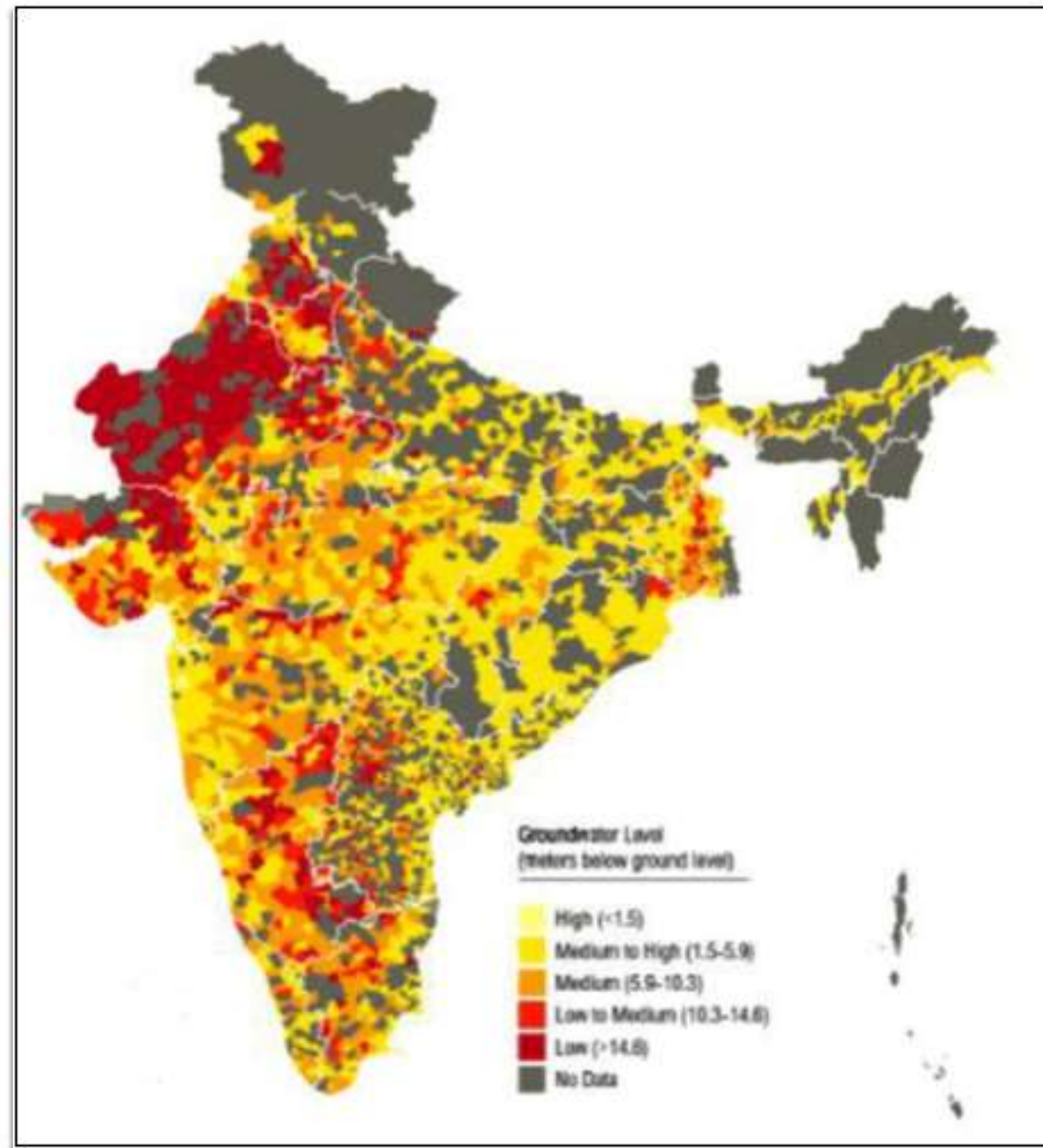
Decline in precipitation and droughts in India has led to the drying up of wetlands and severe degradation of ecosystems

Water stress across India

54%
of India
Faces
**High to
Extremely
High**
Water Stress

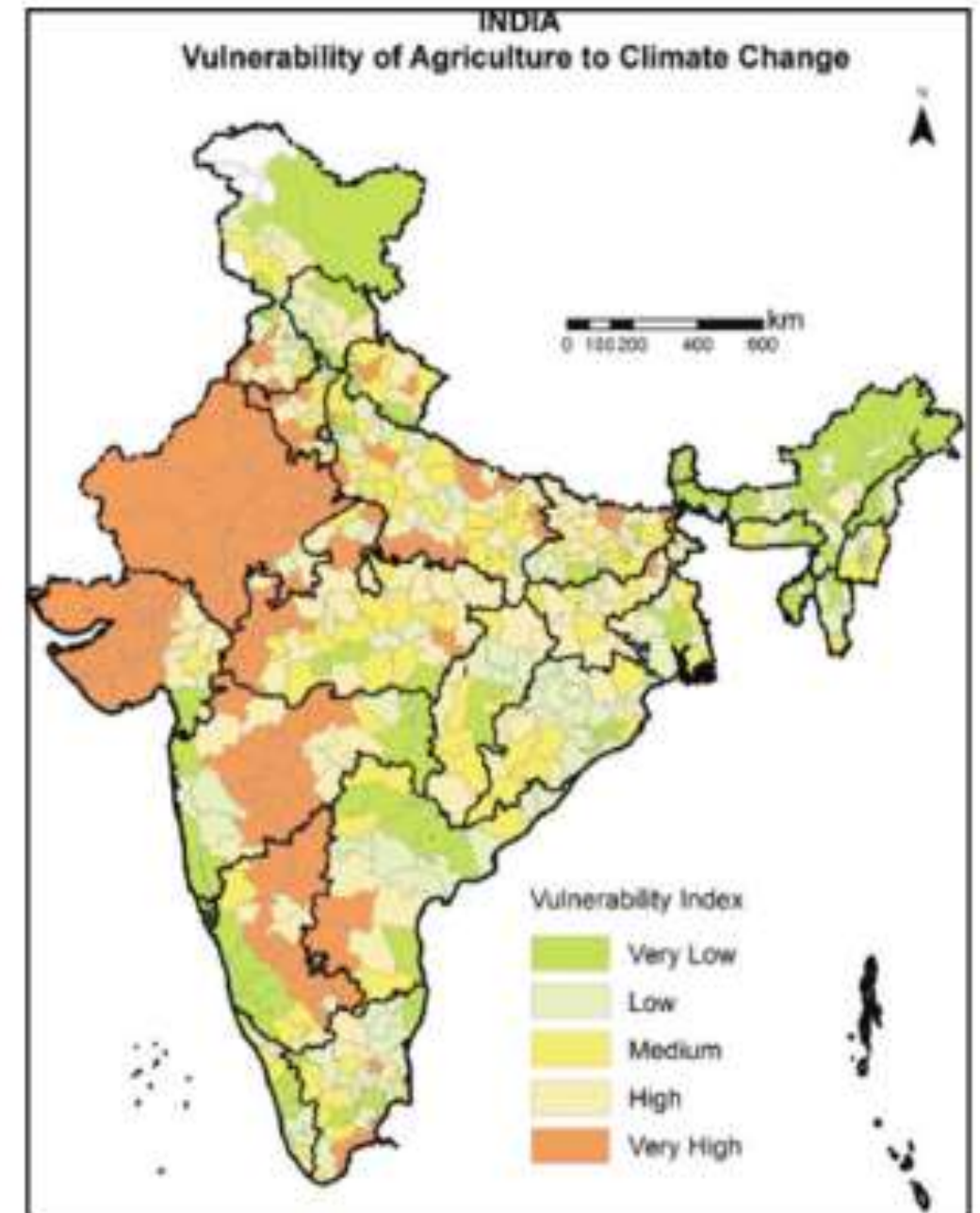


Groundwater level in India (meters below the ground level)



Source: World Resources Institute,

<http://www.wri.org/blog/2015/02/3-maps-explain-india%E2%80%99s-growing-water-risks>



Source: CA Rama Rao et al (2013)²¹

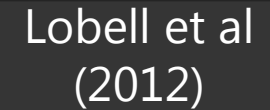
- 
- ▶ 65 percent of India's cropped area is rain-fed.

Wheat

Rice



sensitive
to
climate
change



Lobell et al
(2012)

wheat growth in northern India is highly sensitive to temperatures greater than 34°C

- ❖ Intergovernmental Panel on Climate Change (IPCC) report of 2007 → *0.5°C rise in winter temperature is likely to reduce wheat yield by 0.45 tonnes per hectare in India.*
- ❖ *Acute water shortage conditions, together with thermal stress, will affect rice productivity* even more severely

Food access

- ▶ Variation in the length of the crop growing season and higher frequency of extreme events due to climate change and the consequent growth of output adversely affect the farmer's net income.
- ▶ Climate change will also have an adverse impact on the livelihoods of fishers and forest-dependent people.
- ▶ Landless agricultural labourers wholly dependent on agricultural wages are at the highest risk of losing their access to food.
- ▶ In regions with high food insecurity and inequality, increased frequency of droughts and floods will affect children more, given their vulnerability.

Rodriguez-
Llanes et al (2011)

Children exposed to floods during their first year of life presented higher levels of chronic malnutrition.

URBAN POOR

Urban food insecurity is also a critical issue because poor households from rural and coastal regions typically migrate to urban areas for livelihood options.

R
H
I
S
K

Low-income groups residing in **informal settlements** which are often located in **areas exposed to floods and landslides** and where housing is especially vulnerable to **extreme weather** events such as wind and water hazards

Mumbai, Chennai & Kolkata are especially prone to bear the brunt of climate change

Dasgupta
et al (2012)



Child nutritional status in urban India (2014-15)

	Proportion of children under 5 who are stunted (%)	Proportion of children under 5 who are underweight (%)	Proportion of children under 5 who are wasted (%)
Andhra Pradesh	28.3	28.4	15.5
Assam	22.3	21.4	13.2
Bihar	<u>39.8</u>	<u>37.5</u>	21.3
Goa	18.3	25.3	<u>27.7</u>
Haryana	33.4	28.5	21
Karnataka	32.6	31.5	24.8
Maharashtra	29.3	30.7	24.9
Manipur	24.1	13.1	6.4
Meghalaya	36.5	22.9	13.7
Madhya Pradesh	37.5	36.5	22
Puducherry	24.7	23.3	26.1
Sikkim	22.9	12	13.2
Telangana	20.9	22.2	14.6
Tamil Nadu	25.5	21.5	19
Tripura	17.2	21.7	13.4
Uttarakhand	32.5	25.6	18.6
West Bengal	28.5	26.2	16.7

Source: Compiled from National Family Health Survey – 4 Database¹³

Worst drought in 12 years: Ajit

TIMES NEWS NETWORK
 New Delhi: Union agriculture minister Ajit Singh says the country has not experienced a drought as bad and widespread over the last 12 years as is being witnessed now. Describing the situation as "pretty bad", he said there is already some damage to the crops.
 Singh spoke to *The Times of India* on Wednesday evening, some hours after having chaired a meeting of agriculture and relief ministers from 12 states that are currently experiencing little or moderate rainfall. So far, only UP and Karnataka have

Govt declares worst-ever drought

NEW DELHI, July 26
 M.H. 26/07/2002
 THE Government warned that India was facing its worst-ever drought but assured the nation there would be no famine as there was enough grain to feed everyone.
 "This is an issue of very serious concern. Such a widespread drought has never occurred in the country," Agriculture Minister Ajit Singh told Parliament on Friday.
 "If it rains over the next 5-10 days the situation would be better. If it doesn't, it would be a catastrophe," he added during a debate.
 "However, I want to assure the house that we have enough stocks of foodgrains and there is no possibility of a famine if the state machinery functions well."
 Singh mentioned how large parts of the country, mostly in the north, is a state of severe drought. Standing crops in many states have been destroyed while many farmers have not been able to sow seeds for the next harvest due to inadequate or no rains.
 "The most affected states are Uttar Pradesh and Madhya Pradesh where rainfall has been 50 per cent less than normal," Singh said. "The damage has already been done."
 Singh said planning for adequate relief to affected

Drought declared in 2,700 villages in Gujarat

TIMES NEWS NETWORK
Gandhinagar: In view of the inadequate rainfall received in some pockets of Saurashtra and North Gujarat, the state government has announced drought conditions in as many as 2,747 villages of Kutch, Jamnagar, Banaskantha and Dahod districts where relief works will start by the first week of November.
 State revenue minister Nitin Patel told reporters that a decision to this effect was taken at the cabinet meeting held here. He said that the cattle-breeders would be provided fodder at Re 1 per kg in the drought-affected areas.
 The minister said the state government has already taken a series of measures to deal with the drinking water problem in these villages.
Paddy trouble
BHUBANESWAR: This year's severe drought in Orissa will cause a drop in paddy production by about 35.4 lakh tonnes worth about Rs 1,877 crore, according to a white paper published by the Orissa government. Paddy cultivation had been taken up in 22.4 lakh hectares in the state against the total area of 42 lakh hectares due to lack of rains, the paper submitted in the state Assembly on Monday said. The government had declared 283 out of 314 blocks as drought affected following which a central team visited the state between September 16 and 19.

Global rice meet

BANGKOK: The world's top rice exporters are considering setting up a council for joint rice exports. Thailand's commerce minister Adisai Bodharamik told reporters on Wednesday. The matter will be discussed at a meeting among ministers in charge of rice issues from Thailand, Vietnam, China, India and Pakistan in Bangkok on October 9, Adisai said. The meeting will aim to find a common strategy to stabilise global rice prices and create profitable prices for farmers.

of respiratory diseases are leading to "several hundreds of thousands" of premature deaths, as revealed by data from seven Indian cities, including Ahmedabad, Kolkata, Delhi and Mumbai.
 The report said the Indian data suggested some kind of air pollution was responsible for 24,000 annual premature deaths in the early 1990s. Just a few years later, said the report, the number of premature deaths had increased to an estimated 37,000 per year.
 Underlining the importance of the new study on the so-called "Asian brown cloud", UNEP executive director Klaus Toepfer warned, "In India, they are expecting more than two million people to die because of the incomplete burning of biomass" or the open fires used by the majority of ordinary Indians to cook their food.
 Toepfer stressed that the Asian haze was largely "the result of forest fires, the burning of agricultural wastes, dramatic increases in the burning of fossil fuels in vehicles, industries and power stations and emissions from millions of inefficient cookers burning wood, cow dung and other 'bio fuels'". The scientists, who are calling for an action plan to address the threats across Asia as a whole, have also frightened much of Europe by the suggestion that the Asian haze has "global implications".
 On Monday, Toepfer pointed out to a shocked Europe that "a pollution parcel like this, which stretches three-km high, can travel half way round the globe in a week".
 Environmental groups such as Friends of the Earth have been calling for India and other affected countries to be helped to popularise solar cookers among the poor. Roger Hingman of Friends of the Earth also criticised the West for selling "cars in the middle class in India".
 The UNEP says Project Asian Brown Cloud should establish observatories to study the haze as well as its impact on agriculture, health and water budget.

Press Report on Drought

- Rise in Extreme Weather Events
- Frequency of intense rainfall events has increased over past 53 years.
- Extreme rainfall events also increased over the west coast of India (Analysis of 100 years of data; 1901-2000).

Smog cloud delaying rains, taking its toll

By Harshna Z. Ahmed
 TIMES NEWS NETWORK
 13.8.02

India and the rest of the South Asian region are covered by a deadly, three-km deep blanket of pollution, which is radically changing monsoon patterns, causing drought, reducing India's winter rice harvest and literally killing tens of thousands of people by respiratory disease, a new study has said.
 The report on the "Asian brown haze", released on Monday by scientists working with the United Nations Environment Programme (UNEP), said the east "pollution parcel" could endanger the economic success of South Asian countries, particularly India.
 The haze has been identified as a deadly cocktail of ash, acids, aerosols and other particles by 200 scientists, including India's A.P. Mitra of the National Physical Laboratory, Professor V. Ramanathan of the Scripps Institute of Oceanography in the United States and Nobel laureate Paul Crutzen of the Max-Planck Institute for Chemistry in Germany.
 The scientists, who believe the worst may be yet to come for the stricken area, said the effects of the haze would intensify over the next 30 years, as South Asia's population rises to an estimated five billion people.



Driest July in 100 years

New Delhi: Though the monsoon improved over the past week and is expected to intensify in another two or three days, it has probably come a bit too late to compensate for the damage caused by too, the weather office confirms, was India's driest July in 100 years. The country's average rainfall in July, supposedly the wettest month, is around 50 cm. What the country actually got last month was barely half of this.
 Rains were fairly widespread over the past week, especially in the affected areas of Karnataka, Andhra and Maharashtra. And, the weather office says, the signs are favourable for an intensification after two or three days in the country, including the areas which didn't share in last week's bounty.

Drought situation worse than 1972: Nilangekar

TIMES NEWS NETWORK
Mumbai: The Union government has so far given a paltry Rs 20 crore against the Rs 1,000 crore sought by the Maharashtra government for tackling drought. State revenue minister Shivajirao Patil Nilangekar said on Friday that the drought situation was worse than the 1972 scenario as far as drinking water supplies are concerned.
 "Water levels in dams have gone down. The ground water table has also gone down to a very low level. Unless we take immediate steps drinking water supply will be a serious problem," he said at a press conference.
 The central team of experts has already visited the state, and on the basis of its recommendations the Union government has sanctioned Rs 20 crore. He pointed out that even district headquarters like Latur is being provided water once in a week, indicating the seriousness of the problem. The revenue department has asked the irrigation department to take stock of the water reservoirs in the state and finalise priorities for its distribution for drinking purposes.
 Nilangekar said the state will require funds to pay the increasing number of workers who are reporting for employment guarantee scheme (EGS) projects.
 He said at present there are 4.5 lakh workers under EGS in the state, far more as compared to last year's figures, and every day the number is increasing. District collectors have informed the state administration that a growing number of marginal farmers are seeking work under EGS.
 Nilangekar said he has called an important meeting of officials concerned to take stock of the situation in Pune on February 27 and 28. Chief minister Sushilkumar Shinde will attend the meeting.

FOOD ABSORPTION

- Change in climatic conditions could lead to a reduction in the **nutritional quality of foods due to elevated carbon dioxide levels.**
- In India, where **legumes** (pulses) rather than meat are the main source of proteins, such changes in the quality of food crops will accelerate the largely neglected epidemic known as *“hidden hunger” or micronutrient deficiency.*
- India, children living in poor rural areas and urban slums are at higher risk of morbidity and mortality from diarrhoeal diseases

URBAN POOR [piped water, sanitation, clean drinking water, drainage systems, and health facilities]

vector-borne diseases such as malaria, dengue and chikungunya.

High incidence of undernutrition due to poverty exposes the urban poor to diseases linked to climate impacts, which in turn **aggravates undernutrition and ill-health and reduces the ability to adapt and build resilience to climate change.**

CCIS - Introduction

- Comprehensive Crop Insurance Scheme introduced in 1985
- Operated for almost a decade and a half
- Scheme covered cereals, pulses and oilseeds
- States were free to choose whether to implement it or not
- CCIS compulsory for farmers taking loans for crops production
- Farmer insured for 100% of the loan
- Premiums and claim amounts shared by Central and State govt. in the ratio of 2:1
- Uniform premium rate for the whole country based on crop
- 50% subsidy for small and marginal farmers

NATIONAL AGRICULTURAL INSURANCE SCHEME (NAIS)

- For improving the scope and content of CCIS a broad based NAIS was introduced from Rabi 1999-2000.
- NAIS provides for greater coverage of farmers, crops and risk commitment.
- Premia-structure has been rationalized and the scheme is required to operate at smaller unit area of insurance.
- Subsidy to Small and Marginal farmers.
- It is presently being implemented by 25 States & 2 Union Territories
- In last 22 Crop Season:
 - Farmers Covered : 17.01 crore (Av. not more than 15% farmers)
 - Premium Collected: Rs. 6213.41 crore
 - Claims Paid : Rs. 20437.21 crore
 - Claim ratio : 3.29
 - Loss cost : 9.86%

Crop insurance schemes, old and new

Parameter	Old scheme (NAIS)	Modified scheme (MNAIS)
Insurance unit	District	Village panchayat
Early settlement	Based on final yield estimates submitted by government of state	Up to 25% of likely total claims
Pre-sowing/ planting risk	Not covered	Prevented/failed sowing risk to be covered up to 25% of sum insured
Indemnity levels	60%, 80% and 90%	70%, 80% and 90%
Compulsory/ Voluntary nature	Compulsory for farmers who take loans and voluntary for farmers who don't take loans	No change
Localised calamities	Not covered	Individual claim assessment in case of hail storm, landslide
Post-harvest losses	Not covered	Post-harvest losses due to cyclones to be covered in coastal areas
Weather factors	Different for farmers who take loan and those who don't	Uniform for farmers who take loans and those who don't

Soil Health Card Scheme

- launched by the Government of India in February 2015

Printed report that a farmer will be handed over for each of his holdings. It will contain the status of his soil with respect to 12 parameters, namely N,P,K (Macro-nutrients); S (Secondary-nutrient); Zn, Fe, Cu, Mn, Bo (Micro-nutrients); and pH, EC, OC (Physical parameters). Based on this, the SHC will also indicate fertilizer recommendations and soil amendment required for the farm.



Soil Health Card

nccsindia.org

(7) Crop wise fertilizer recommendation based on soil analysis report.
(For individual field)

Season/ Crop	Department's General Recommendation for fertilizer (N:P:K/Heater)	Recommendation based on soil analysis			
		FYM (Tn/H)	Nitrogen (Kg/H.)	Phosphorus (Kg/H.)	Potash (Kg/H.)
1. Monsoon					
Banana	100: 90: 100 (Gr./Plant)	15	200	90	180
Jowar (Fodder)	75: 40: 0	15	85	40	0
Paddy (Early)	80: 30: 0	12	90	30	0
Paddy (Medium)	100: 30: 0	20	110	30	0
Paddy (Late)	120: 30: 0	20	130	30	0
Tobacco (Autumn)	180: 0: 0	25	200	0	0
Til (Semi Winter)	20: 25: 0	10	55	25	0
Til (Semi Winter)	12: 12: 0	10	12	12	0
Hybrid Bajri	80: 40: 0	25	90	40	0
2. Winter					
Wheat	120: 60: 0	25	130	60	0
3. Summer					
Summer Bajri	120: 60: 0	25	120	60	0

SOIL HEALTH CARD AGRICULTURAL DEPARTMENT GUJARAT STATE

Soil Health Card No. : SHC/0007842

- Farmer's Name : Mr. Parbhottambhai Hirabhai Patel
- Village : zarola Taluka : Borsad District : Anand
- Account No. : 180
- Land/Soil detail as per account :

Sr.No.	Survey No	Area (Hector)	Soil Type
1			
2			
3			

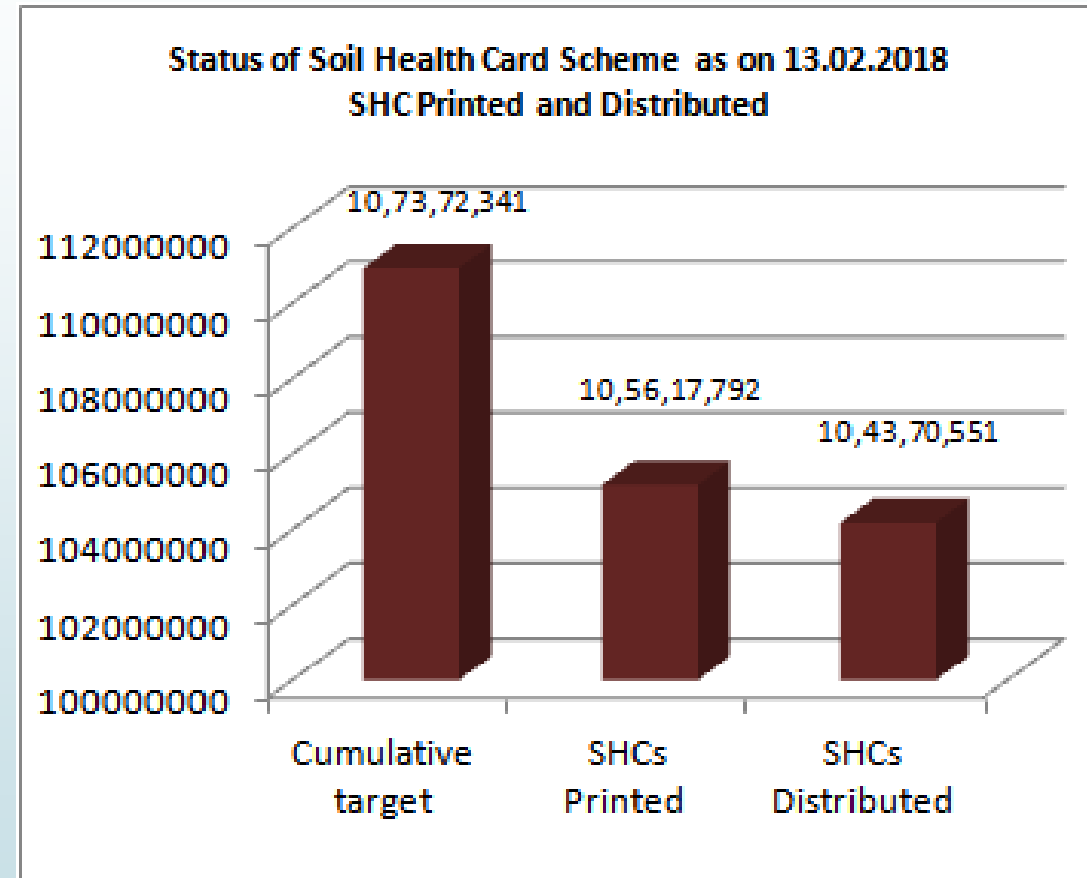
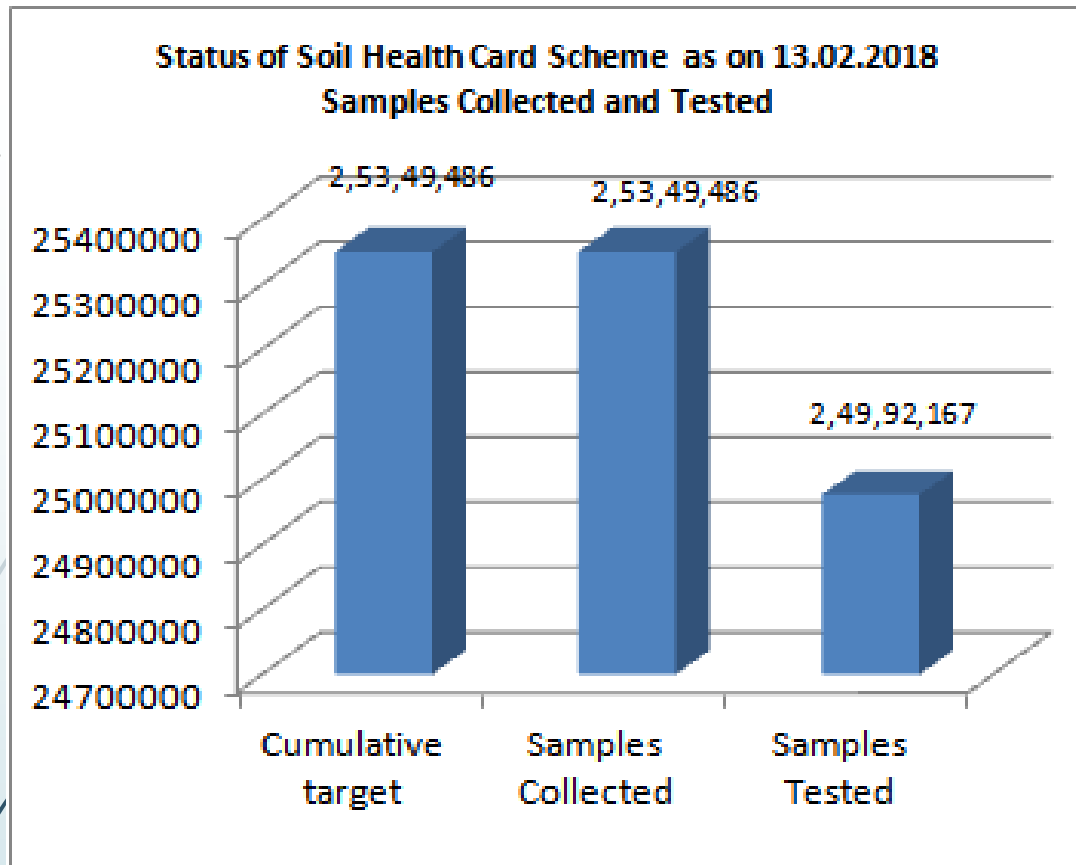
- Soil Fertility Status based on the analysis of the village soil.

Sr.No.	Fertility	Nitrogen	Phosphorus	Potash
1	Low			
2	Medium			
3	High			

- Soil Analysis Detail of individual field : Survey No. - 1004-2

Sr No.	Detail	Result	Explanation of the result
1	pH Value (Soil reaction)	7.20	Normal
2	EC (Electric Conductivity) (millimhos/cm)	0.49	Normal
3	Organic Carbon (%)	0.26	Low
4	Available Phosphorus P ₂ O ₅ (Kg/ha)	43.00	Medium
5	Available Potash K ₂ O (kg/ha)	254.00	Medium

	pH	EC (Electric Conductivity)
Acidic	< 6.5	200 < 1.0
Normal	6.5 to 8.5	200 to 1.0
Basic	> 8.5 (Optimum to be used)	Hardly > 1.0



RECOMMENDATIONS

Adoption Of Sustainable Agricultural Practices

- ❖ Better management of water resources must be a key feature of sustainable agriculture.
- ❖ Water supply management options such as new storages and water harvesting are important, especially in the water-stressed regions of north-western India

STRATEGIES

- ✓ Increase irrigation efficiency
- ✓ Promote micro irrigation in water-deficient areas
- ✓ Better water resource infrastructure planning
- ✓ Restoration of water bodies in rural areas



Stronger emphasis on public health

- ▶ *Despite the fact that the disease burden from vector-borne and diarrhoeal diseases is very high in urban slums and tribal areas of India, this area was overlooked when the original National Action Plan for Climate Change (NAPCC) was formulated.*
- ▶ *The Ministry of Health is currently formulating a National Mission for Health under the ambit of NAPCC but given the close relationship between climate change, infectious diseases and food absorption, public expenditure on health needs to be stepped up drastically.*

Enhance livelihood security

National Rural Employment Guarantee Act (NREGA) of 2005

- Increasing rural wage
- Reducing gender wage gaps
- Enabling better access to food
- Reducing distress migration from rural areas
- Child well being, through the reduction of hunger and improvement of health and education

- ❑ Such a scheme should be tailored to not only provide livelihood security to the urban poor but also create climate resilient urban infrastructure in Indian cities.
- ❑ Additional efforts are required for the vulnerable populations residing in the ecologically fragile coastal and forest regions.



Greater emphasis on urban food insecurity

- Improve access to healthy food,
- Effective public distribution systems need to be put in place in other states like Tamilnadu
- To improve food absorption, living conditions in urban informal settlements need to be upgraded.
- The Swachh Bharat Mission, which aims to construct 10.4 million individual toilets and 0.5 million public toilets and adopt scientific solid waste management in 4,041 towns, may be regarded as a step in the right direction.
- Public investment in climate-resilient infrastructure should be enhanced.



Long-term relief measures in the event of natural disasters

- ▶ Long-term undernutrition prevention programmes must be implemented in disaster-affected regions.
- ▶ Additional efforts must be directed towards reducing the risk in agriculture.
- ▶ Such schemes should be specially targeted towards small farmers.

Need for more impact assessment studies

- Research efforts should be directed towards assessing and quantifying where possible the impact of climate change on undernutrition and food absorption.



Conclusion

- Understanding the cascade of risks of the most vulnerable populations is key to frame ways to adapt.
- Reducing vulnerabilities is key to net impacts on food security and nutrition and also to reducing long-term effects.
- The strategies for food security should be gender-sensitive, multi-scales, multi- sectors and multi-stakeholders.
- The National Adaptation Plan process set up under the UNFCCC provides the opportunity to integrate food security and nutrition as a key objective

*SAVE ENVIRONMENT
SAVE EARTH*



Thank you