CLIMATE CHANGE AND FOOD SECURITY IN INDIA

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Food security – an evolving concept

- In the 50s and 60s:
  - Food security = self sufficiency in major staples
- After World Food Conference of 1974:
- Food Security = Access to sufficient food

- Situations that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life
  - World Food Summit of 1996

FOOD UTILIZATION

- Nutritional value
- Social value
- Food safety

FOOD ACCESS

- Affordability
- Allocation
- Preference

FOOD SECURITY DIMENSIONS

FOOD AVAILABILITY

- Production
- Distribution
- Exchange

FOOD STABILITY

- Yield loss
- Extreme events

Context 1 : Increasing populations

Census of India

Office of the Registrar General & Census Commissioner, India

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Census Data 2001 >> India at a glance >> Population Since 1901

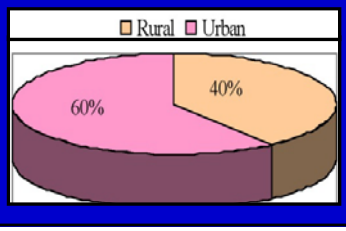
Variation in population since 1901

Year	Total	Rural	Urban
1901	238,396,327	212,544,454	25,851,873
1911	252,093,390	226,151,757	25,941,633
1921	251,321,213	223,235,043	28,086,170
1931	278,977,238	245,521,249	33,455,989
1941	318,660,580	274,507,283	44,153,297
1951	361,088,090	298,644,381	62,443,709
1961	439,234,771	360,298,168	78,936,603
1971	548,159,652	439,045,675	109,113,977
1981	683,329,097	523,866,550	159,462,547
1991	846,302,688	628,691,676	217,611,012
2001*	1,028,737,436	742,490,639	286,119,689

Comparative population Growth Rate

Source : CIA World Fact Book,2009

Context 2 : Urbanisation



Context 3: Increased demand for food

- Increase in Population
- Increase in income levels
- Increased meat consumption
  - But 1 kg poultry meet = 1.75 kg grain as feed
- Increase in Feed requirement

Context 4: Limited land areas

Decline in total cultivable land

1980-81 : 185.09 M ha

2005-06 : 182.57 M ha

Land converted to non agricultural uses

Increased area under non food crops Eg : Biofuels

Context 5 : Prone to Hazards

- **Floods and Droughts**
- **Cyclones and Storms**
- **Tsunami**
- **Heat and Cold waves**
- **Earthquakes**

- **Food production losses**
- **Infrastructure damage**
- **Asset losses**
- **Increased livelihood risks**
- **More food emergencies**
- **Health risks**

Context 6 : Climate Change

Drivers

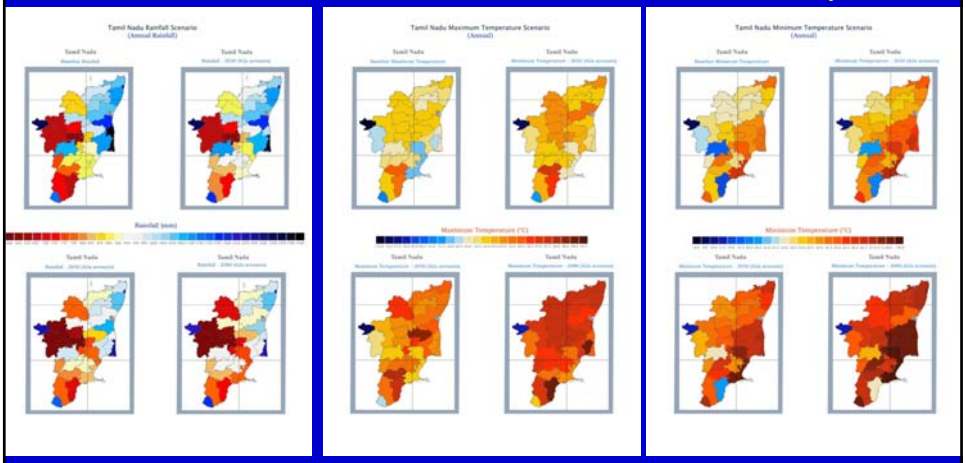
- Demographic
- Economic
- Technical
- Social
- Political
- Cultural

Observed Changes

- Increase in GHG
- Global warming
- Change in precipitation
- Glacier Melt
- Sea level rise
- Extreme events

Expected Changes: Tamil Nadu

Rainfall | Maximum Temperature | Minimum Temperature



Possible effect of Climate Change on Agriculture

CO2 fertilization effect + Increase in Temperature

Change in crop water requirement + Increasing glacier melt - availability of irrigation

Fertilizer Use Efficiency + Green House Gas emission

Latitudinal effect + Food Price, Trade and Food security

Population dynamics of pest and disease

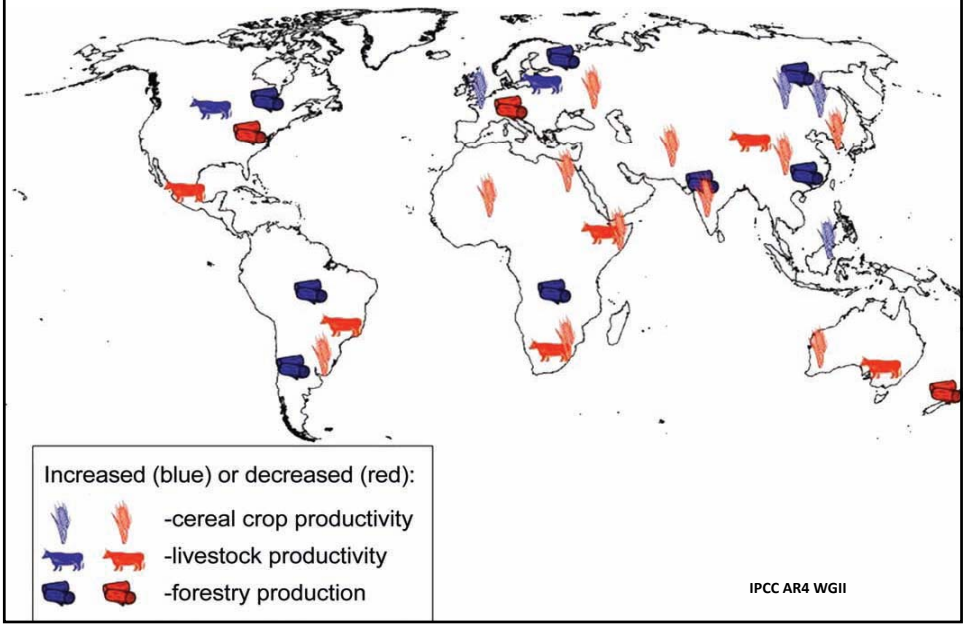
Extreme weather events

Quality of Agricultural Produces

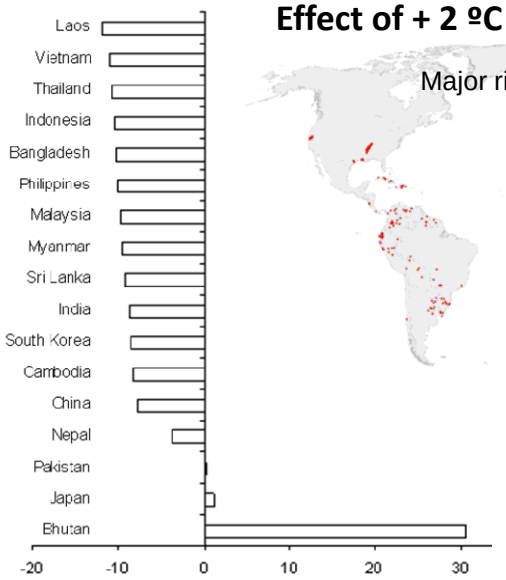
Fluctuation in food production

Storage, transport and Marketing

CC Impacts on crop, livestock and forest production

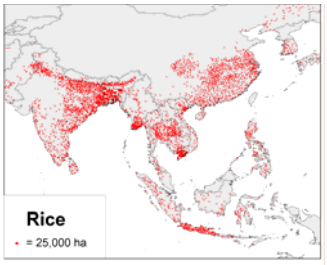


Effect of + 2 ºC on rice production

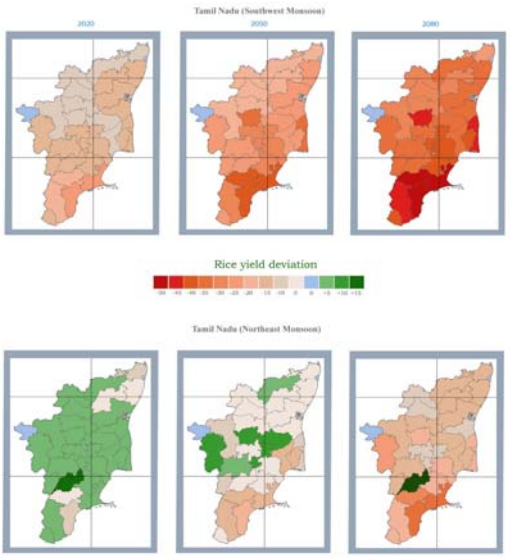


Change in yield (%)

Major rice growing areas of the world



Impacts of changing climate on Rice production in Tamil Nadu

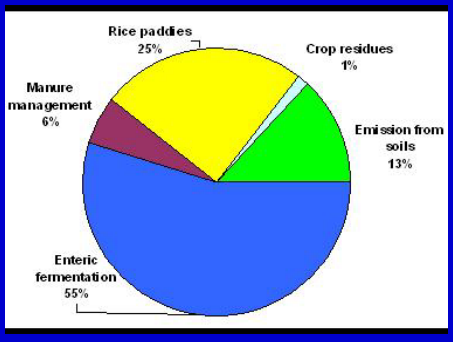


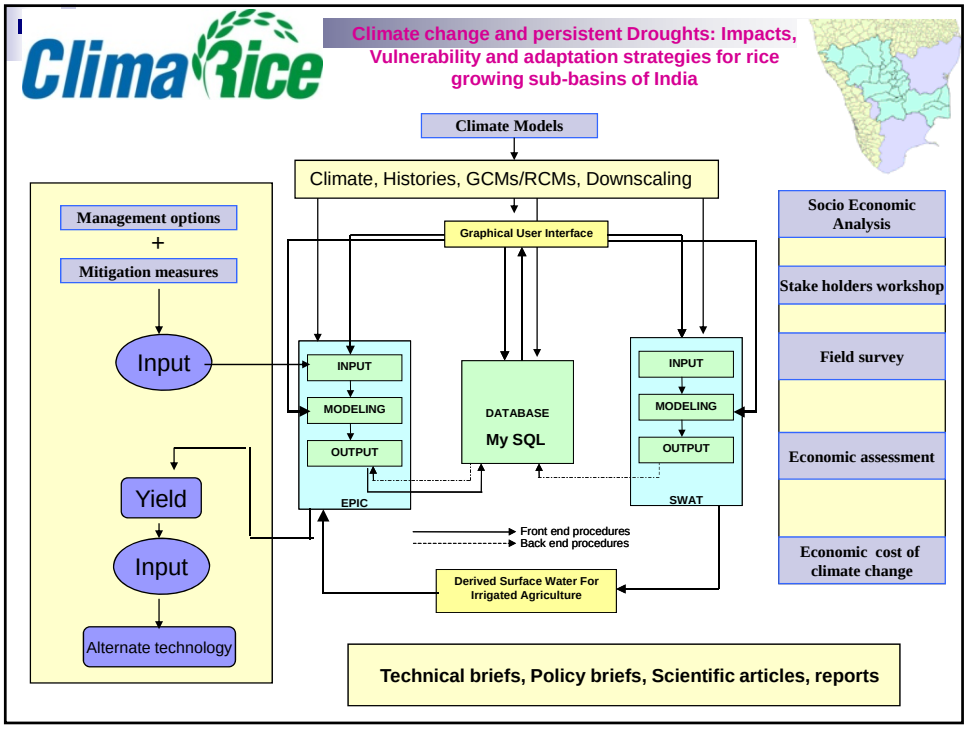
Contribution of Indian Agriculture to Global Warming

Agriculture sector contributes 28% of the total GHG emissions from India (as per the data of 1994; MOEF).

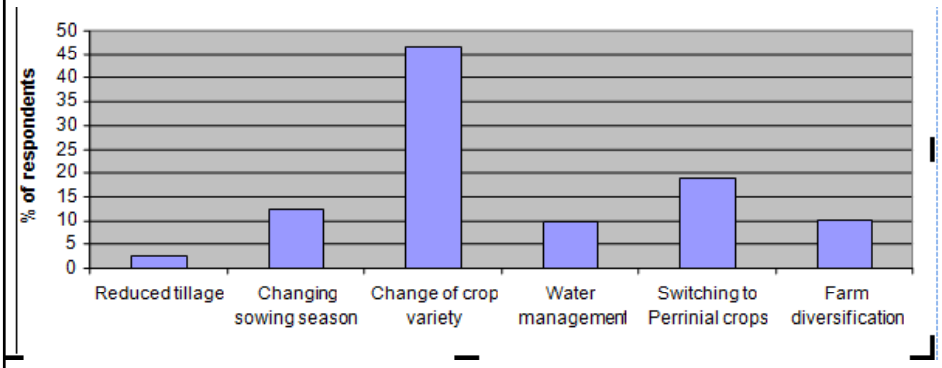
The emissions from Indian agriculture are likely to increase significantly in future

Increased temperatures would lead to higher emissions even at the current level of fertilizer consumption.

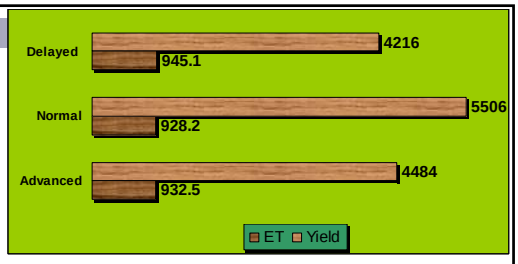




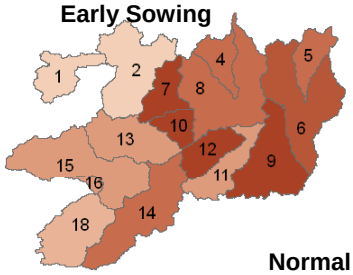
Adaptation options – Farmers opinion



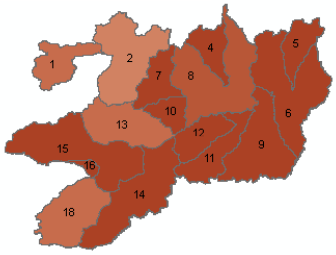
Shifting of sowing window



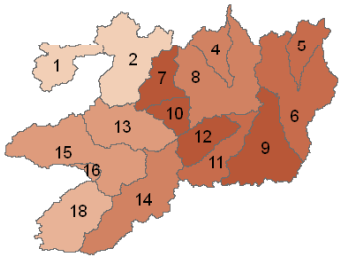
Early Sowing

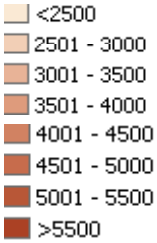


Normal Sowing



Late Sowing





Changing the system of cultivation

Rainfall : 871 mm ET : 709 mm PET : 1828 mm

21	Number of Irrigations given	28
1220	Quantum of water used	920
- 0 -	Saving of irrigation water	300

	Flooded	SRI
Area under Rice crop in ha (56 % of 3246.4 sq.km)	1817984	1817984
Total water required for irrigation under flooded cultivation (mm)	2217940480	1672545280
Total water saved in the basin (mm)	-	545395200
Additional area that can be brought to Rice (ha)	447045	592821
Yield (Kg/ha)	3032	4109
Yield advantage	-	26%

Altering Water Management

Particulars	**Aerobic Rice**	**Alternate wetting and Drying**
Rainfall (mm)	871	871
ET (mm)	692.8	704.5
PET (mm)	1828	1828
Number of Irrigations given	19	17
Total Quantum of water used for irrigation (mm)	740	1020
Saving in irrigation water / ha	280	-
Yield	2401	3282
Yield advantage	-	1831

Mitigation measures . . .

Mitigation options for GHG emission from Paddy field soils

Methane

- Modification of irrigation pattern
- Management of organic inputs
- Change of crop establishment technique
- Change of fertilizer management
- Use of suitable crop cultivars

Mitigation of methane emission

More methane

Aerobic rice

Less methane

Direct seeded rice

Less methane

Bed-planted rice

Organic Input Management

- Fermented manure (Biogas plant)
- Timing of manure incorporation

Global warming mitigation potential of biogas plants in India

H. Pathak · N. Jain · A. Bhatia · S. Mohanty · Navinder Gupta

Brown Manuring

Co-culturing of *sesbania* with rice for 25-30 days and then knocking down with 2,4–D ester

Water Saving Technologies

Laser land leveling

Raised bed planting

Mitigation options for GHG emission from agricultural soils

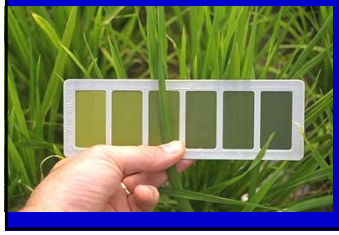
Nitrous oxide

- Improving N fertilizer management
- Optimizing irrigation practices
- Optimizing tillage operations
- Managing organic inputs

Fertilizer Management

- Nitrification inhibitors
- Sulphate containing fertilizers

Leaf colour chart



Urea tablet

Mitigation options for GHG emission from agricultural soils

Carbon dioxide

- Conservation agriculture
- Cover crop, crop rotations, diversification
- Judicious use of off-farm input
- Integrated crop management
- Integrating trees and livestock with crop
- Drip, furrow or sub-surface irrigation
- Conservation/restoration of degraded soils

Implementation of Mitigation Options

- Cost effectiveness
- Maintained or enhanced production
- Resource availability of the farmers
- National and international policy environment

TNAU

"Humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose ultimate aim is to contain Global Warming"

TNAU

Mahatma Gandhi said that "There are people in the world so hungry, that God cannot appear to them except in the form of bread"

Those least able to cope and least responsible for Global Warming are the most affected

TNAU

Theodore Roosevelt, America's 26th President and a dedicated conservationist, said:

"The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased, and not impaired in value."

The science that we do, we research, allows us to clean our air, improve our health, and leave our planet a better place for our children.