

# ***Climate Resilient Agriculture India's Experiences***

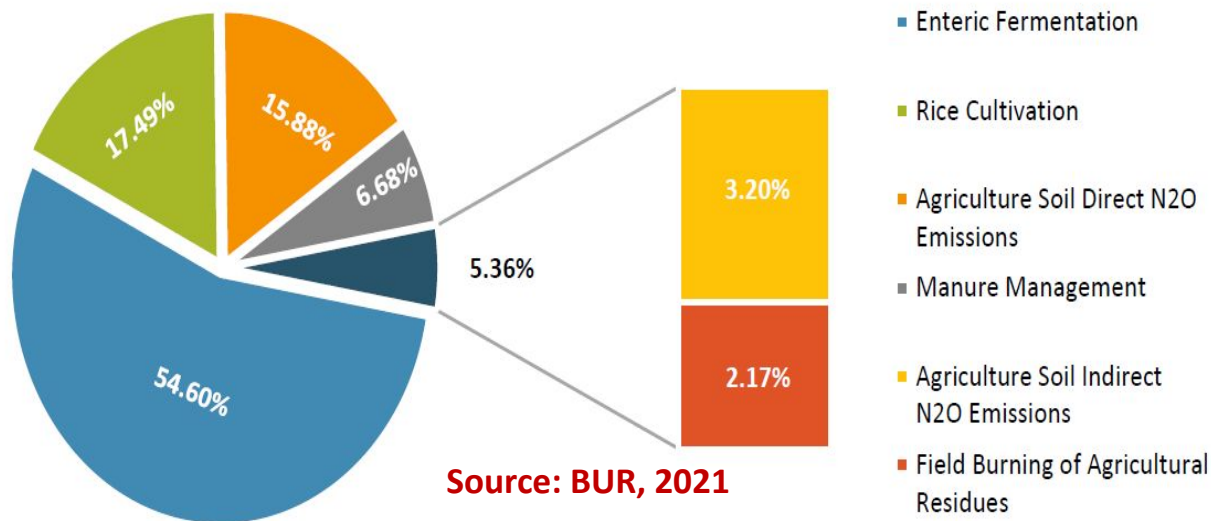
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Central Research Institute for Dryland Agriculture (CRIDA)  
Hyderabad, India**

# Evidences of Climate Change in India

- Warming of the climate
- Increase in Min Temp ( $0.21^{\circ}\text{C}/\text{decade}$ ) during 1991-2016
- Expansion of arid regions
- Shortening of the growing season
- Increase of rainfall variability & number of heavy rainfall events
- Increased flooding

GHG emissions (Gg) from Agriculture sector during 2016 ( $\text{CO}_2 \text{ e}$ )



# India Initiatives to address Climate Change

Prime Minister's Council on Climate change has prepared National Action Plan on Climate Change (NAPCC) in 2008 to address the climate change concerns comprehensively

A National Action Plan has been prepared involving eight National Missions

- 1) National Solar Mission
- 2) National Mission for Enhanced Energy Efficiency
- 3) National Mission on Sustainable Habitat
- 4) National Water Mission
- 5) National Mission for Sustaining the Himalayan Ecosystem
- 6) National Mission for a Green India
- 7) National Mission on Strategic knowledge for Climate change
- 8) National Mission on Sustainable Agriculture (NMSA)

NMSA improved crop seeds, livestock and fish cultures, water use efficiency, pest management, improved farm practices, nutrient management, agricultural insurance, credit support, e-markets, access to information and livelihood diversification

Direct seeded rice upscaled in 1.12 mha, micro irrigation implemented in 12 mha,  
Soil health cards issued for 1224 million farmers

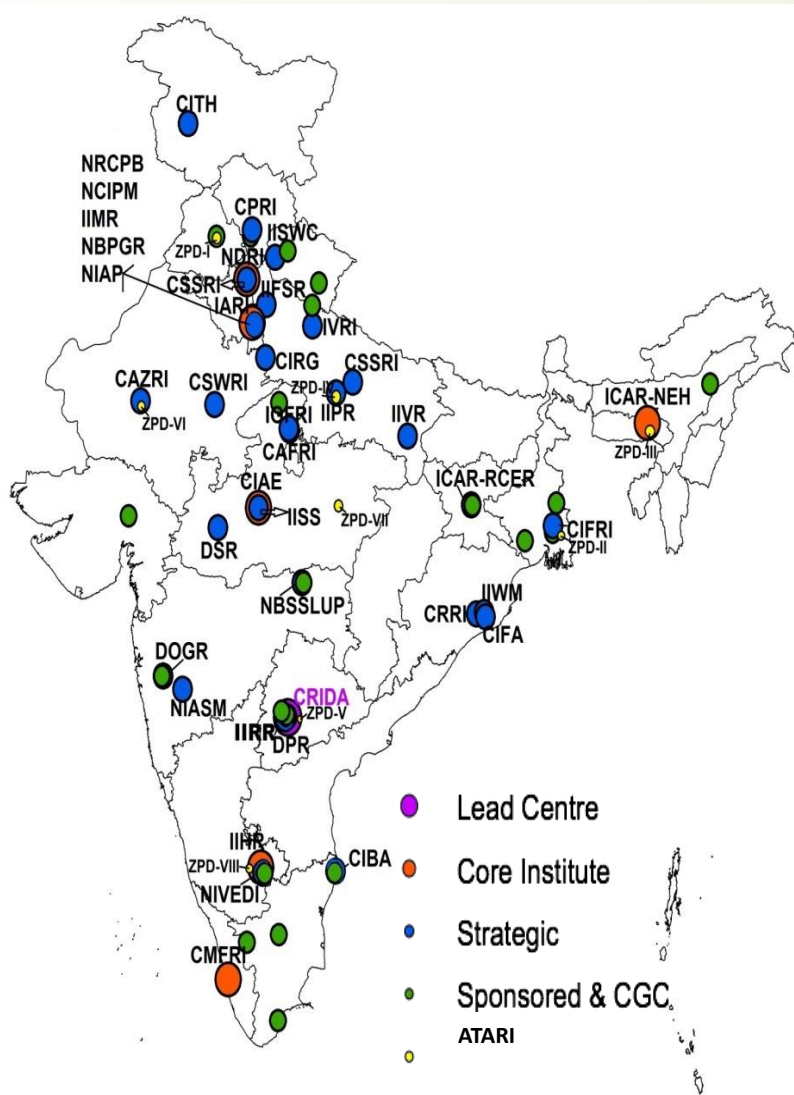
# Impact on Crops & Adaptation

| Crop    | Projections for future (RCP 4.5)                                                                                                                                                                                                                             | Adaptation                                                                                                                               |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Rice    | <p>Irrigated rice yield to reduce by 4% in 2010-2039</p> <p>Rainfed rice yield to reduce by 6% in 2010-2039, &lt;2.5% in 2041-2070</p>                                                                                                                       | <p>Irrigated rice yield to improve by about 17%</p> <p>Rainfed rice yield to improve by about 20%</p>                                    |
| Wheat   | <p>A rise of 1°C in mean max &amp; min Temp for vegetative and grain filling period can reduce wheat yield by 360 and 265 kg/ha, respectively Yield reduction (6-23%) by 2050. With every 1°C rise in temperature yield to be reduce by 6 million tonnes</p> | <p>Adjusting time of sowing, Suitable variety, Fertilizer and irrigation management (All these three will increase yield by &gt;10%)</p> |
| Maize   | <p><i>Kharif</i> yield reduction (18%)</p>                                                                                                                                                                                                                   | <p>Improve in yield (21%)</p>                                                                                                            |
| Mustard | <p>Yield reduction (2%)</p>                                                                                                                                                                                                                                  | <p>Short duration (&lt;130 days) cultivars with 63% pod filling period are adaptable</p>                                                 |



# National Innovations in Climate Resilient Agriculture

## Research Network



## Components

### Research

Strategic  
(24 Institutes,  
IIT)

Sponsored  
Grants  
(1)

Competitive  
Grants  
(17)

AICRPDA  
Centres (19)

AICRPAM  
Centres (20)

### Technology Demo (151 CRVs)

151 Farm Sci.  
Centres

11 ATARIS

7 ICAR  
Institutes

### Capacity Building

Farm Sci.  
Centres

ICAR inst.

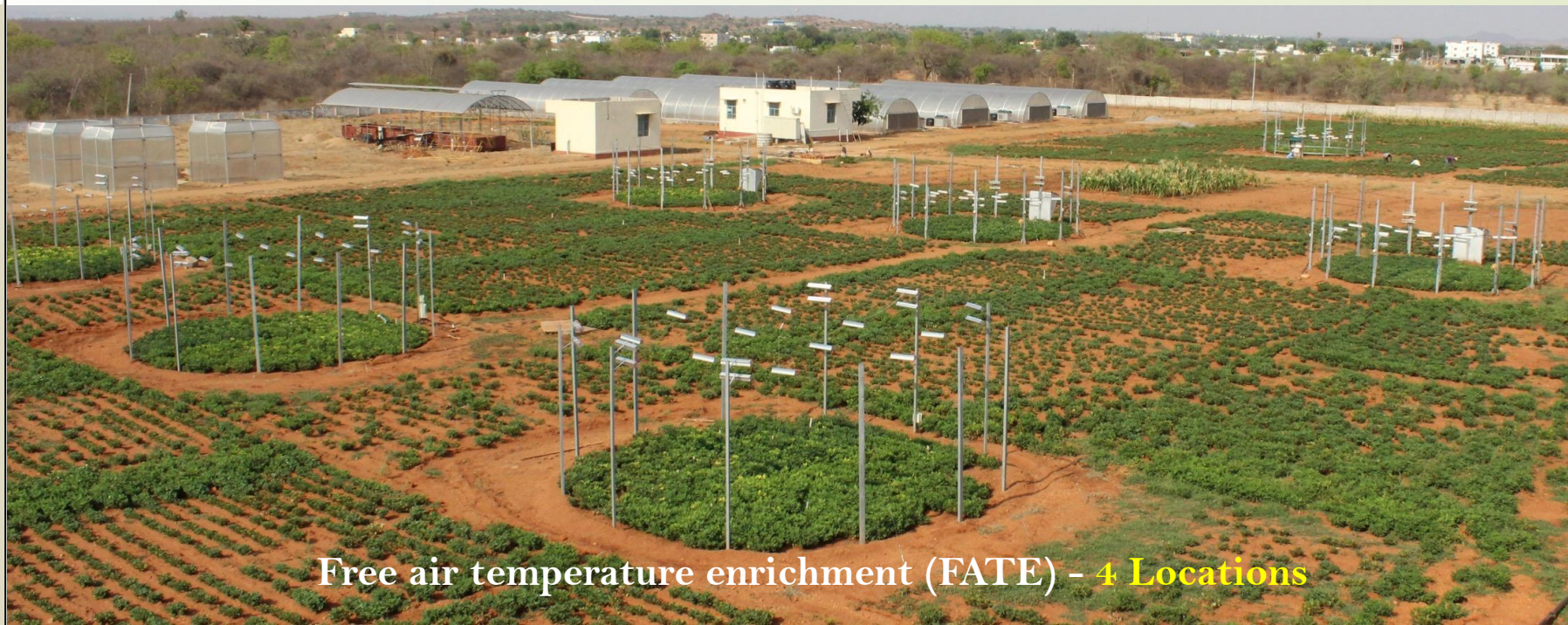
SAUs

1200 Scientists, 874 Research Scholars, 156 Post Graduate Students



# State of Art Climate Change Research Infrastructure

ICAR-CRIDA, Hyderabad, India



Free air temperature enrichment (FATE) - 4 Locations



CO<sub>2</sub> Temperature gradient channels - 3 Locations

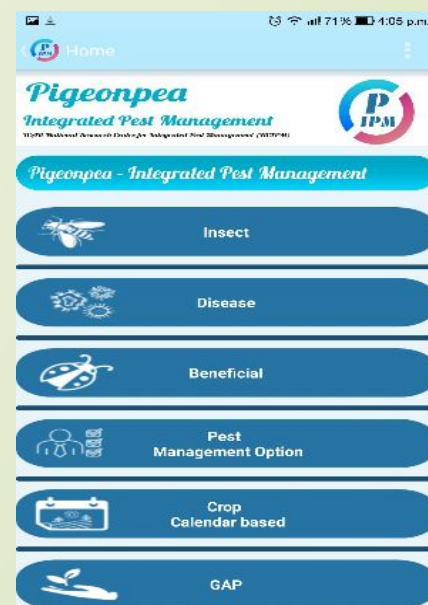


High Throughput Plant Phenomics - 4 Locations

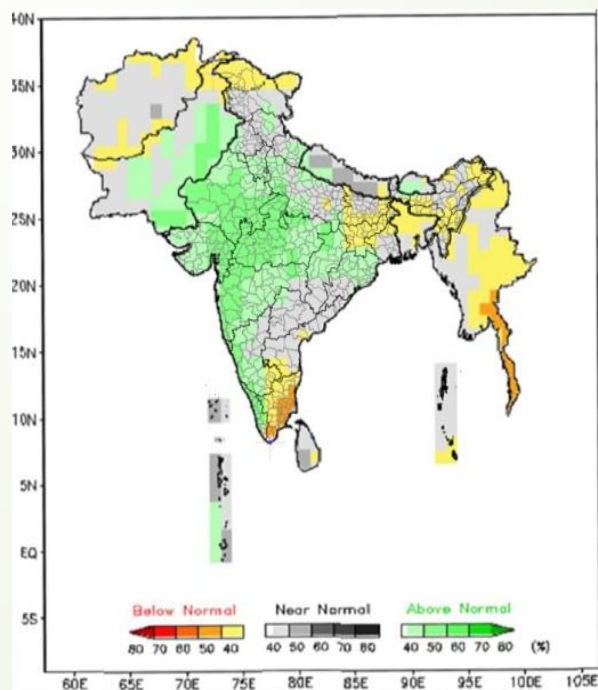


# Outputs of Climate Change Research

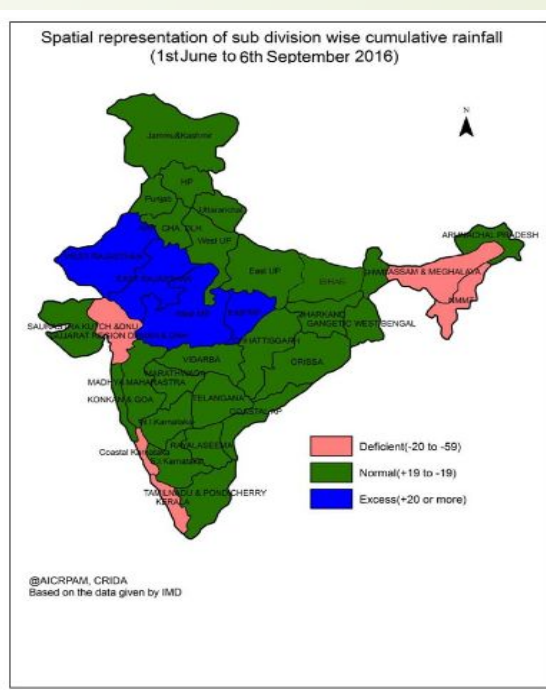
- Developed climate resilient varieties (283) and bio-fortified crop varieties (87)
- Screened large germ-plasm using advanced molecular tools to identify various climate resilient traits (drought, heat, flood & NUE)
- Region specific GHG inventory (6 production systems) Aquatic system, livestock, agroforestry, Rice- wheat
- Simulation modelling to understand impact of climate change (7 crops)
- Climate analogues for area expansion in future climate (3 crops)
- Carbon sequestration potential of agroforestry systems (17 states)
- Feed additives, shelter and breed management to minimize impact of heat stress in livestock
- Digital tools for minimizing climate risks (12 mobile Apps)
- Policy briefs on climate resilient agriculture (8)



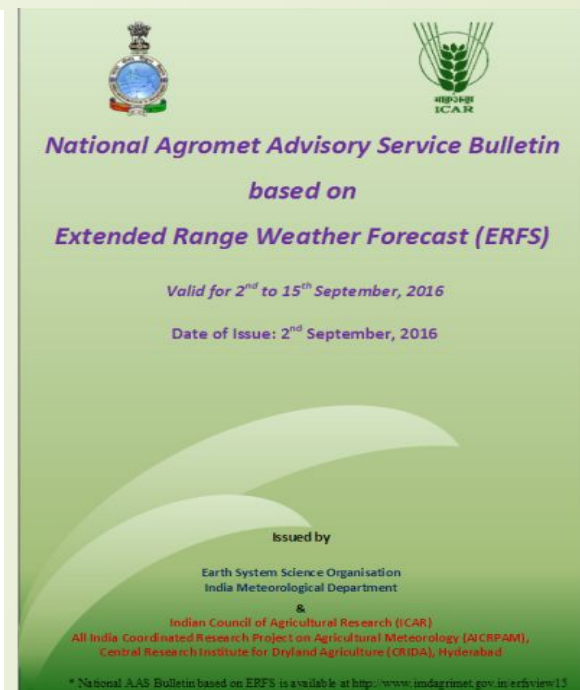
# Agromet Advisory Services



Seasonal Forecast



Daily bulletin-Progress of rain over India



**National Agromet Advisory Service Bulletin**  
based on  
**Extended Range Weather Forecast (ERFS)**

Valid for 2<sup>nd</sup> to 15<sup>th</sup> September, 2016  
Date of Issue: 2<sup>nd</sup> September, 2016

Issued by  
Earth System Science Organisation  
India Meteorological Department  
&  
Indian Council of Agricultural Research (ICAR)  
All India Coordinated Research Project on Agricultural Meteorology (AICRPAM),  
Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad

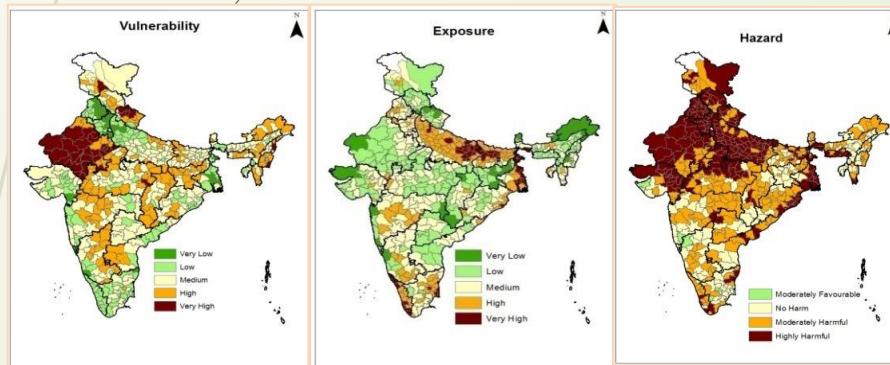
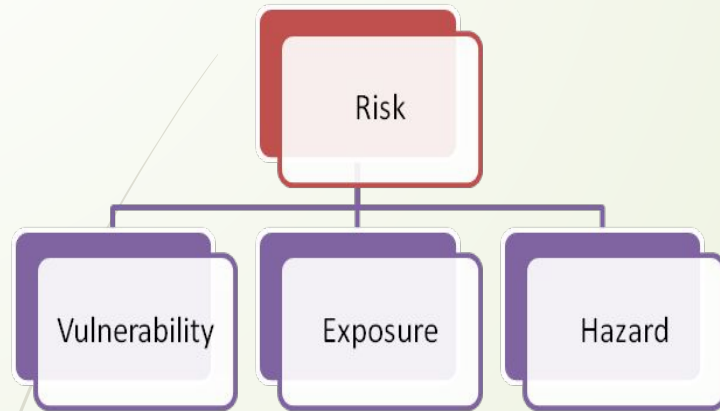
\* National AAS Bulletin based on ERFS is available at <http://www.undagrmet.gov.in/erfview15>

Weekly National Agromet Advisory Services (NAAS) Bulletin

- Developed Meghdoot App for accessing real-time weather information
- Providing agro advisories covering 25 million farmers
- Contingency plans (650 districts, 386 revised)
- State-level interface meetings (54) to sensitize the department officials based on the seasonal forecast



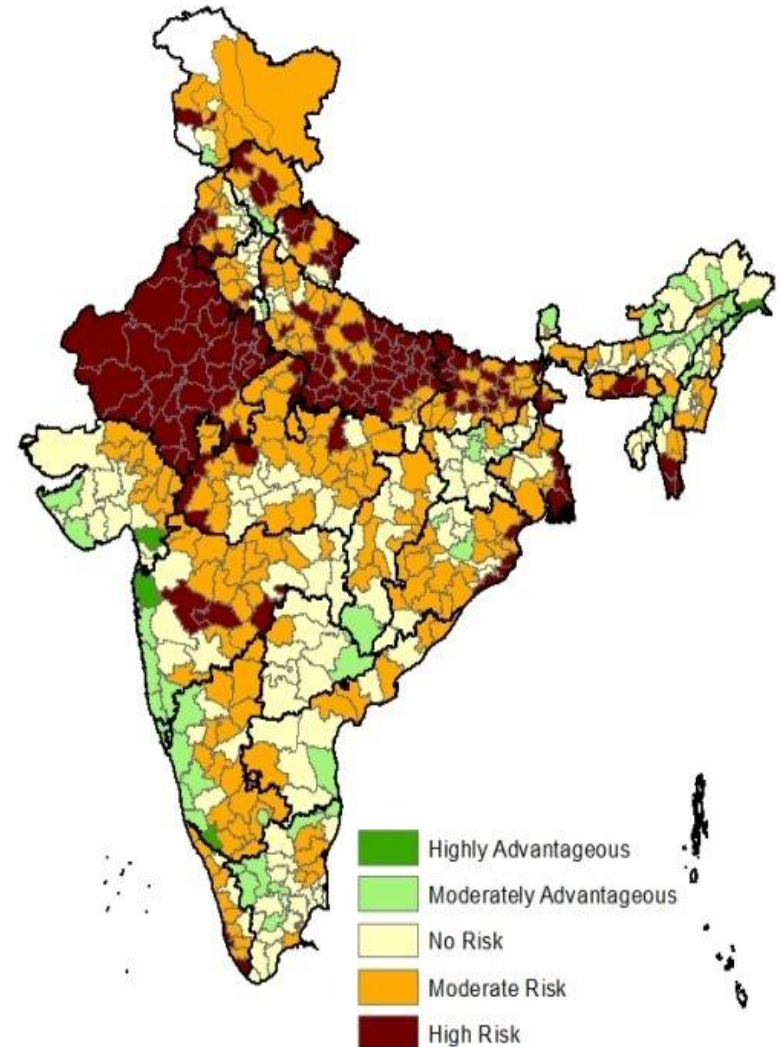
# Risk Assessment of Agriculture due to Climate Change



Identified districts that are risk prone (201 high, 109 very high) where investments can be targeted

Factors contributing to vulnerability provide directions to adaptation research

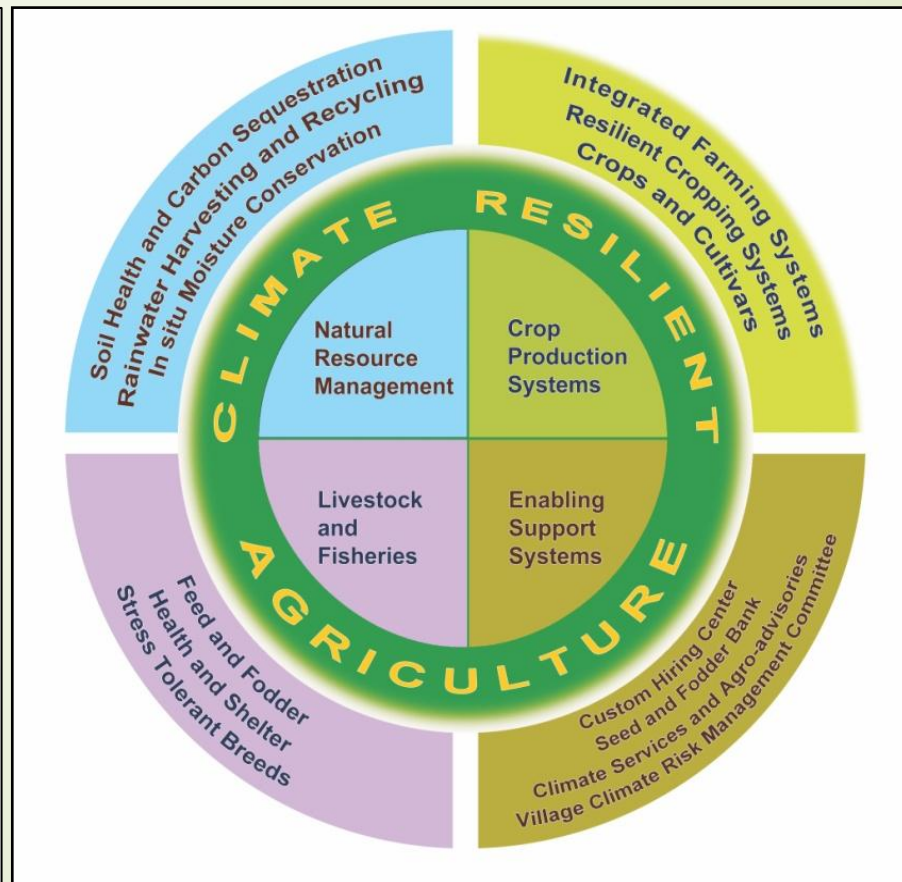
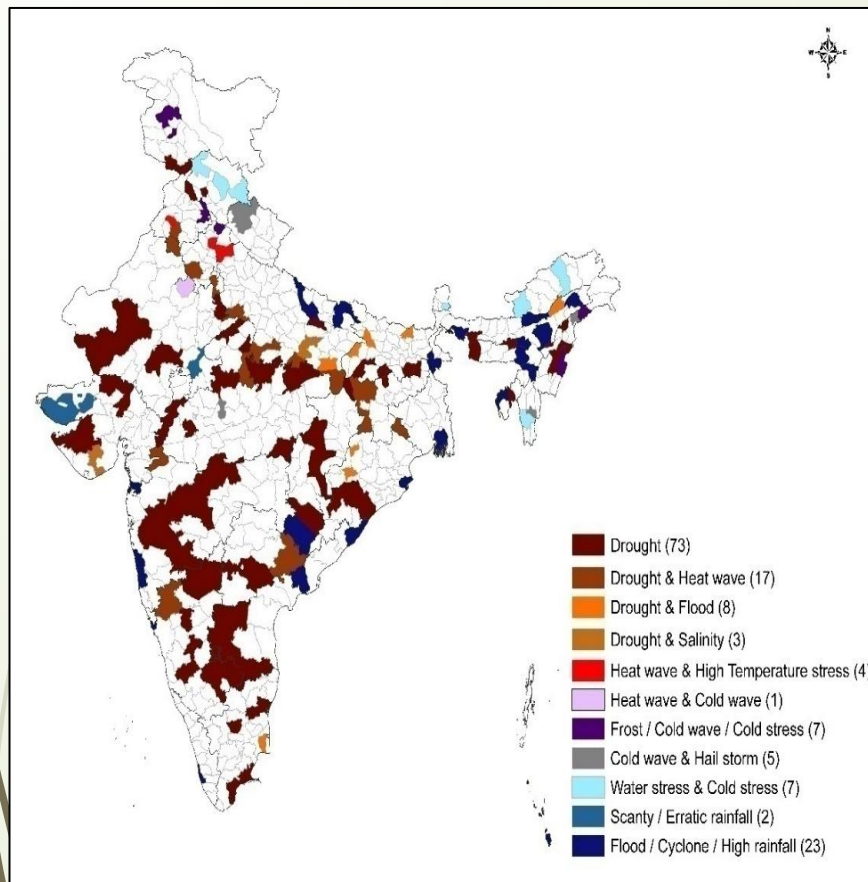
Climate change risk  
(RCP4.5, 2040-69)



# Climate Resilient Villages

151 clusters in climatically vulnerable districts

Package of Technologies



Technological & Institutional Options for Climate Resilient Village

Weather

Water

Crop

Nutrient

Carbon

Institutional



# Large scale Demonstration of Climate Resilient Technologies Demonstrated

ICAR-CRIDA, Hyderabad, India

| Module                      | Demos         | Farmers         | Area (ha)       |
|-----------------------------|---------------|-----------------|-----------------|
| Natural Resource Management | 5278          | 141893          | 95631           |
| Cropping systems            | 9976          | 254217          | 108731          |
| Livestock & Fisheries       | 4185          | 182551          | -               |
| <b>Total</b>                | <b>19,439</b> | <b>5,78,661</b> | <b>2,04,362</b> |

- The promising resilient technologies identified (151 districts) and shared with the development departments
- Evidences of the performance of resilient practices are documented by video films (25)
- Promising resilient technologies for states were compiled





# Capacity Building of Farmers

| Zone                | Programmes    | Participants    |
|---------------------|---------------|-----------------|
| ATARI I- Ludhiana   | 86            | 1340            |
| ATARI II- Jodhpur   | 26            | 708             |
| ATARI III- Kanpur   | 49            | 1454            |
| ATARI IV- Patna     | 60            | 1606            |
| ATARI V- Kolkata    | 44            | 892             |
| ATARI VI-Guwahati   | 18            | 444             |
| ATARI VII- Barapani | 37            | 880             |
| ATARI VIII- Pune    | 62            | 1392            |
| ATARI IX-Jabalpur   | 81            | 2149            |
| ATARI X- Hyderabad  | 36            | 894             |
| ATARI XI- Bengaluru | 116           | 1480            |
| <b>Total</b>        | <b>18,796</b> | <b>4,56,893</b> |

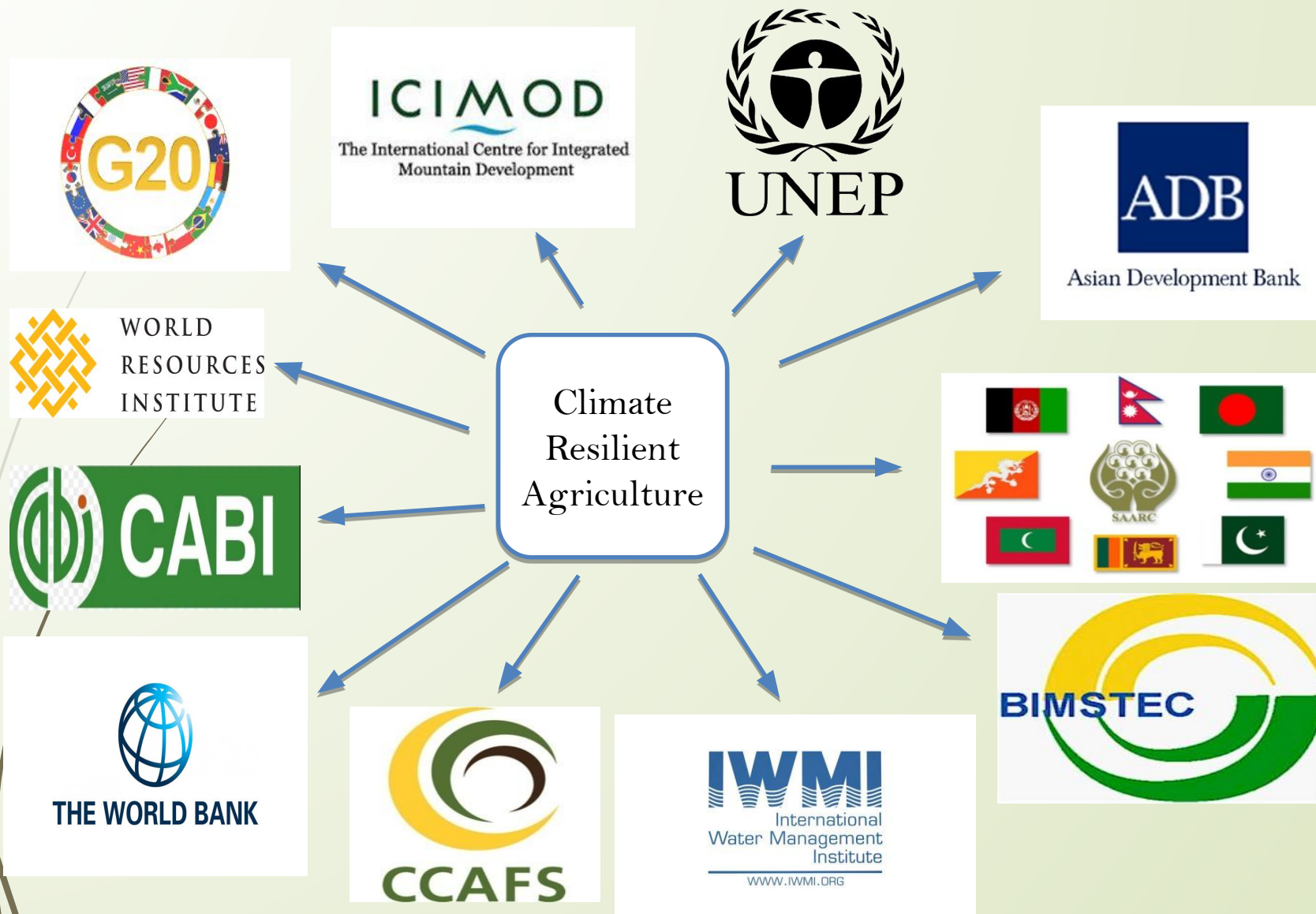


Climate resilient technologies such as Water harvesting, Contingency cropping, Stress tolerant cultivars, Farm implements and machineries, Soil health management, Crop residue management, Feed management, Silage making, Stress tolerant breeds



# Upscaling of Climate Resilient Agriculture

ICAR-CRIDA, Hyderabad, India



## Way Forward

- Vulnerability assessment of agriculture to climate change sub-district level & climate resilient indicators at village level
- Strengthening capacities in frontier areas of climate change research viz., simulation modelling, AI, precision agriculture tools, plant phenomics etc.
- Innovative climate resilient technologies with more emphasis on adaptation & co-benefits of adaptation
- GHG fluxes at ecosystem level
- Expansion of climate resilient villages
- Global collaboration to address climate change issues in Asia-Pacific



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Azadi Ka  
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THANK YOU