Adapting South Asian Agriculture to Climate Change and Declining Resources

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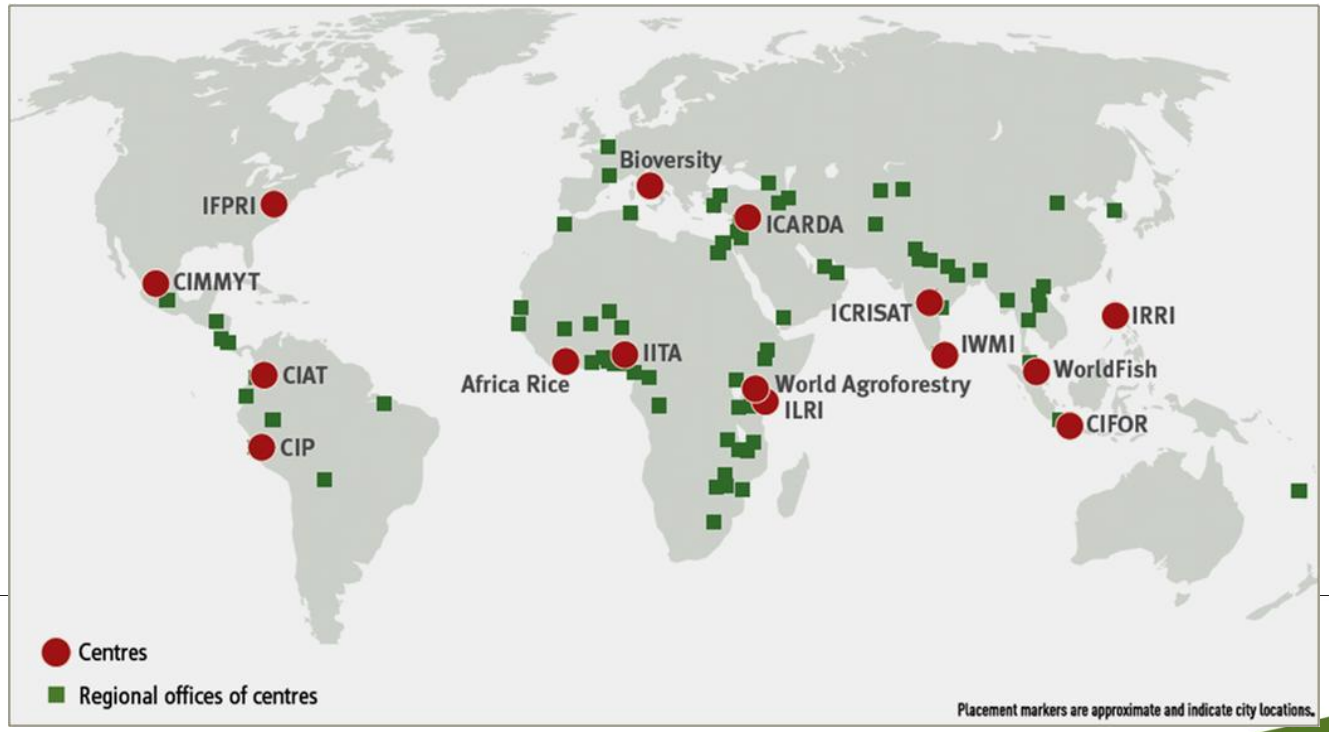
CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

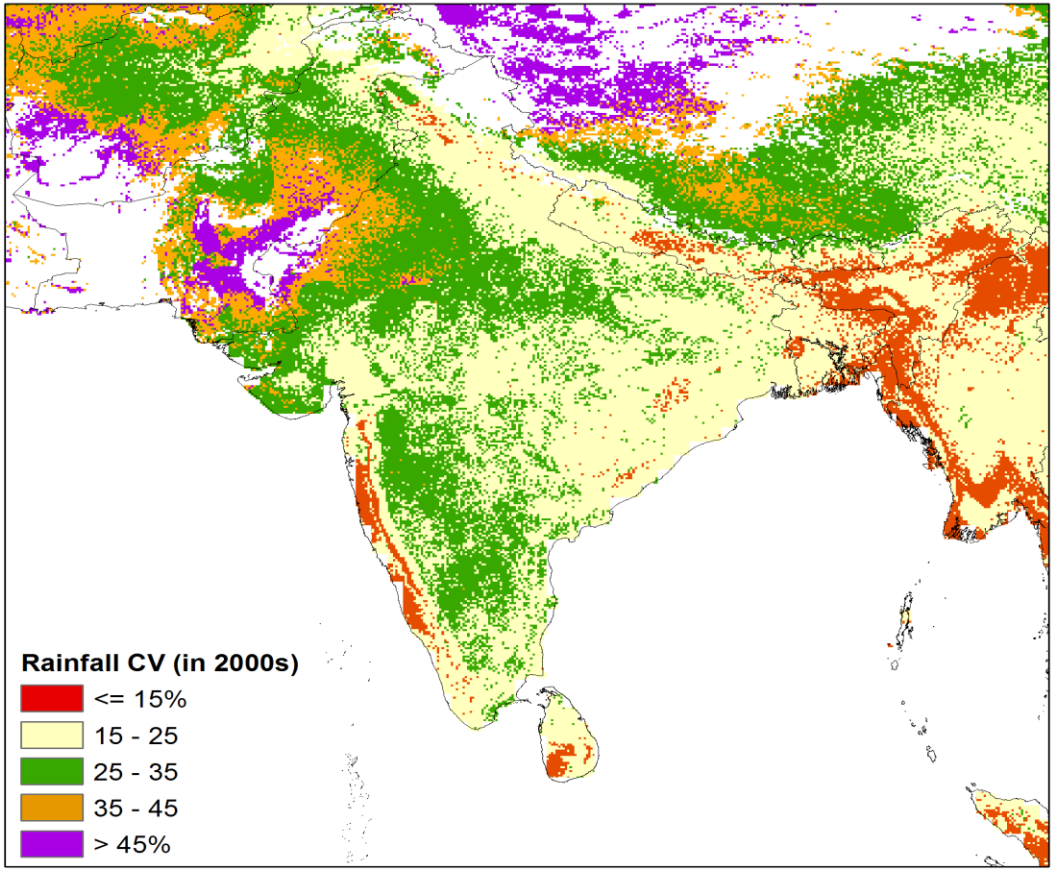
The CCAFS Partnership

CGIAR + Earth System Science Partnership + NARS



Climatic stresses are common in South Asia

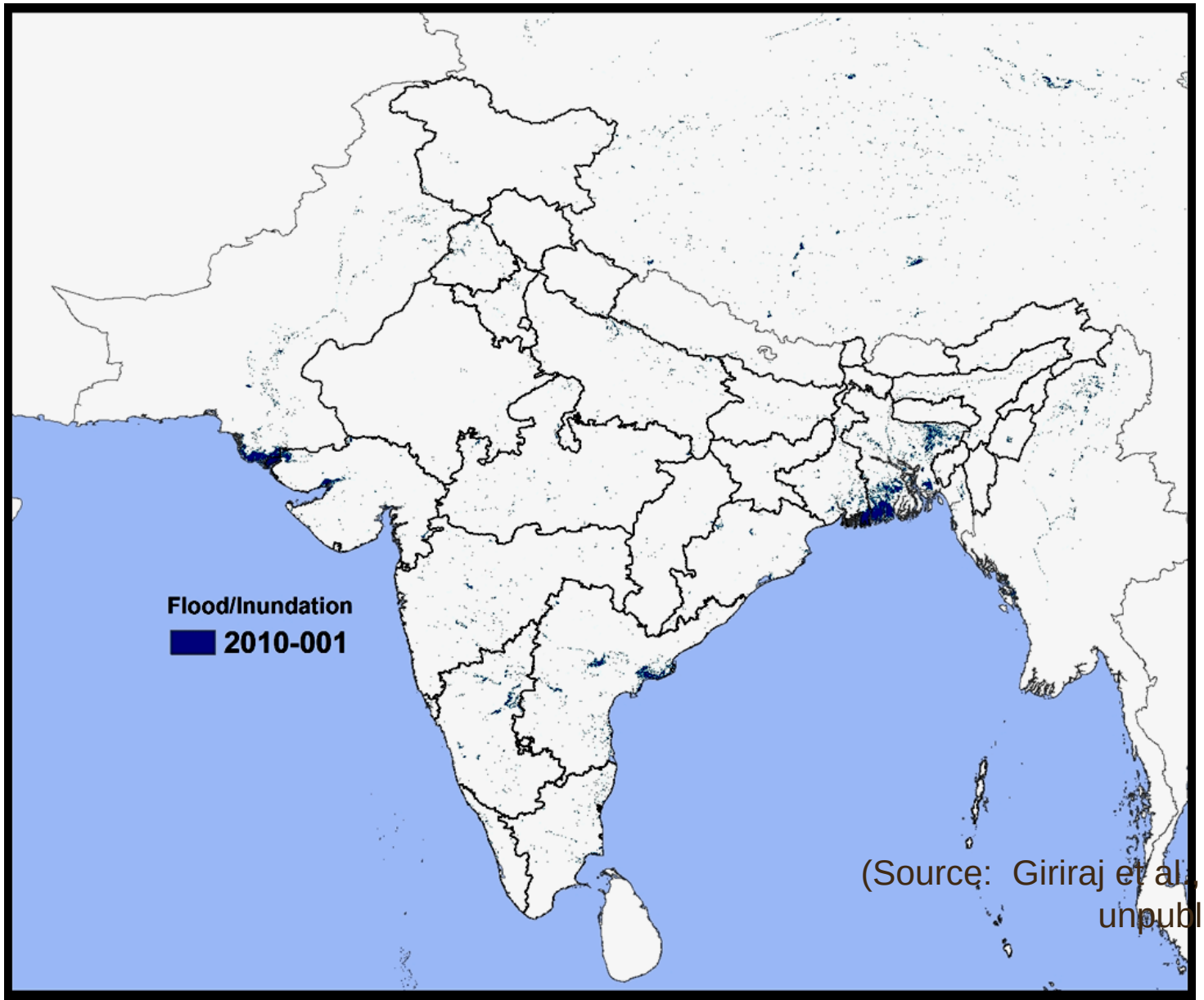
High CV of rainfall in Pakistan; northwest and south India



- Drought: >26 droughts in last 130 years
- 70% land drought prone; 12% flood prone and 8% to cyclones
- Frost: common in northern regions
- Heat: frequent episodes at many places
- Frequent floods and cyclones in several regions

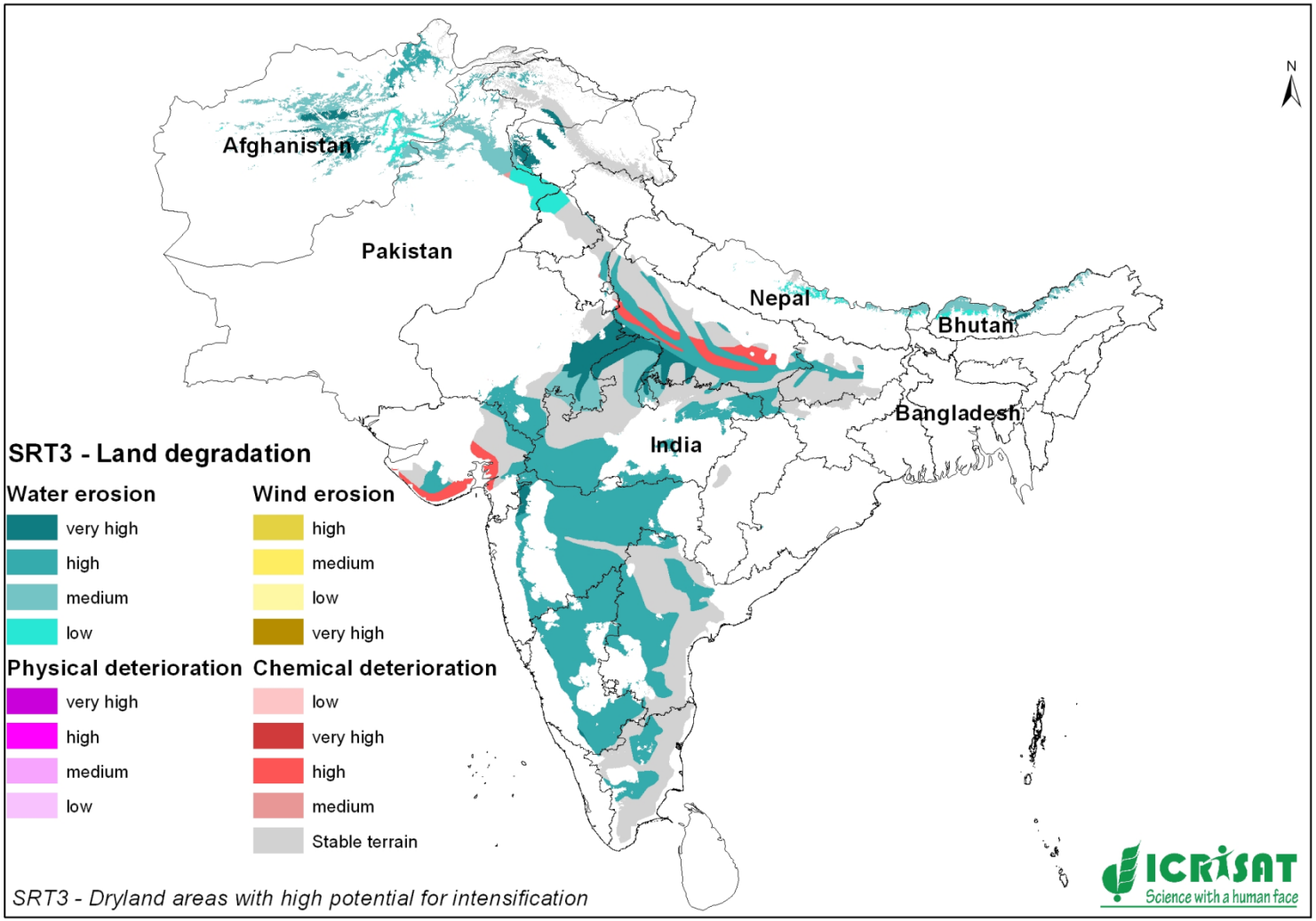
(Source: Erickson et al., 2011)

Flash flood hotspots in South Asia: 2010 scenario

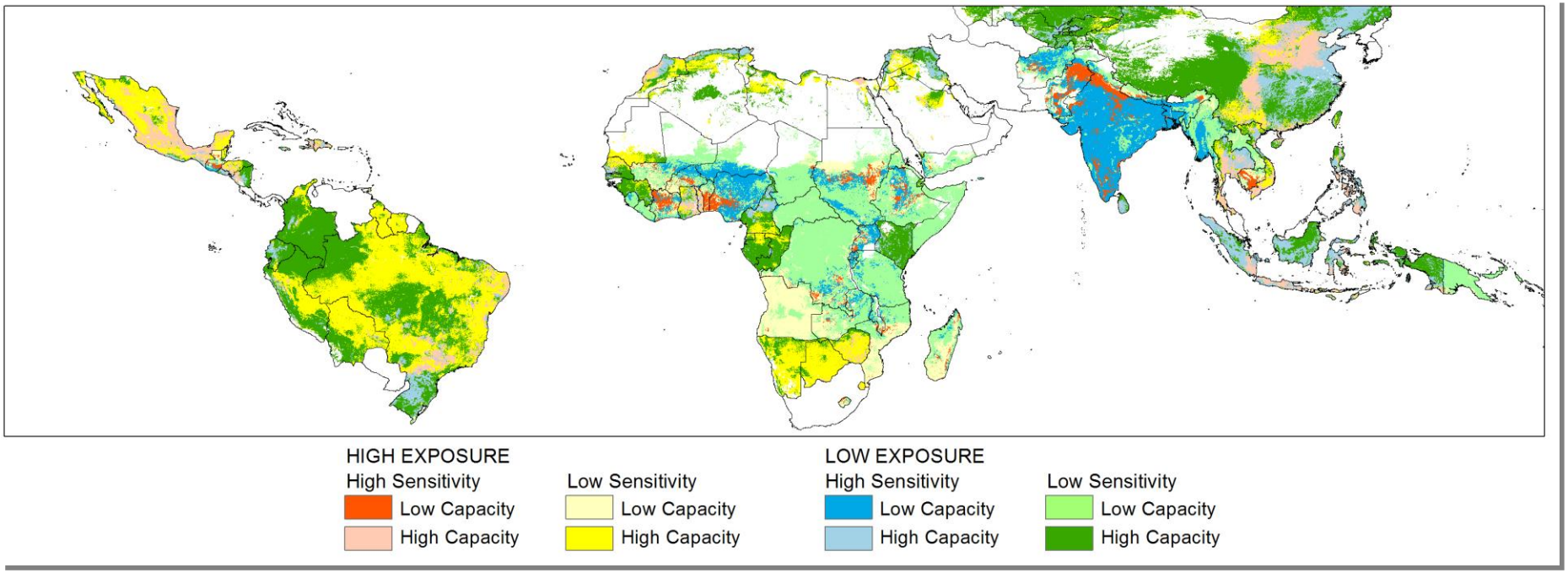


(Source: Giriraj et al., 2012; unpublished)

Land degradation in South Asia



Climate change brings an additional stress: South Asia a major hotspot



(Source: Erickson et al., 2011)

Projected impacts of climate change on agriculture in South Asia

- Increase in CO_2 (550 ppm) increases yields of most C3 crops by 10-20%.
- A 1^{o}C increase in temperature may reduce yields of some crops by 0-7%. Much higher losses at higher temperatures.
- Productivity of most crops to remain unaffected/ marginally decrease by 2030 but decrease by 10-50% by 2100.
- Increased droughts, floods, and heat events will increase production variability.
- Climate change may also provide new opportunities in agriculture: need to identify and exploit these.
- Large implications for intra- and inter-national trade.

Adapting South Asian Agriculture to Climate Change and Declining Resources: Key challenges

- Increasing demand for (quality) food
- Increasing competition for resources
- Increasing degradation of resources
- Increasing climatic risks
- Increasing variability of global supplies, and prices

Adapting South Asian Agriculture to Climate Change and Declining Resources: Four Key action points

1. Invest in management of land and water resources, and input delivery and market linkage mechanisms, to fully exploit the benefits of available technologies.
2. Manage current climatic risks for poverty alleviation and for equitable development.
3. Exploit large mitigation co-benefits of adaptation options.
4. Address issues of poverty, governance, institutions, and human capital which limit agriculture growth even today.

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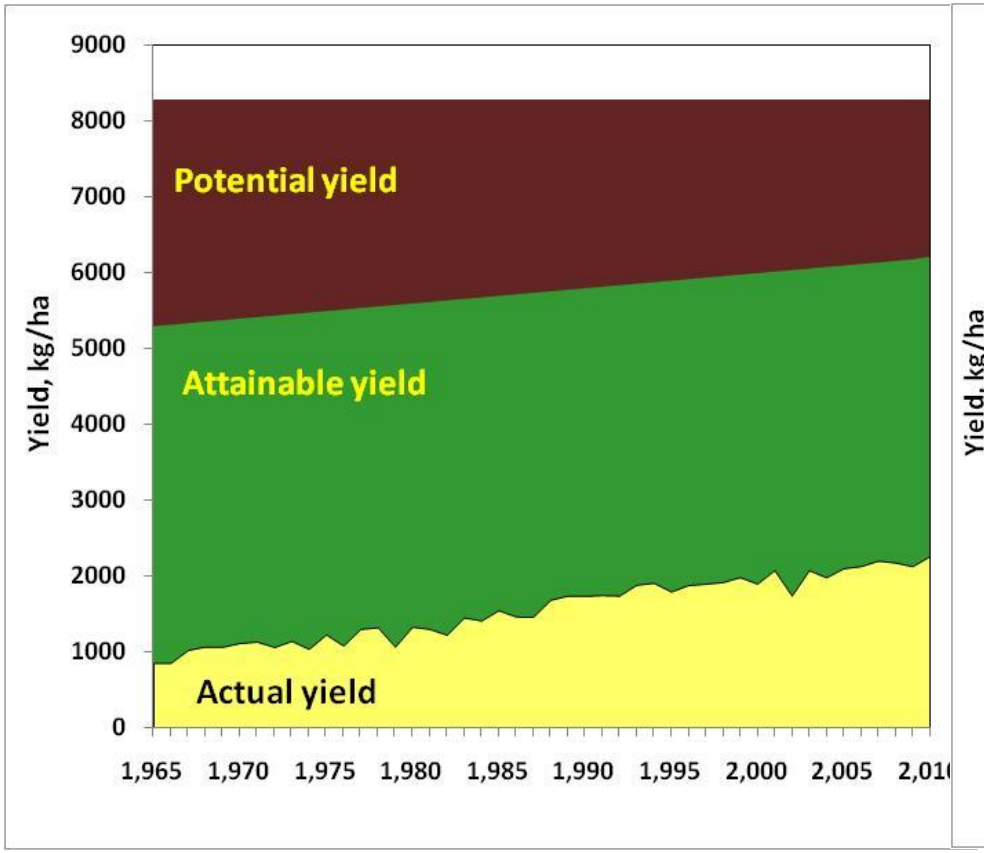
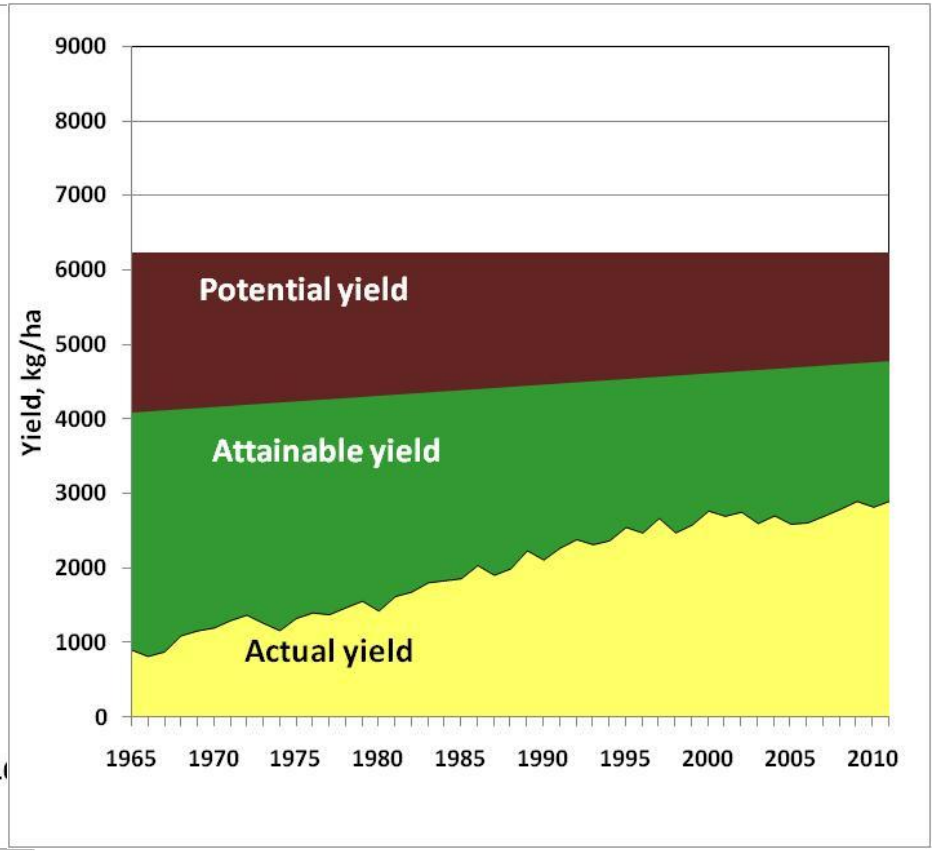
There is a large untapped potential of currently available agricultural technologies





Rice

Wheat

Bridging yield gaps: Focus on scientific management of natural resources, and innovative partnerships

- **Management of land resources: conservation agriculture, land policies, reclamation of degraded lands**
- **Management of water resources: increasing irrigation availability and use efficiency**
- **Input delivery systems: seeds, fertilizer, machinery, chemicals: Partnerships with industry**
- **Post-harvest primary processing and marketing hubs in rural areas for employment and income- China model**

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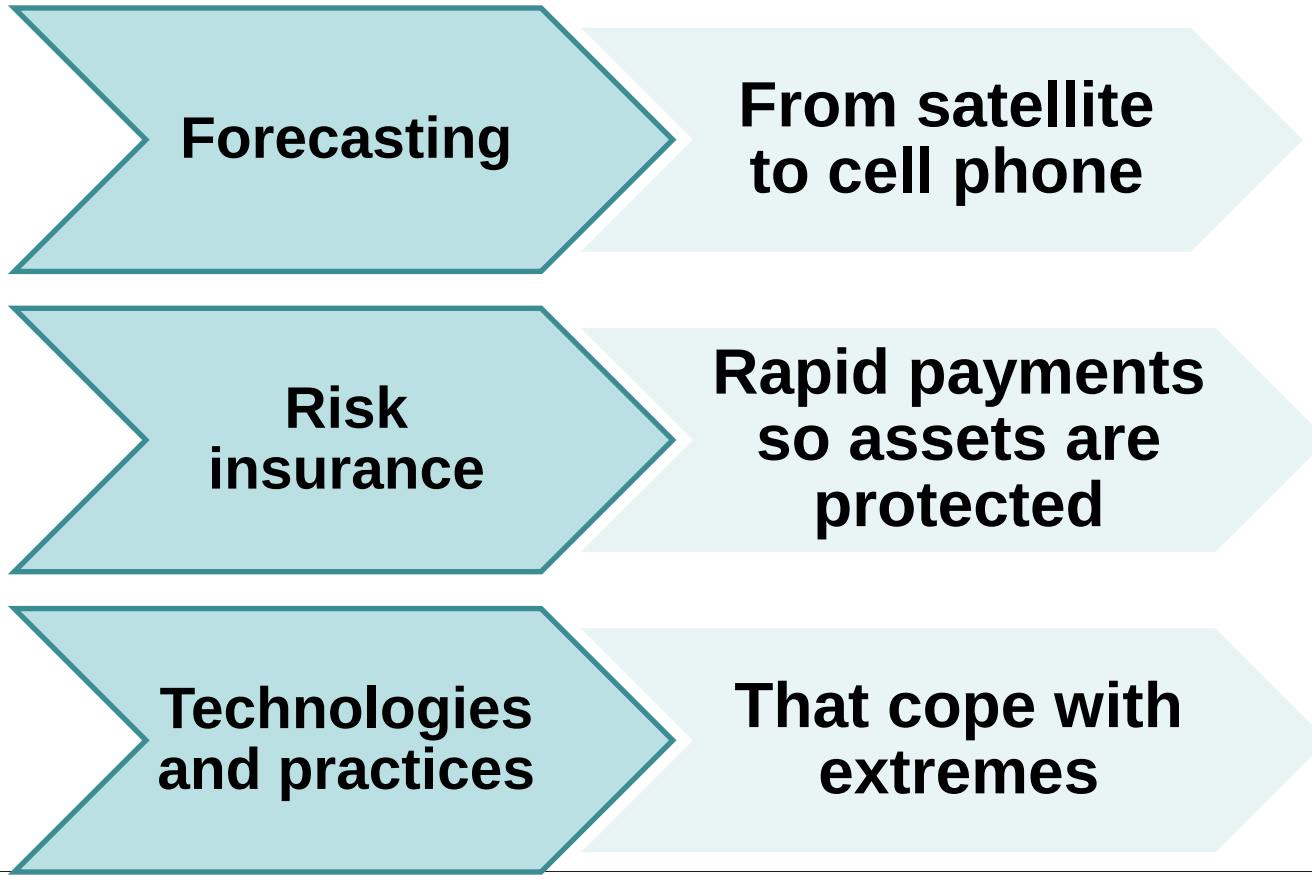
Greater focus on climate risk management



Adaptation to increasing climatic risks:
Assisting farmers to cope with current climatic risks

- **Providing value-added weather services**
  - Weak weather infrastructure; data protocols, storage, access and dissemination
- **Promoting insurance for climatic risk management**
  - scientific and economically validated schemes; weather derivatives; awareness
- **Facilitating community partnership in food, forage and seed banks**
  - Technical know-how; capital costs; reduced acceptance if successive years are risk free
- **Compensating farmers for environmental services**
  - Technical know-how; costs of production go up
- **Sharing experiences across similar regions**
  - Validation in emerging scenarios of development and climate risks

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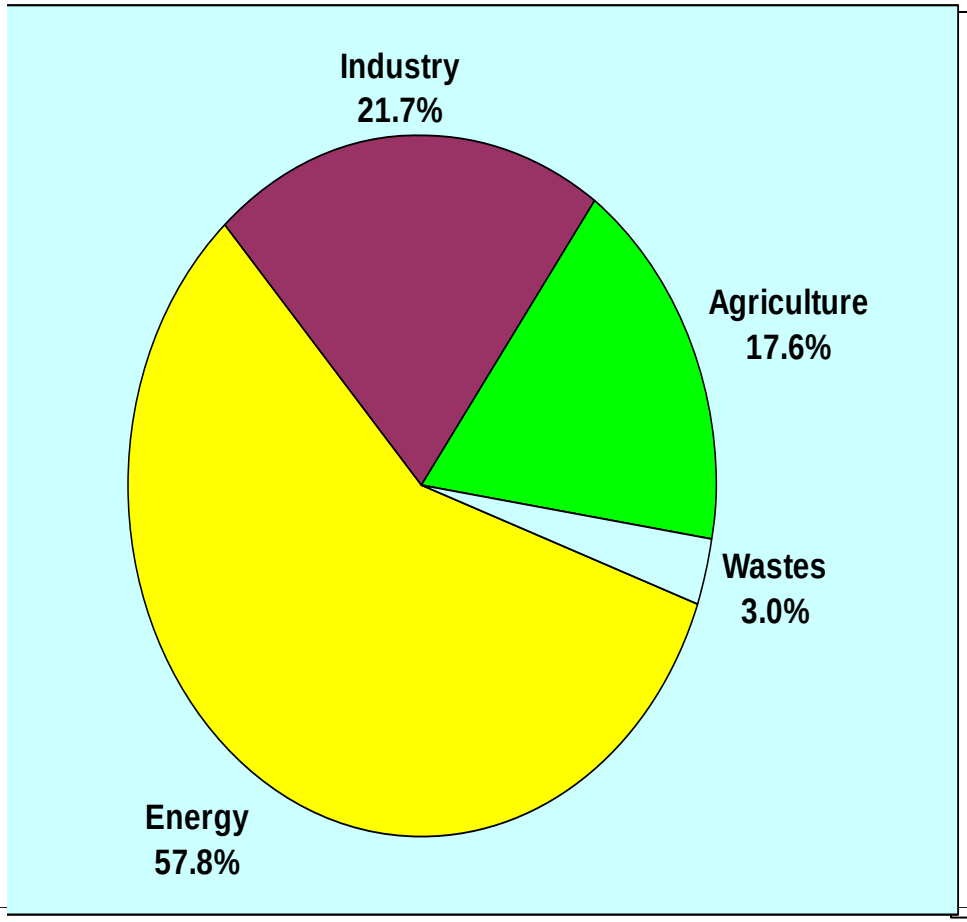
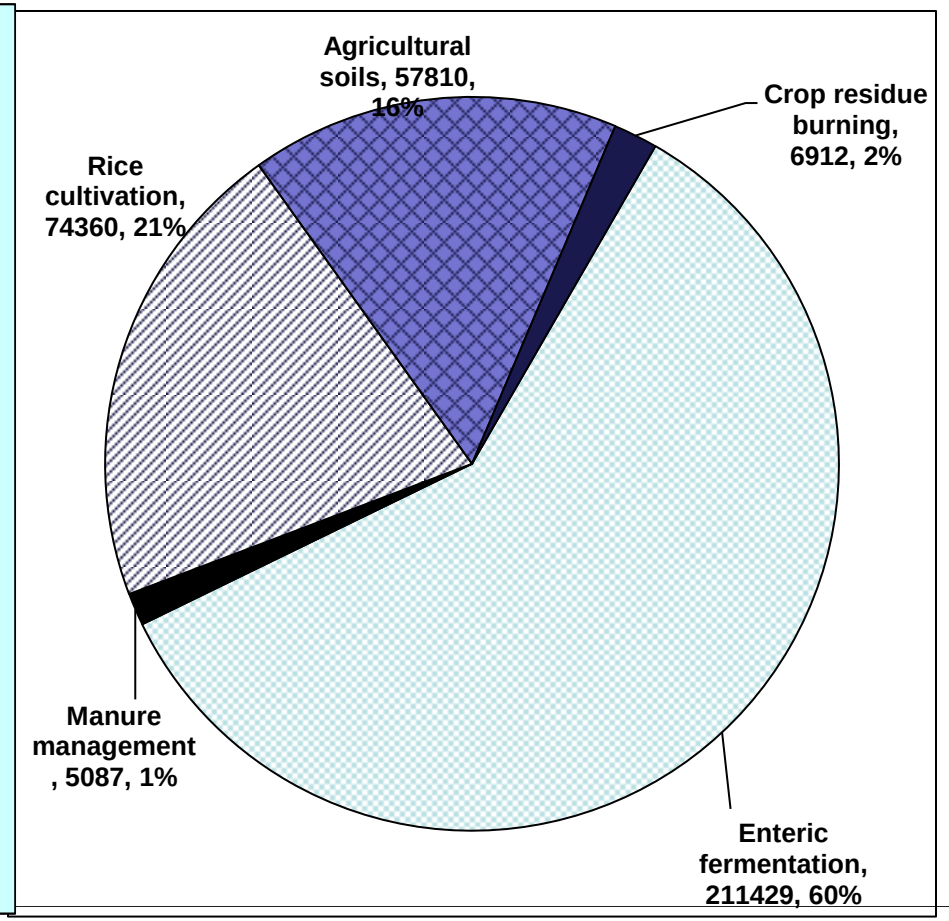
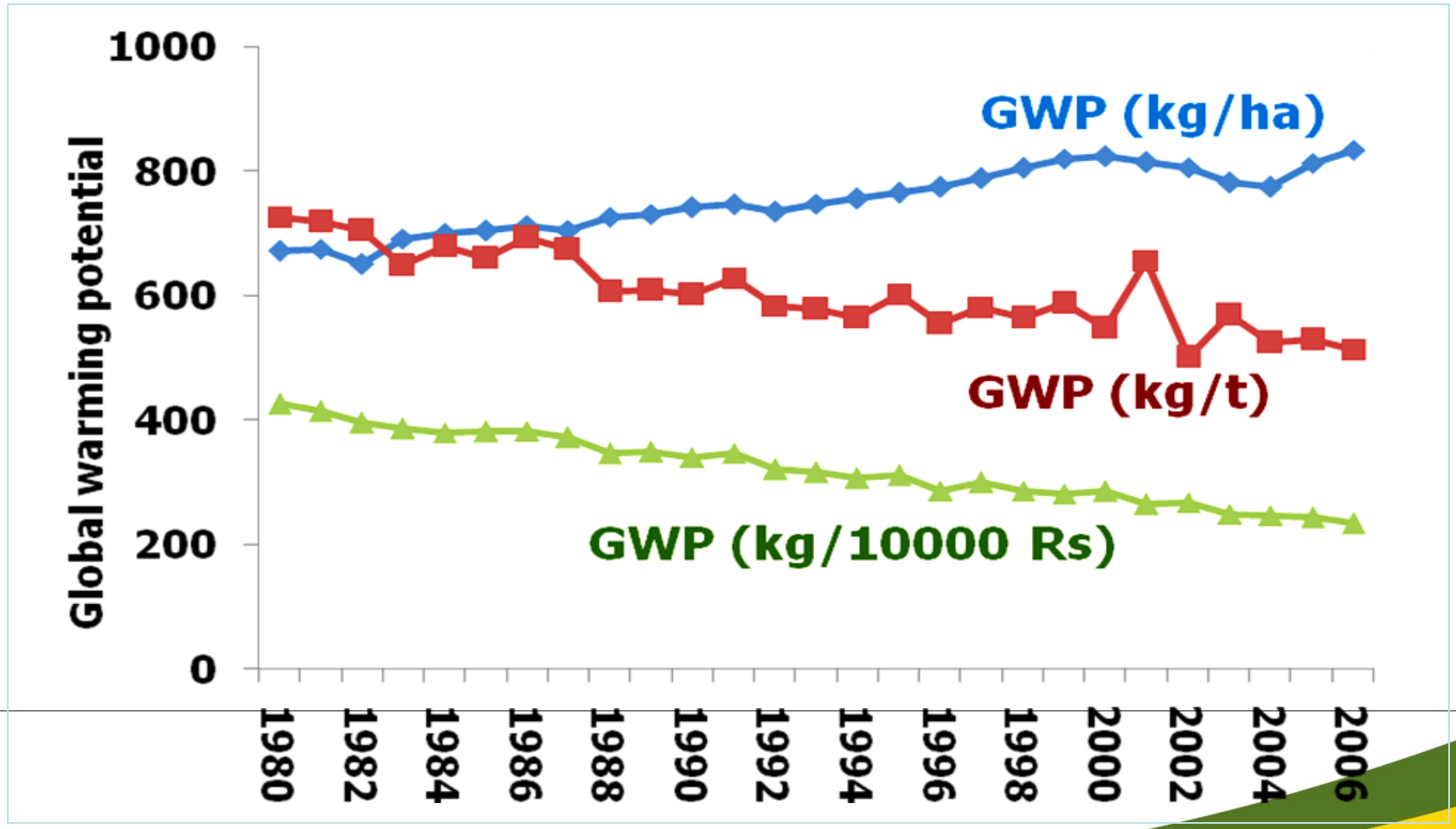
GHG emissions from South Asia: example of India





Change in GHG emission intensity of agriculture with time



Adaptation options with large co-benefits in mitigation

Paddy

- **Increase WUE: alternate wetting and drying in irrigated regions; direct seeding**

Soils

- **Increase N fertilizer use efficiency: placement and timing, inhibitors**
- **Carbon sequestration: conservation agriculture, agro-forestry**
- **Land reclamation**

Livestock

- **Management of livestock population; feed management**

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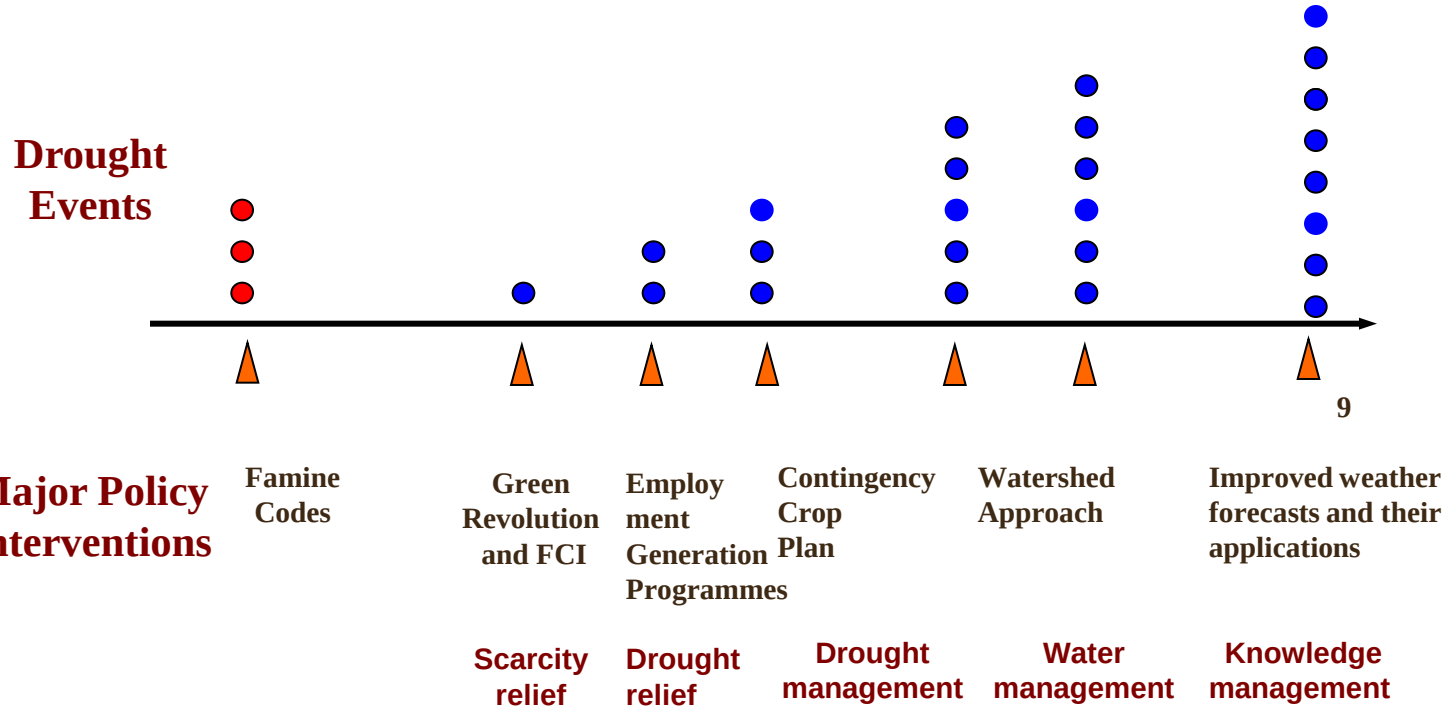
Policy innovations induced by droughts in India



Each round represent death of one million people

Each round represent around fifty million people affected

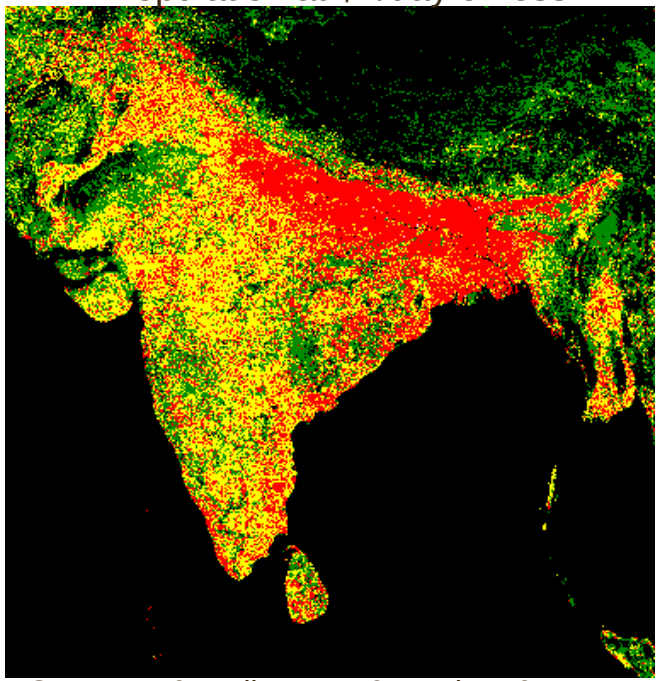
Source: ADPC/MOA

Despite such policy responses, climatic risks still cause considerable loss

Key reasons

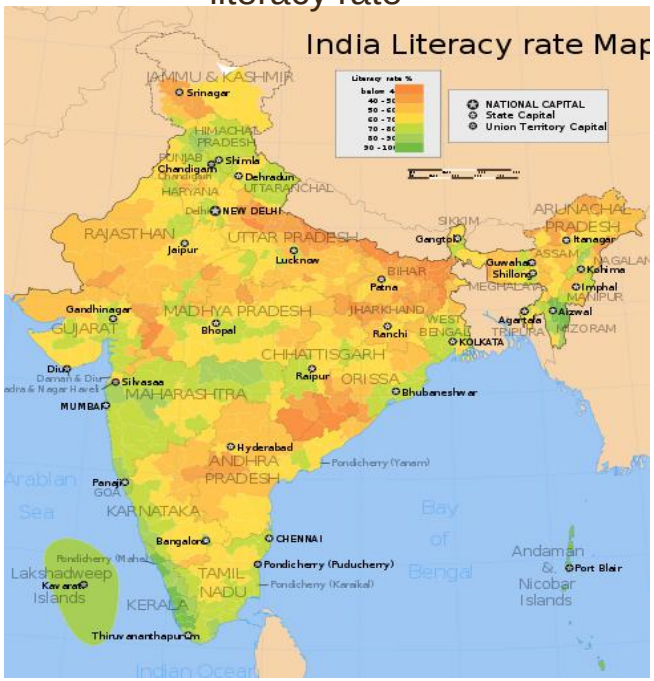
- Widespread poverty
- Limited human capital
- Poor governance including limited stakeholder analysis, and dissemination of knowledge

Poverty (2005)
Population at $2/day or less



Green 1-10, Yellow 11-50, Red > 50

Human capital
literacy rate

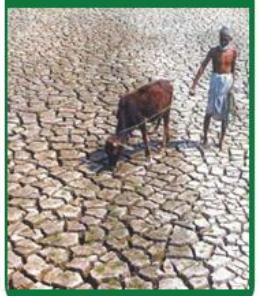


Capacity strengthening: Climate smart villages/farms for sustainable intensification

CLIMATE SMART VILLAGE / FARM

Weather smart

- Seasonal weather forecasts
- ICT based agro-advisories
- Index based insurance
- Climate analogues

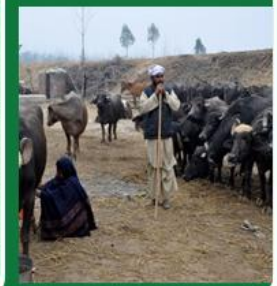


Water smart

- Aquifer recharge
- Rainwater harvesting
- Community management of water
- Laser leveling
- On-farm water management

Carbon smart

- Agroforestry
- Conservation tillage
- Land use systems
- Livestock management



Nitrogen smart

- Site specific nutrient management
- Precision fertilizers
- Catch cropping / legumes

Energy smart

- Biofuels
- Fuel efficient engines
- Residue management
- Minimum tillage

Knowledge smart

- Farmer-farmer learning
- Farmer networks on adaptation technologies
- Seed and fodder banks
- Market info
- Off-farm risk management-kitchen garden

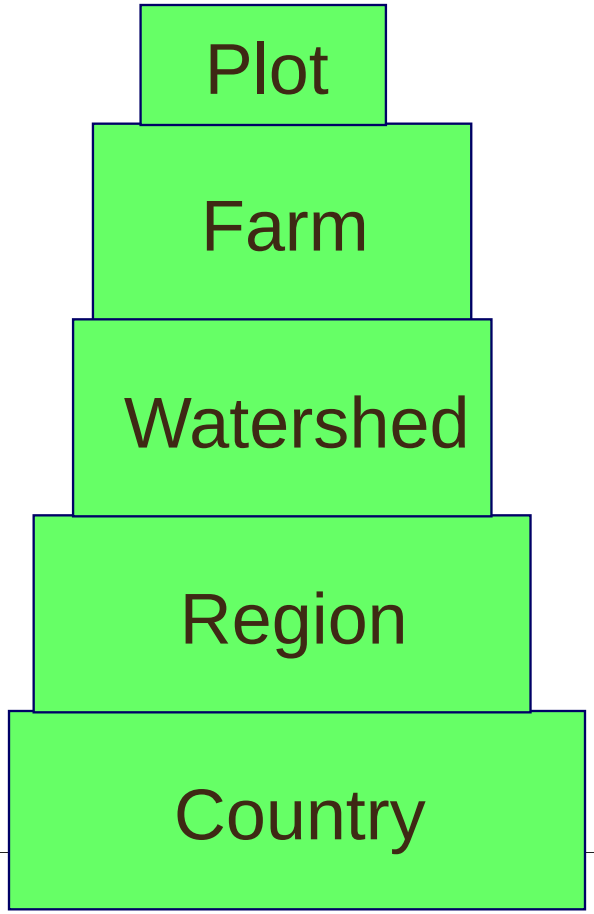
Capacity Enhancement Workshops on Gender and Climate Change Adaptation for rural women leaders

Farms of the Future: Enabling farmers adaptation learning across climate analogue sites

- **Farmer exchanges facilitate shared examination of challenges, opportunities and strategies for reaching locally defined goals and visions.**
- **Socially and culturally appropriate exchange locations are chosen from climate analogue locations through a participatory process.**

Source: Ariella Helfgott

Tools to prioritize investment in climate change adaptation/mitigation at different scales

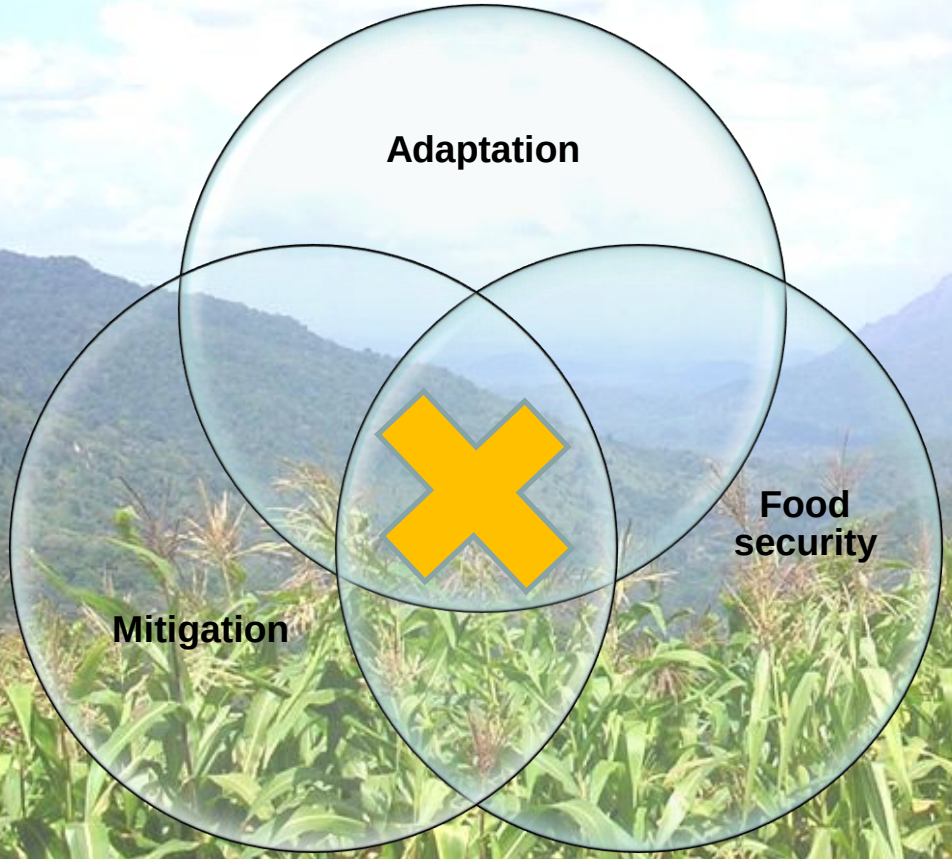


Biophysical research

New Tools

Policy research

Conclusion: Adapting South Asian Agriculture to Climate Change and Declining Resources: Four Key action points



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