

CLIMATE-SMART  
**Agriculture**  
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# **Climate-smart agriculture in South Asia: Opportunities and constraints in scaling out**

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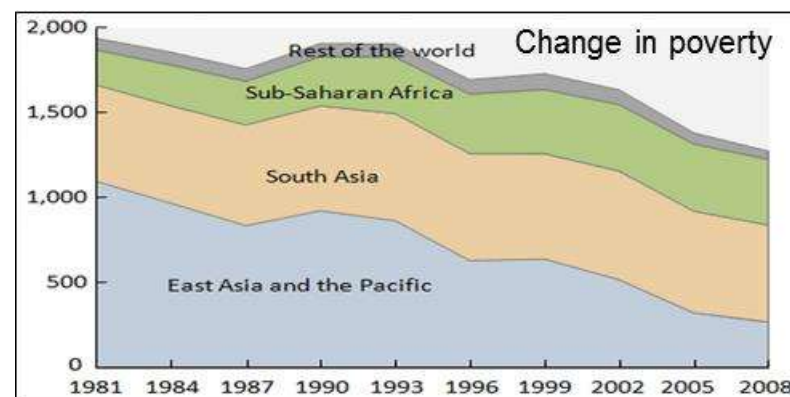
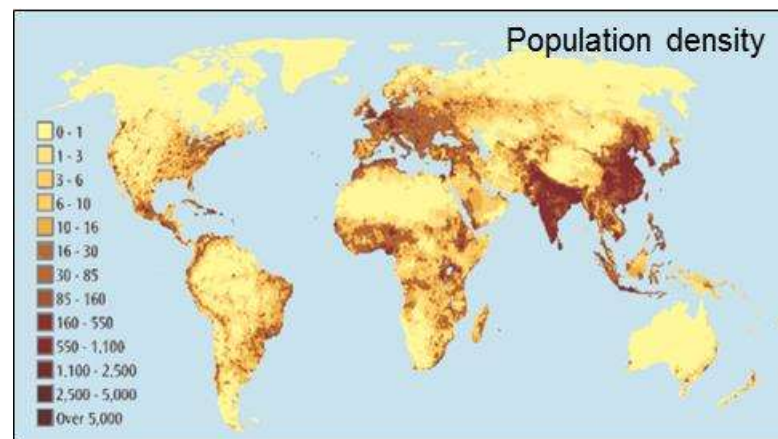
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# South Asia: Home for 40% of World's Poor

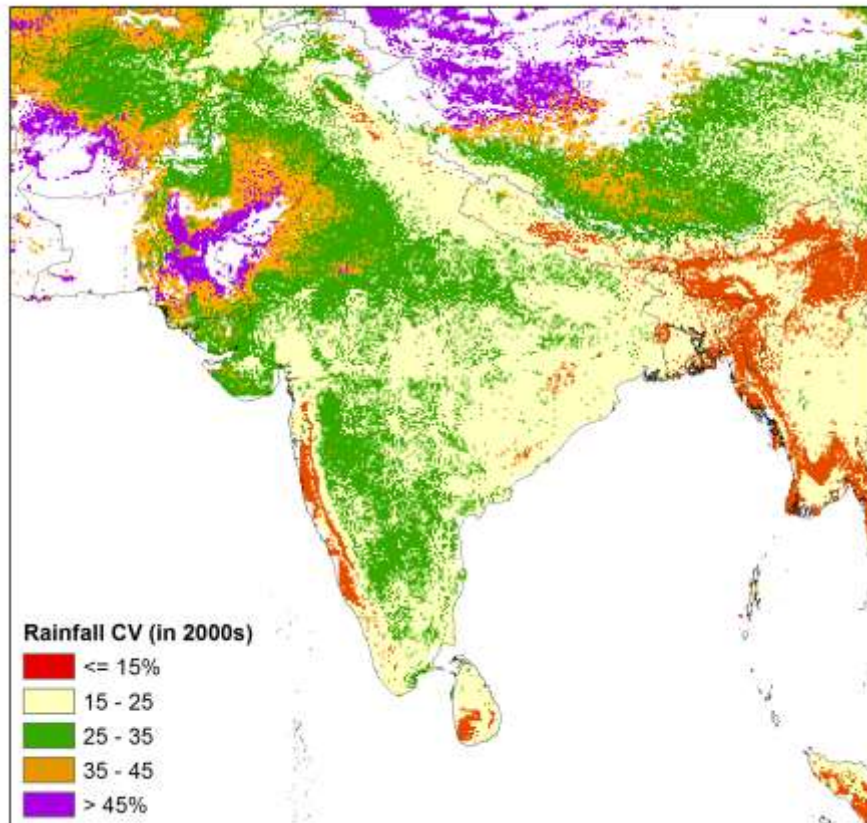
- > 1.6 billion people, 2.4% of the world's land area and 17% of world's population
- Still has high growth rate of population
- Tremendous progress in last 4 decades
  - Food consumption increased from 1900 kcals to > 2500 kcals
  - Average GDP growth >6%
  - Little food imports now
- Yet, 1/4<sup>th</sup> of the world's hungry; 40% of the world's malnourished children and women
- Lagging in MDGs
- Agriculture important for livelihood security of > 50% population
- Projected to be very vulnerable to climatic risks



Source: World Bank, 2015

# Climatic stresses are common in South Asia

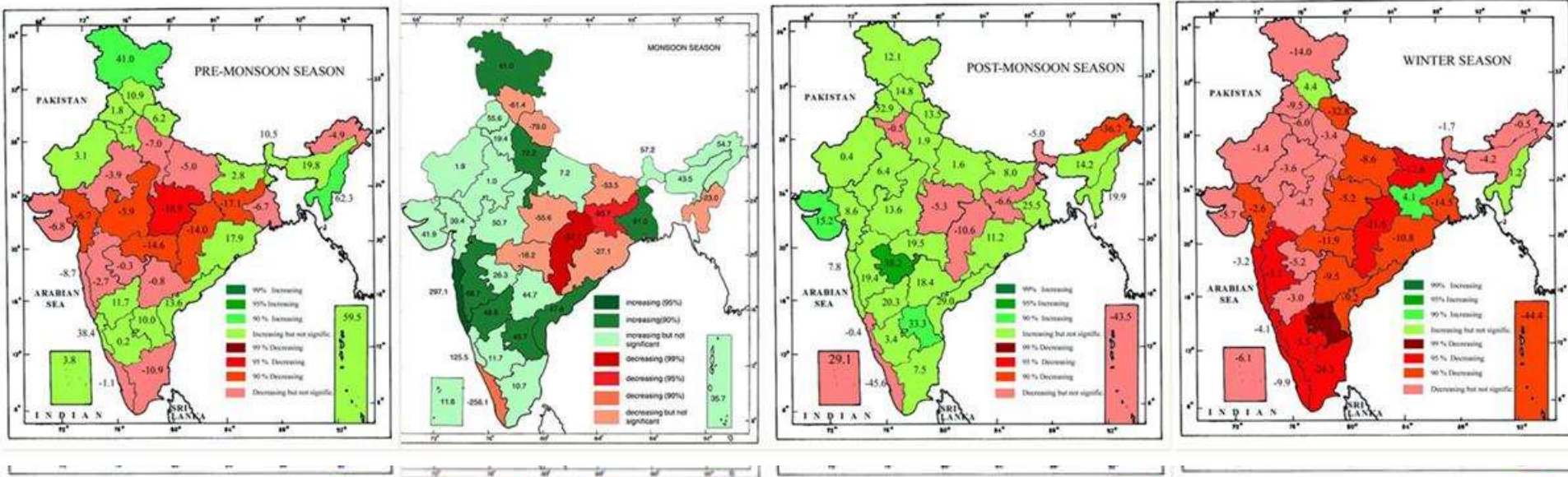
High CV of rainfall in Pakistan; northwest and south India



- Drought: 70% land
- Floods: 12% land
- Cyclones: 8% land
- Frost: Northern regions
- Heat: Frequent at many places
- Coastal salinity ingressions
- One of the most vulnerable regions to climate change
- Food security and poverty are the key issues

# Early signs of climate change: Rainfall trends in India for different seasons (1901-2003)

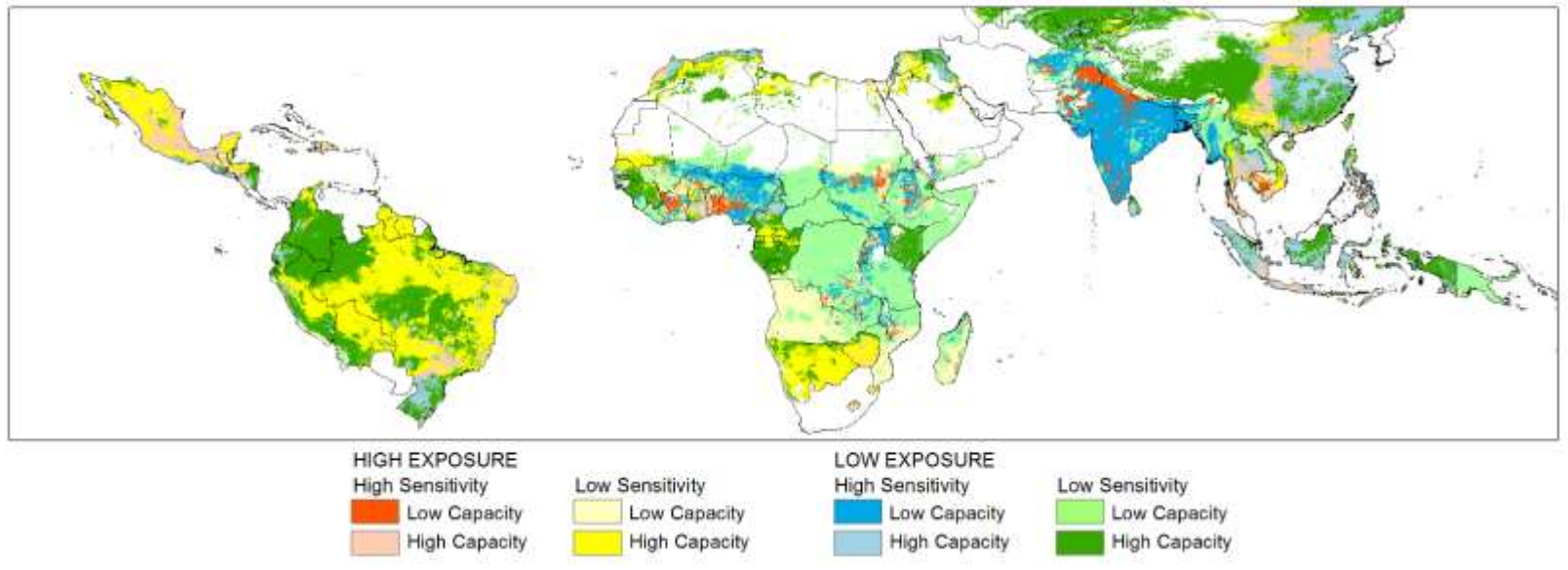
Different colors represent levels of significance



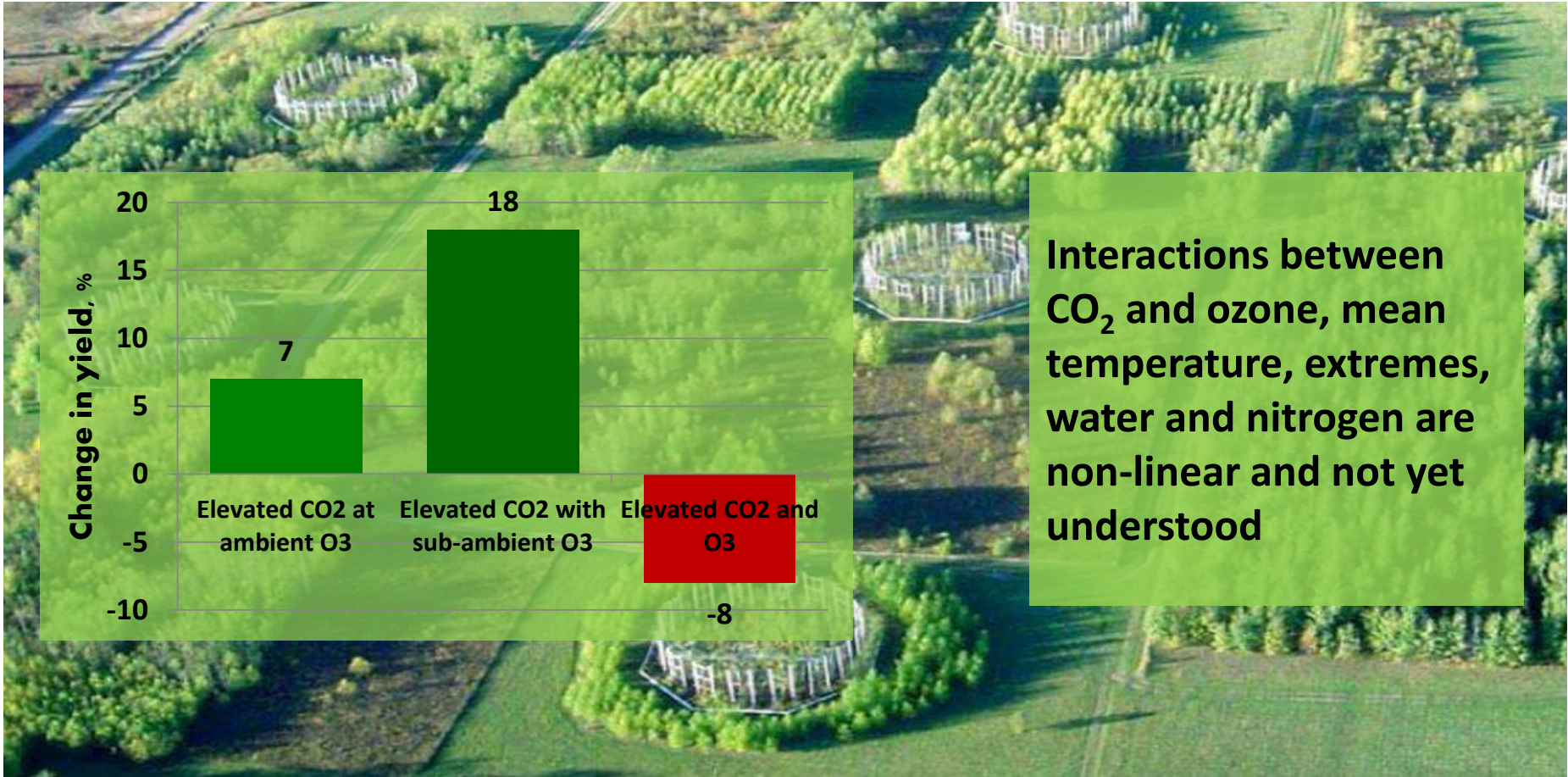
Source: IMD, 2010

# Climate change and agriculture- South Asia is a major hotspot

- Climate change likely to reduce agricultural production by 10-50% by 2050 and beyond, if we do not start adapting now.
- Increased production variability due to more frequent droughts, floods, and heat events
- Large implications for intra- and inter-national trade.

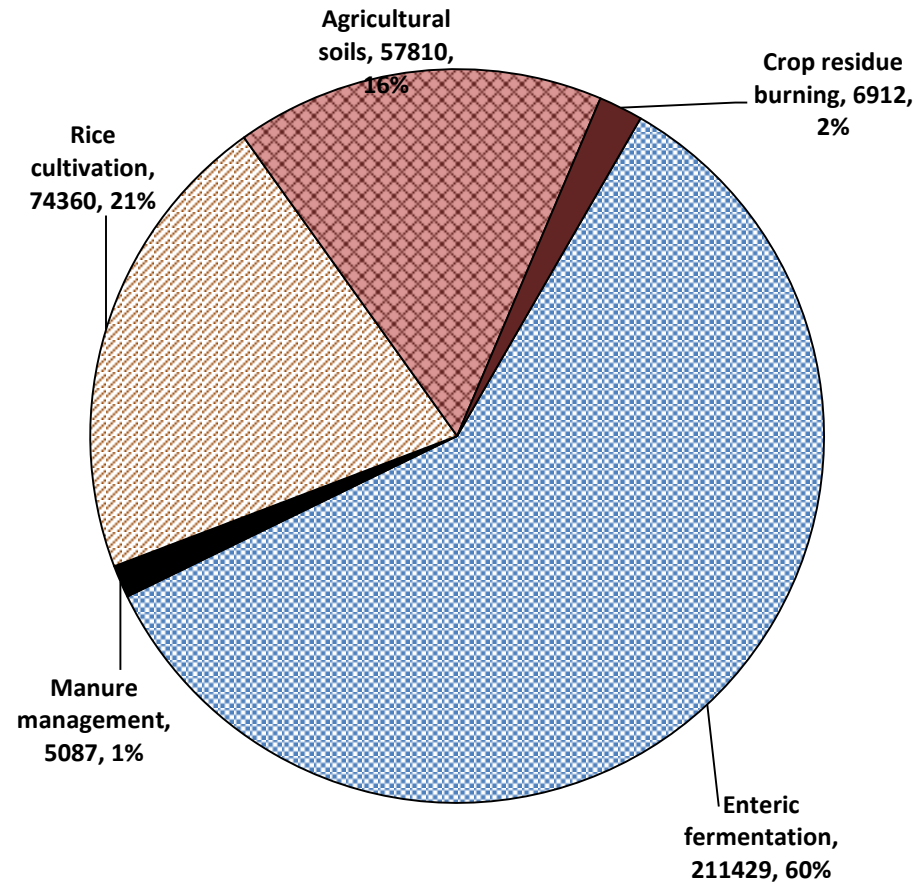
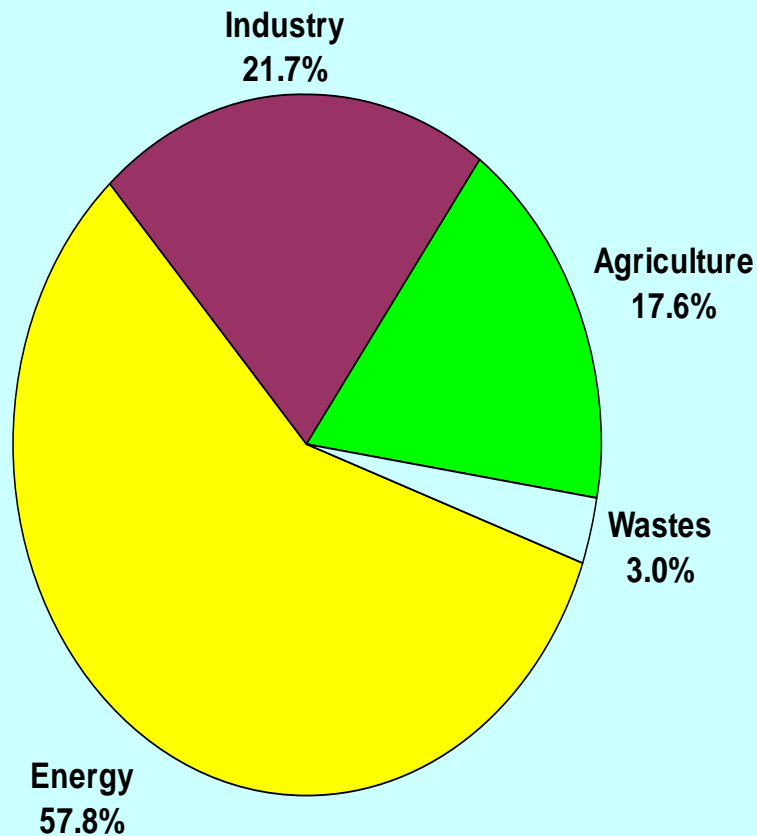


# Elevated tropospheric ozone can reduce the benefits of CO2 on crop yields (*high confidence*).



Source: IPCC-AR5 2014;  
Bhatia et al. 2015 personal comm

# Agricultural emissions from the region



# Adapting South Asian Agriculture to Climate Change and Declining Resources: Need for CSA

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

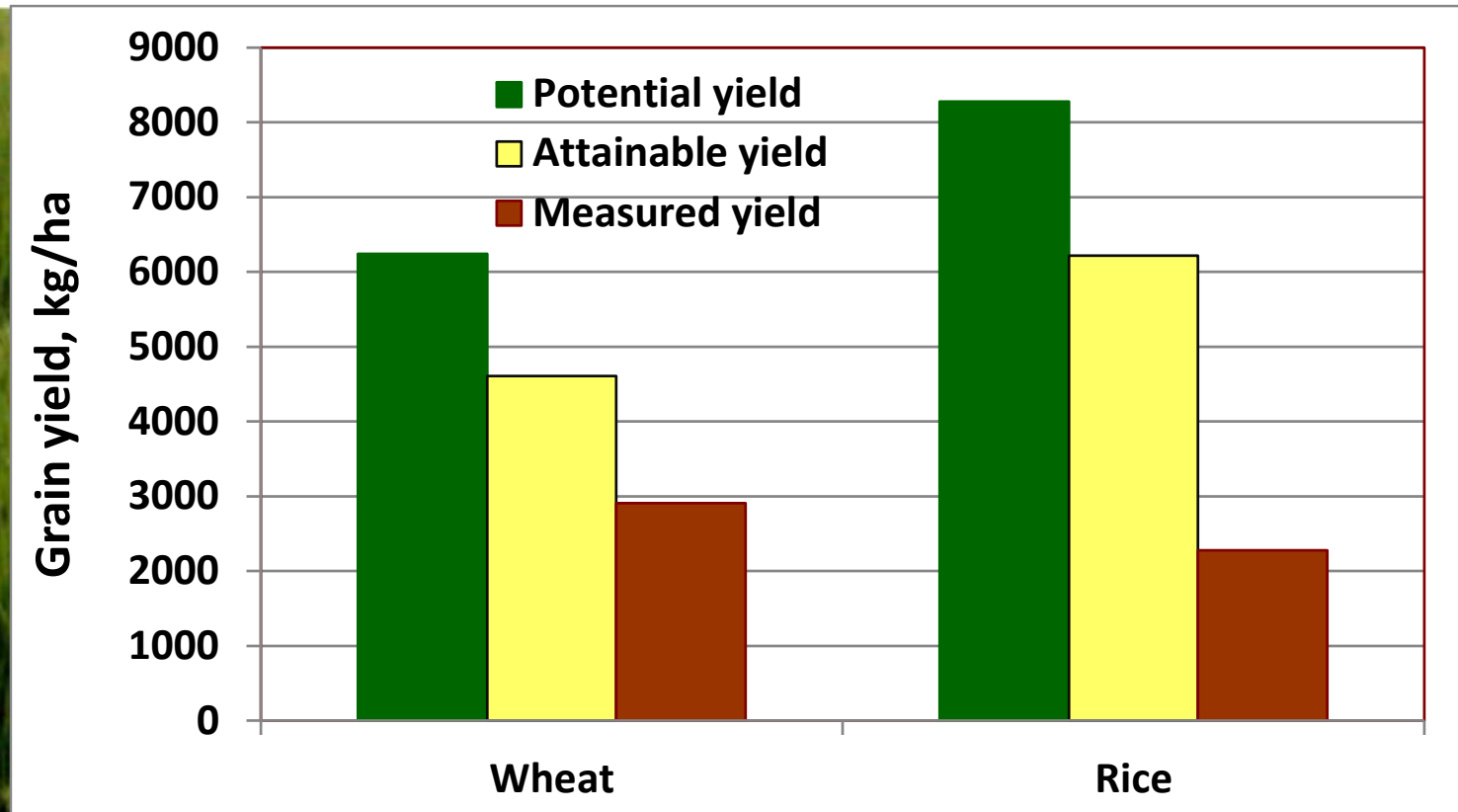


# Addressing climate change and agriculture in South Asia

## Six key action points



# 1. Make full use of untapped potential of currently available technologies



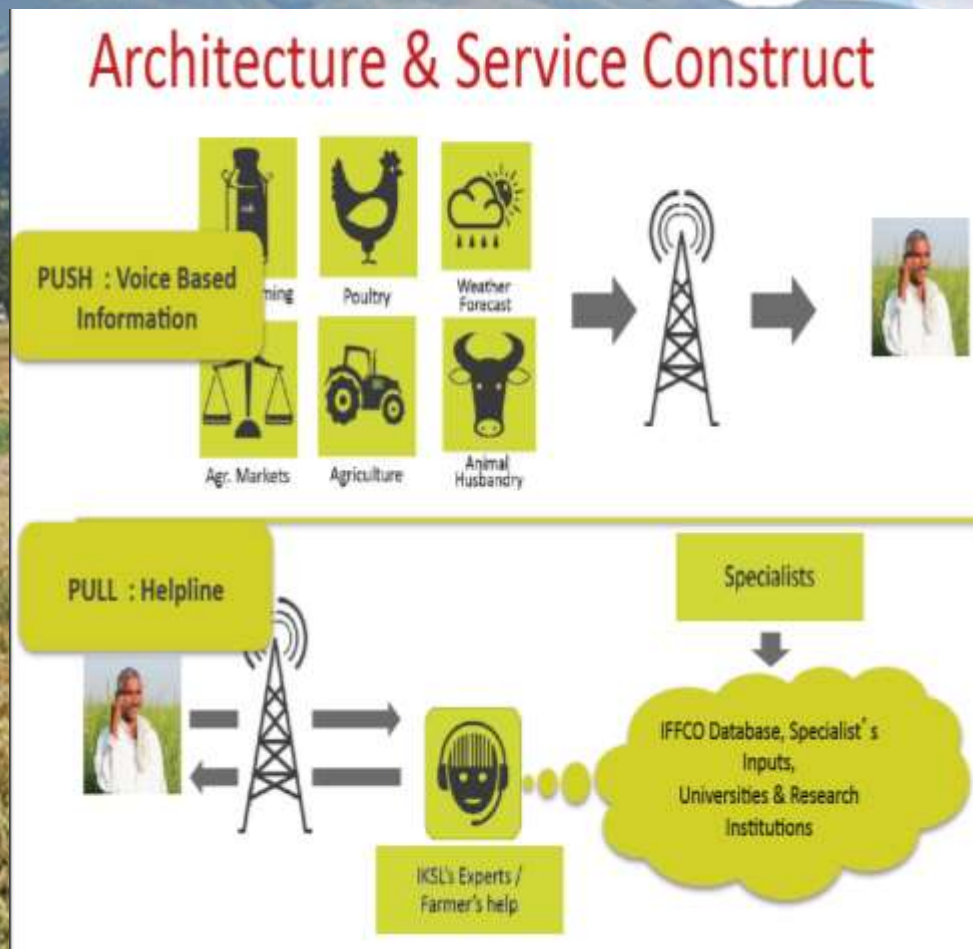
**Invest in management of land and water resources, and input delivery and market linkage mechanisms**

## 2. Identify and exploit potential benefits of climate change

- Change in temperature zones
- Increase in rainfall
- Shorter crop durations
- Shorter life cycle of fish

# 3. Improved climatic services

## Scaling-out weather –based agro-advisories



Source: IMD and IKSL

### Current status

- > 3 million farmers in India; pilots in other countries
- High dropout rate
- Generic advice; need to make this demand driven
- Cheap android phones; crowdsourcing and cloud computing could increase effectiveness and also facilitate scaling-out

# 3. Improved climatic services

Innovative crop Insurance schemes for improved management of climatic risks

- 30 million insured farmers in India; linked to credit; most are dissatisfied with products and services
- Pilots in other countries

## Innovations needed

1. AEZ specific 'indices' for rainfall/temperature
2. MRV schemes managed by farming communities
3. Bundling crop insurance with other financial instruments and risk mitigating technologies
4. Improved models for delivery- PPP models
5. Direct benefits transfer: 110 million bank accounts in last 6 months



# 4: Maximize synergies among interventions

## 'Climate-smartness' of interventions

Intervention	Yield	CV	GHG emissions	Emission intensity	Investment	Income
Higher inputs	↑	?	↑	?	↑	↔
Zero tillage	↔	↓	↔	↓	↓	↑
Laser levelling	↑	↓	↓	↓	↑	↑
Residue management	↑	↓	↔	↓	↔	↑
N sensors	↔	↔	↓	↓	↓	↑
Tensiometers	↔	↓	↓	↓	↔	↑
Climatic services	↔	↔	?	?	↑	↑
Crop insurance	↔	↔	↔	↔	↑	↑
<b>Climate-smart village</b>	↑	↓	↓	↓	?	↑

# Climate-smart villages: Integrated solutions leading to higher income, resilience, adaptation and mitigation

Several initiatives; top-down approach; lack of synergy among interventions; limited capacity of stakeholders

## Strategy

- Integrated farmer participatory approach
- Builds on local knowledge and plans
- Precision agronomy principles-sensors
- Use of modern ICT tools
- Capacity strengthening and technology targeting



For more details visit [www.ccafs.org](http://www.ccafs.org)

# Key Interventions in a Climate-Smart Village

## 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
- Solar solutions for agriculture



### Knowledge Smart

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

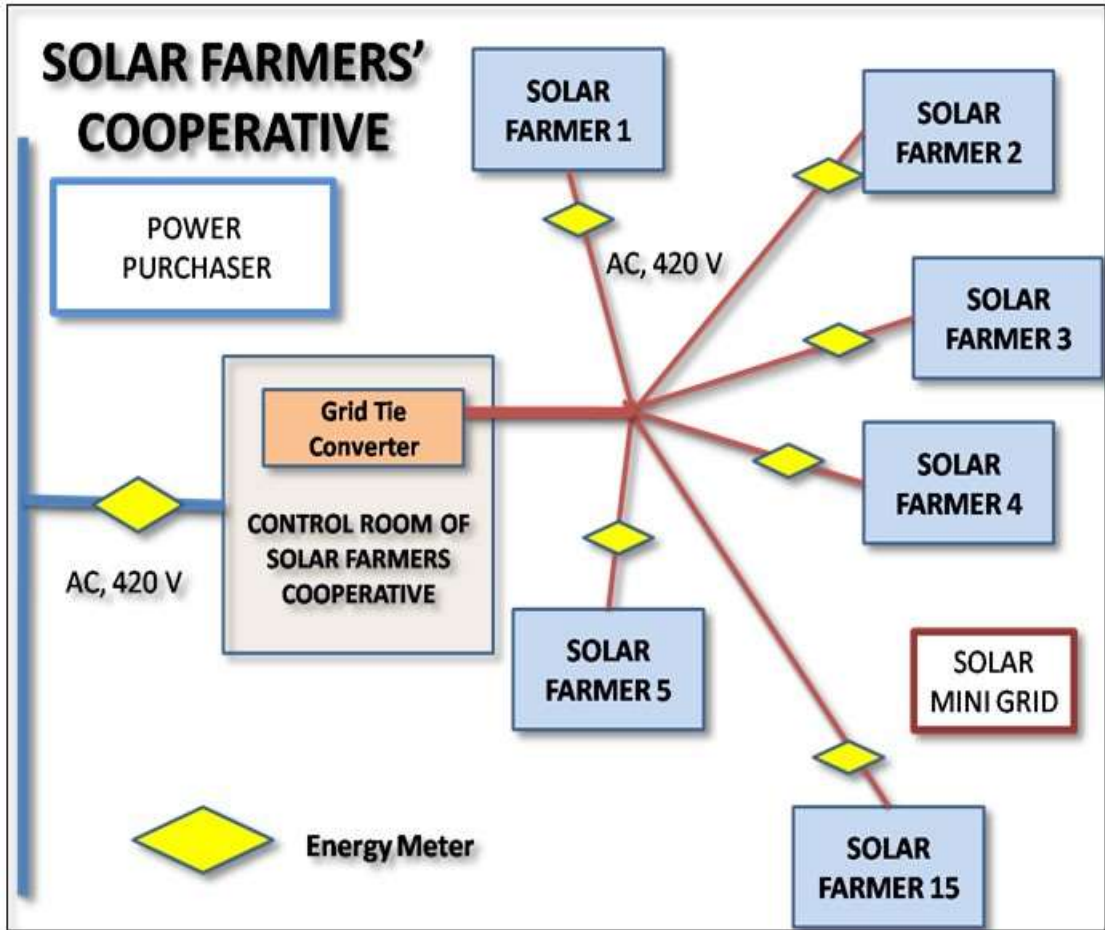




# CSVs: Initial evidence from field

Technology	Yield gain/loss (kg/ha)	Economic gains/loss (USD NR/ha)	Water saving (M3/ha)- for water smart practice	Energy Saving (MJ/ha)	Increase in NUE (as kg/kg)	Reduction in GHG (CO <sub>2</sub> -e kg/ha)
Zero tillage in wheat (without residue)	342	131	414	3040	1.44	1507 (from LCA)
Zero tillage with residue in wheat	468	190	550	2650	1.61	?
Permanent beds in maize/wheat	195	289	1650	?	1.33	?
Direct seeded rice	<u>+150</u>	136	3000	?	-	420 (based on soil flux only)
Improved water management	375	97.51	405	?	1.40	-
Nutrient Expert in wheat	500	104	-	?	10	200
Laser leveling (RW svstem)	600	130	2500	?	?	330

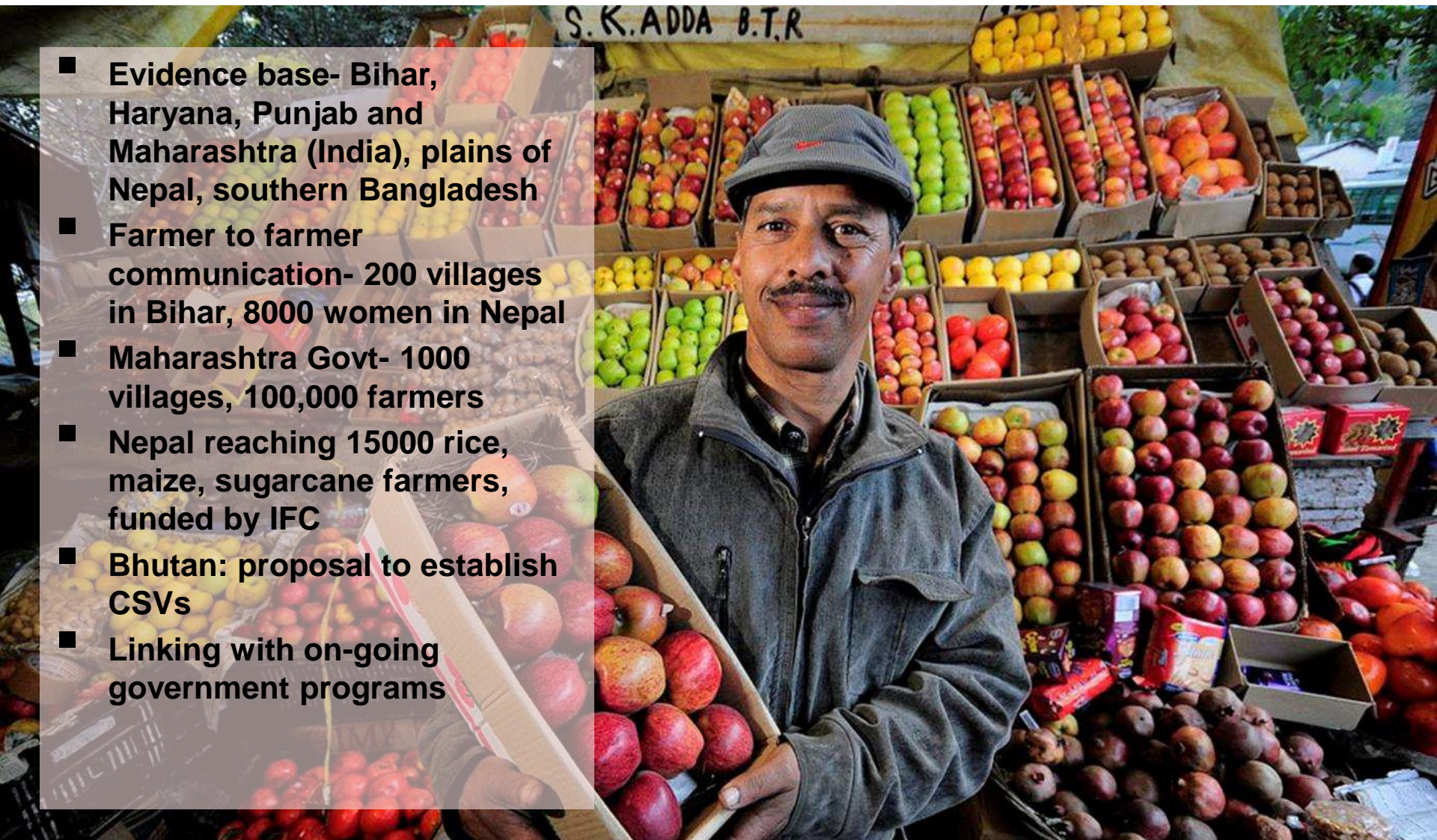
# Climate-smart villages: 'Growing' solar power as a remunerative crop



Source: T. Shah, IWMI

# Progress/plans on CSVs in South Asia

- Evidence base- Bihar, Haryana, Punjab and Maharashtra (India), plains of Nepal, southern Bangladesh
- Farmer to farmer communication- 200 villages in Bihar, 8000 women in Nepal
- Maharashtra Govt- 1000 villages, 100,000 farmers
- Nepal reaching 15000 rice, maize, sugarcane farmers, funded by IFC
- Bhutan: proposal to establish CSVs
- Linking with on-going government programs



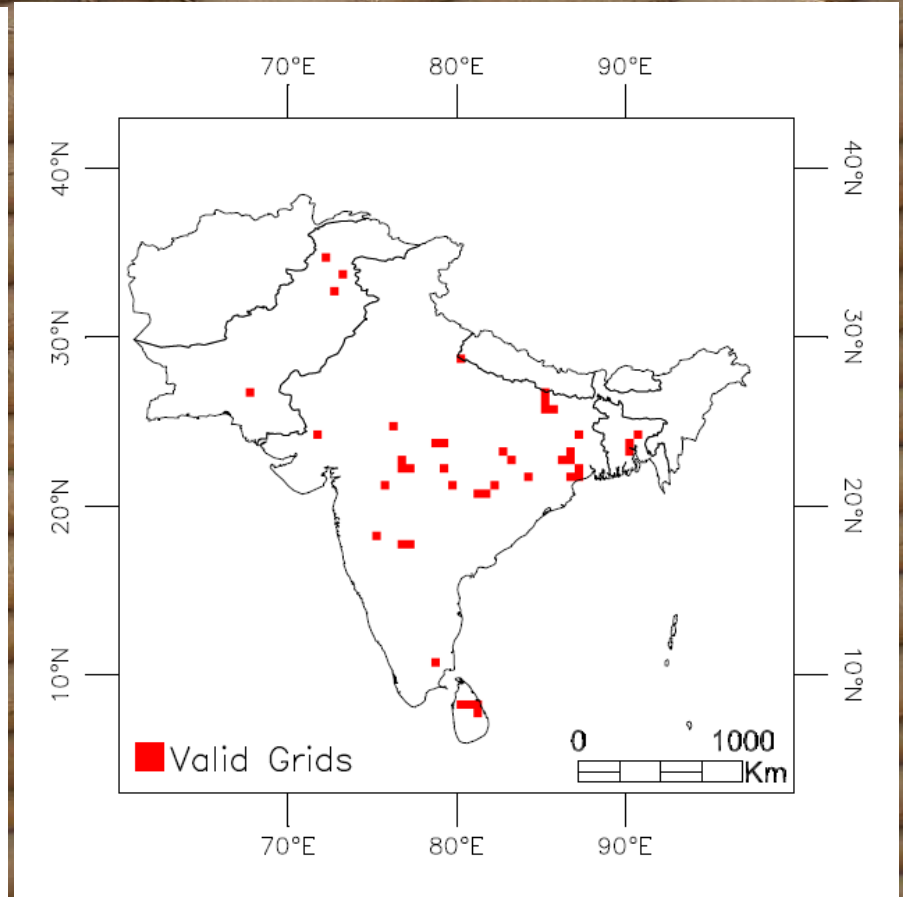
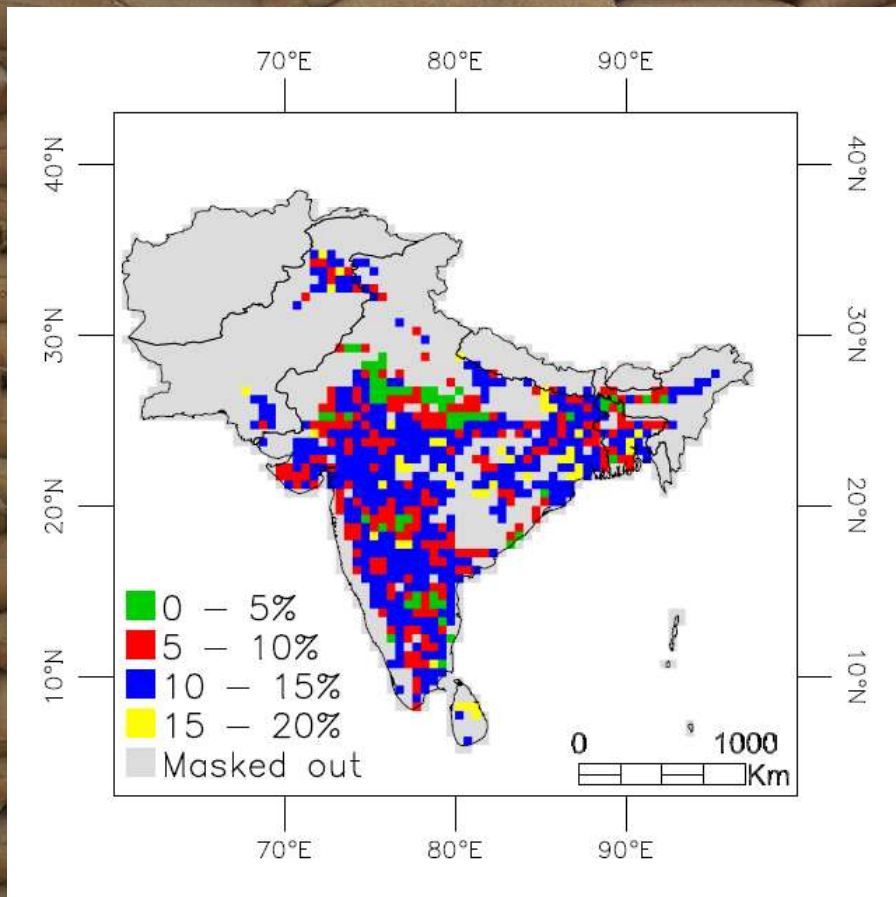
# 5. Improved targeting of technologies and policies

What technologies and policies lighten the load for women in climate risk regions?



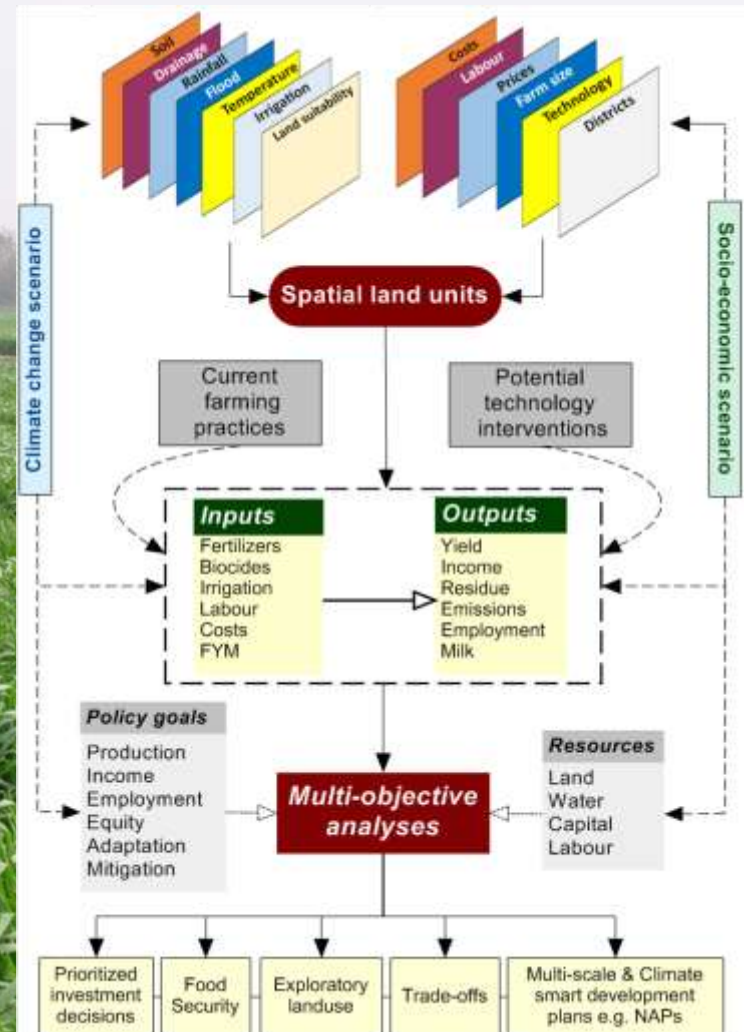
# 5. Improved targeting of technologies and policies: Do we need Seed banks to manage climatic risks?

1. Seed banks considered an important risk management/ adaptation strategy
2. Costs and logistics involved are large



# 5. Improved targeting of technologies and policies: CSA-enabled development plans- Prioritizing interventions

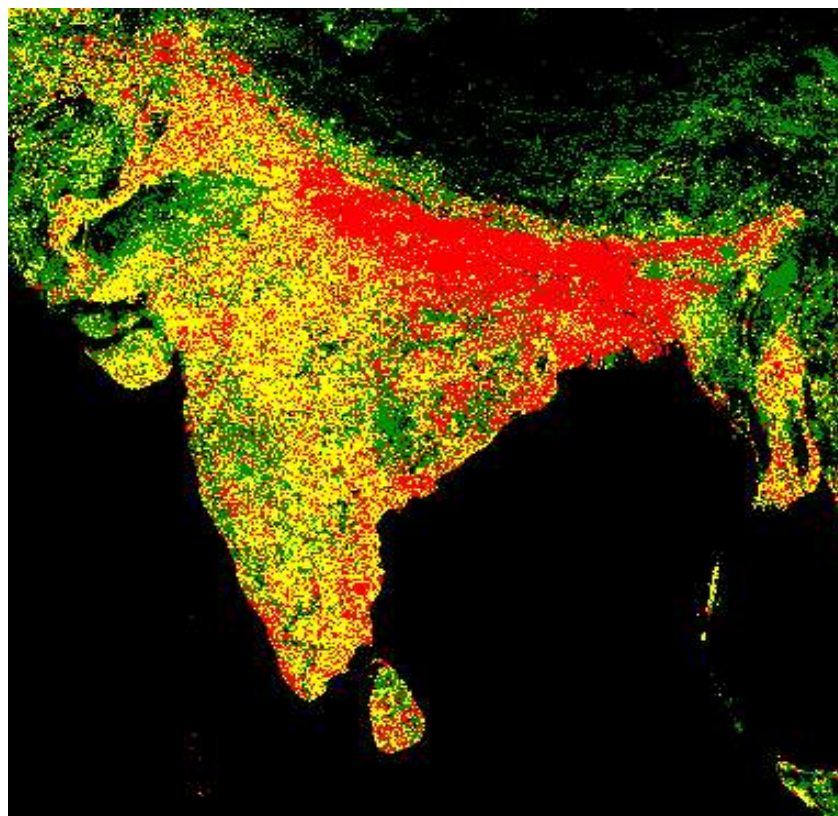
- Builds from bottom-up biophysical and socio-economic datasets
- Spatially explicit, integrated modeling framework
- Addresses climatic and socio-economic scenarios
- Supports multi-objective trade-off analyses
- Supports more informed decision making
  - What crops to cultivate;
  - Which CSA technologies and practices to invest in;
  - Where to target that investment, and
  - When those investments should be made.
  - NAPAs/ NAPs/NAMAs



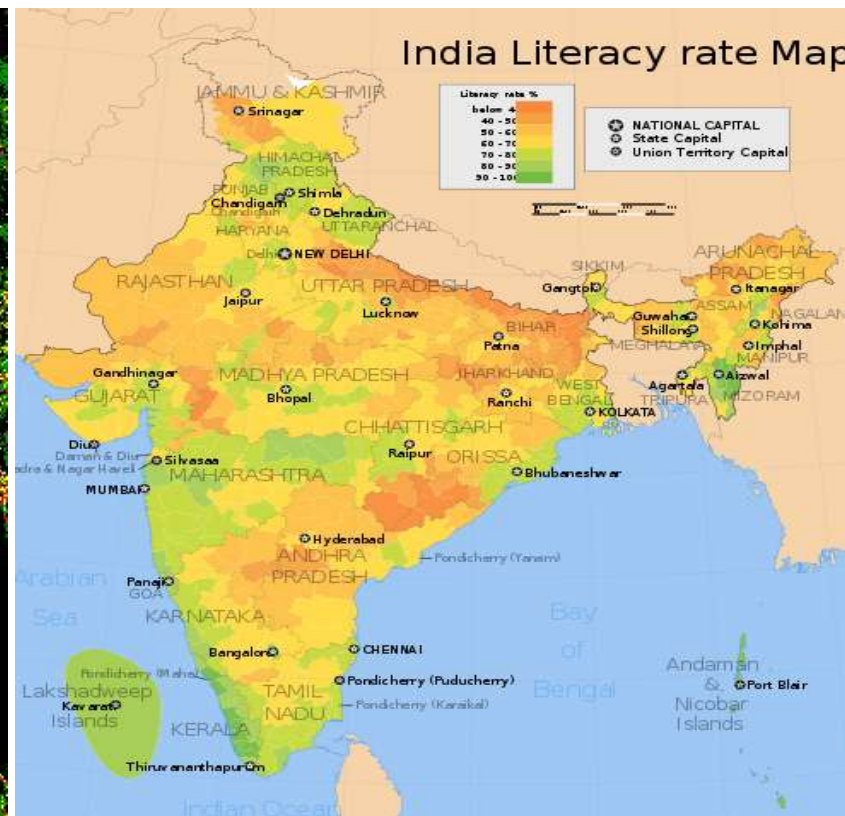
# 6: Address simultaneously poverty, governance, institutions, and human capital which limit agriculture growth even today

Poverty  
Population at \$2/day or less

Human capital  
literacy rate

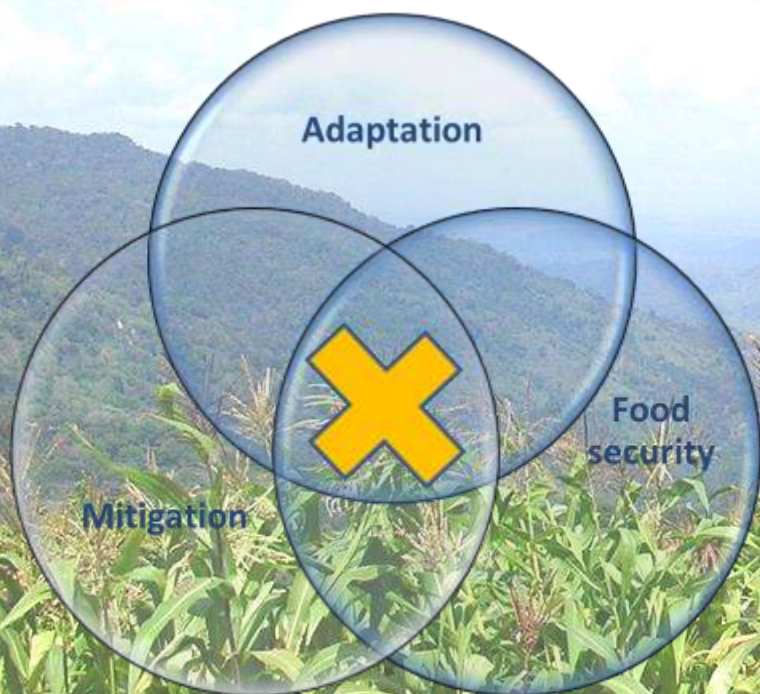


Green 1-10, Yellow 11-50, Red > 50



# Conclusions:

## Scaling-out CSA: Key ingredients

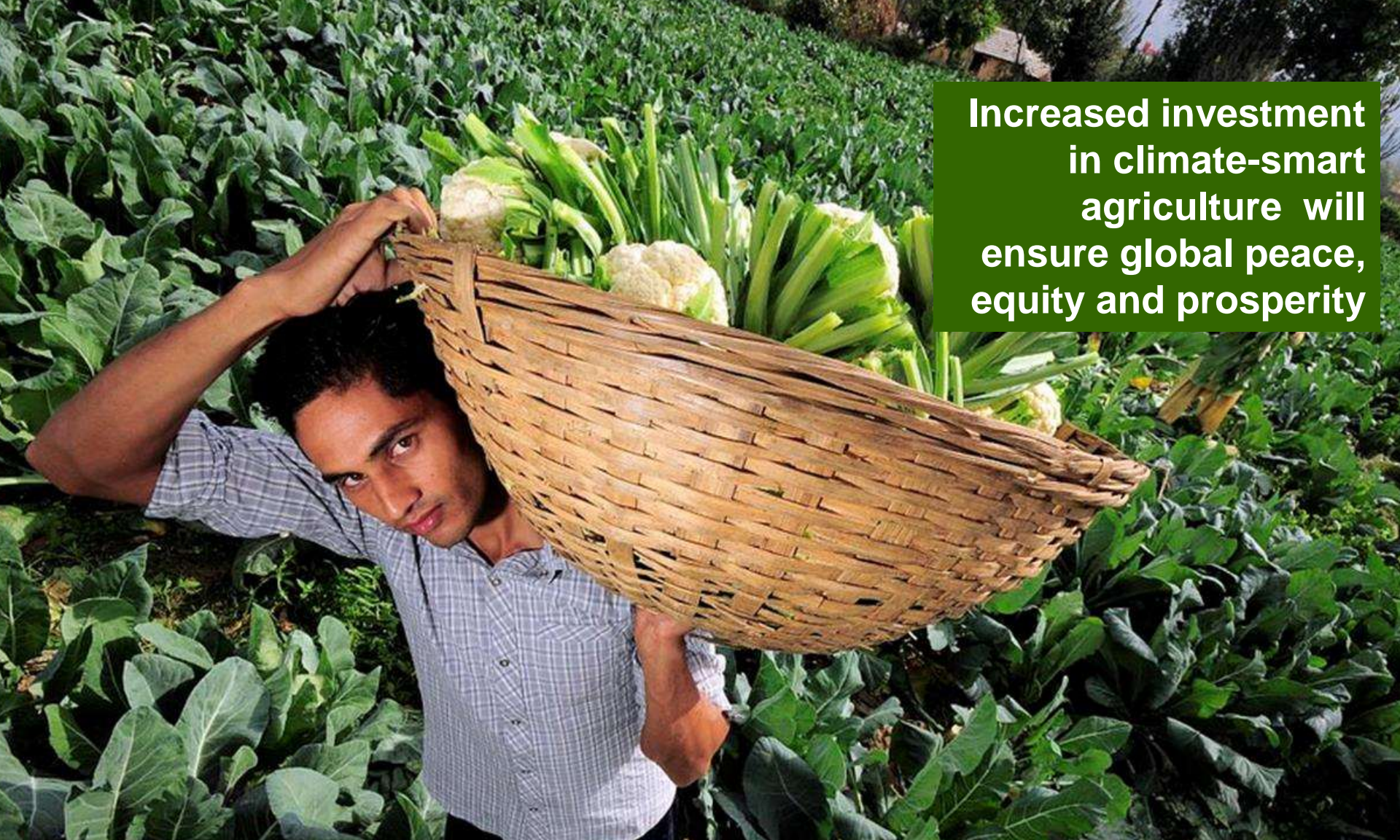


### 1. Scaling-out CSA- challenges similar to intensification

- **Good evidence base:** technology targeted for AEZs and farmer typologies – resources, priorities
- **Impact pathway:** key actors, partners, R4D.
- **Business models:** bundling interventions; institutional mechanisms: local govts; PPP
- **Capacity strengthening** of key actors: farmers, industry, planners,....
- **Policy support**

### 2. CSA has additional challenge since this is knowledge intensive





Increased investment  
in climate-smart  
agriculture will  
ensure global peace,  
equity and prosperity



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