Impacts of climate change on agriculture and role of agriculture insurance in building resilience in Asia

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Potential impact of climate change on agriculture sector

**<Positive Impact>**

- Increase in productivity due to the increased CO₂ concentration
- Increase in productivity at low level of temperature rise
- Possibility of cultivating new crop varieties
- Extended growth period
- Reduction of heating cost for protected cultivation

**<Negative Impact>**

- Reduction of productivity due to temperature rise
- Quality degradation due to temperature rise
- Increase of weeds, blights and pest
- Increase of agricultural disasters such as moisture stress and drought
- Increase of soil erosion

Changes in the agricultural environment
- Temperature rise
- Increase of dry and wet conditions
- Increase of CO₂ in the atmosphere

Change in areas suitable for cultivation

Source: Kim, Chang-Gil and et al. (2009), p.38.
Projected changes in crop yields due to climate change over the 21st century
Specific impacts

- The effects of climate change on crop and terrestrial food production are evident in several regions of the world - Negative impacts of climate trends have been more common than positive ones.
- Climate trends are affecting the abundance and distribution of harvested aquatic species, both freshwater and marine, and aquaculture production systems in different parts of the world.
- A large negative sensitivity of crop yields to extreme daytime temperatures around 30°C have been identified for several crops and regions.
- Evidence confirms the stimulatory effects of CO₂ in most cases and the damaging effects of elevated tropospheric ozone on crop yields.
- All aspects of food security are potentially affected by climate change, including food access (affordability and allocation), utilization (pests, animal diseases, human diseases), and price stability.
- For the major crops (wheat, rice, and maize) in tropical and temperate regions, climate change will negatively impact production for local temperature increases of 2°C or more above late-20th-century levels, although individual locations may benefit.
### Projected impacts for crops – World, South Asia and India

<table>
<thead>
<tr>
<th>Region</th>
<th>Sub-region</th>
<th>Yield impacts (%)</th>
<th>Scenario</th>
<th>Reference</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(R) Maize: −2, −12</td>
<td>2050</td>
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<td></td>
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<td>(I) Rice: −9.5, −12</td>
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<td>(R) Rice: −1, +0.07</td>
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<td>(I) Wheat: −10, −13</td>
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<td>(R) Wheat: −4, −10</td>
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<td></td>
<td></td>
<td>Maize: −16</td>
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<td>Knox et al. (2012)</td>
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<td>Sorghum: −11</td>
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<td></td>
<td>South Asia</td>
<td>(I) Maize: −16</td>
<td>2050</td>
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<td>Sorghum: −11</td>
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<td></td>
<td></td>
<td>Cereal production−4 to −10</td>
<td>+3°C</td>
<td>Lal (2011)</td>
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<tr>
<td>India</td>
<td>Winter sorghum: up to −7, −11, −32</td>
<td>A2, 2020, 2050, 2080</td>
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<td>Sivastava et al. (2010)</td>
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<td>(I) Rice: −4, −7, −10</td>
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<td></td>
<td></td>
<td>(R) Rice: −6, −2.5, −2.5</td>
<td>A1B, A2, B1, B2, 2020, 2050, 2080</td>
<td>Kumar et al. (2013)</td>
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<td></td>
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<td>Monsoon maize: −21 to 0, −35 to 0, −35 to 0</td>
<td>A1B, A2, B1, B2, 2020, 2050, 2080</td>
<td>Kumar et al. (2011)</td>
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<td></td>
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<td>Winter maize: −13 to +5, −50 to +5, −60 to −21</td>
<td>A2, 2020, 2050, 2080</td>
<td>Byjesh et al. (2010)</td>
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<tr>
<td>Northeast India</td>
<td></td>
<td>(I) Rice: −10 to +5</td>
<td>A1B, 2030, +CO, PRECIS/HadCM3</td>
<td>Kumar et al. (2011)</td>
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<td>(R) Rice: −35 to +5</td>
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<td>Maize: up to −40</td>
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<td>Wheat: up to −20</td>
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<td>Coastal India</td>
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<td>(I) Rice: −10 to +5</td>
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<td>(R) Rice: −20 to +15</td>
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<td></td>
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<td>(I) Maize: −50 to −15</td>
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<td>(R) Maize: −35 to +10</td>
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<td>Western Ghats, India</td>
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<td>(I) Rice: −11 to +5</td>
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## Projected impacts for crops – Africa

<table>
<thead>
<tr>
<th>Region</th>
<th>All regions</th>
<th>Maize</th>
<th>2050</th>
<th>Reference</th>
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</thead>
<tbody>
<tr>
<td>All regions</td>
<td>Maize: -24 ± 19</td>
<td></td>
<td>2090, +5°C</td>
<td>Thornton et al. (2011)</td>
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<tr>
<td>East Africa</td>
<td>Maize: -3.1 to +15.0, -8.6 to +17.8, Beans: -1.5 to +21.8, -18.1 to +23.7</td>
<td></td>
<td>A1F1; B1; 2030, 2050, HadCM3; ECHAM4</td>
<td>Thornton et al. (2010)</td>
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<tr>
<td>Sahel</td>
<td>Millet: -20, -40</td>
<td></td>
<td>+2°C, +3°C</td>
<td>Ben Mohamed (2011)</td>
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</tbody>
</table>
Relief or Insurance? Case study from India

When freak becomes the norm

2013
States affected: 5
Crops damaged
0.35 million hectares
Economic loss
Rs 500 crore (approx.)

2014
States affected: 6
Crops damaged
5.5 million hectares
Economic loss
Rs 5,000 crore (approx.)

2015
States affected: 15
Crops damaged
18.23 million hectares
Economic loss
Rs 20,000 crore

The 15 states represent 75 per cent of India’s population and about 70 per cent of its geographical area, and produce approximately 81 per cent of its foodgrains.
Relief mechanism in India

- Ministry of Agriculture and Farmers Welfare and Ministry of Home Affairs are mandated with coordination of relief measures in the event of natural calamities like drought, floods, cyclones, hailstorms etc.
- States have ready availability of funds through State Disaster Response Fund (SDRF) - Central share is 75% while the states contribute 25% to the fund.
- The allocation for SDRF for the period 2010-15 was 5003.8 million USD.
- This has significantly increased for the period 2015-20 to 9122 millions USD.
Relief mechanism in India

- Items and norms of assistance under SDRF as also NDRF have been significantly enhanced wherein the eligibility for relief has been reduced to 33% of crop loss vis-a-vis 50% earlier.

- Relief is provided largely under following head:
  - Agricultural Input Subsidy for crop loss
  - Emergency supply of drinking water
  - Provision of fodder/feed concentrate
  - Transport of Fodder
  - Repair restoration of damaged infrastructure requiring immediate attention.
The chaotic and politicized ‘relief’ scenario

- Problem in declaration of calamity
- Eye estimation is the foundation of relief assessment
- Time consuming and inaccurate assessments
- Frequent cases of corruption in the system
- Insufficient amounts to cover losses
- Large fraction of affected people excluded
- No rationale - Huge differences in relief amounts from Rs13,500 to 18000 to 50,000 per ha for same crop – unseasonal rain and hail
Role of agriculture insurance

- Increasing frequency of natural disasters often reduces the ability of vulnerable groups to rebound quickly, to respond to the challenges of hunger and malnutrition.
- Farmers use a wide range of strategies to manage risk in agriculture – informal and formal risk management strategies.
- Low cost agricultural insurance schemes are increasingly viewed as mechanism for providing social protection to such risks.
- Agriculture insurance might play an important role in managing climatic and natural risks.
- Government of India has decided to slowly move from relief system to formal insurance system and use part of relief money to subsidize insurance premium.
- However, it is clear that agriculture insurance system in its current form will not be able to help farmers.
Need for Agriculture insurance

- Farmers need an agricultural insurance mechanism which is affordable, accountable, fair and effective.
- Agricultural insurance cannot be built on massive profit maximization but has to be built on principle of reasonable profitability.
- Universal coverage of vulnerable farmers is required.