Impact of Climate Change on Agriculture and Food Security

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Impact on Ecosystems

Semi-arid regions

- ↑↑ Frequency of extreme weather climates.
- By 2050 winter rainfall will ↓↓ by 10-20 %.
- N. India: ↑↑ temperature could rise by 3.5oC to 5oC.
- Water Shortages at all levels.
Impact….

Arid regions

• Fresh water decreases.

• Water salinity ↑↑ due to excess rainfall & flooding
Impact....

*Tropical wet and dry regions*

- Drought prone regions experience frequent flooding.
- High incidence of extreme weather events.
Impact....

**River deltas and coastal areas**

- Krishna, Cauvery and Narmada rivers expected to experience water shortage.
- Sea incursion threatens coastal regions.
- Expected $\uparrow\uparrow$ in temperature from $1^\circ$C to $7^\circ$C by 2070 in coastal regions.
- Sea level rise: 3-16 cm by 2030, 50 cm by 2070 and 60 cm by 2100.
Impact....

**Mangroves**

- Temperature above 35°C will affect mangrove root structure.

- ↑↑↑ in sea level and extreme water events will destroy mangrove ecosystem.

- ↓↓↓ in rainfall will affect mangrove geographical distribution and biodiversity.
Impact of Climate Change on Agriculture

• Melting Himalayan glaciers reduce water for agriculture

• N. India: water levels ↓↓ by 40.5 mm per year

• Uttarakhand: 34% water streams dried/become seasonal

• High temperature → dry soil → reduced root growth → less N2 fixation → low yield
Impact on Agriculture...

- Rise in number of invasive alien species pose threat to agriculture.

- Rise in the spread of disease and pests will reduce yields.

- ↑↑ temperature will negatively impact pollination.
Impact on Crops

Cereal Crops

- **Wheat**: 1°C rise in temperature will decrease wheat production by 6 million tonnes.
- **Rice**: 1°C increase in night time temperature led to a 10 percent reduction in yield.
- **Maize**: Yield reduction by 18% by 2080.
Vegetables and Legumes

• Chickpeas: \(\uparrow\uparrow\) CO2 can increases yield
• Onion: \(\uparrow\uparrow\) CO2 enhanced accumulation of dry matter = big size bulbs.
• Tomato: \(\uparrow\uparrow\) CO2 increases yield, higher no. of fruits.
• Coconut: Temperature sensitive. Likely to decline on east coast, increase in west coast.
• Apples: Reduction in yield in current locations.
**Impact on Livestock**

- Indigenous breeds have better tolerance to heat, pests & disease
- Hybrid cattle highly vulnerable
- Current milk production based on hybrid cattle will decline
Impact on Fisheries

**Marine Fish:**

- Increased mortality, changed geographic distribution; affects availability.
- Rise in sea surface temperature affects spawning activity.
Fresh water fish:

- ↓↓ in rainfall alters flow of water affect breeding patterns.
- Changes in rainfall and ↑↑ temperature affects shift in distribution of species in rivers.
- Quality & quantity of water in ponds/tanks affects fresh water fish.
Adaptation

- Adaptation based on Sustainable Agriculture
- Global-India must negotiate that global temperature rise is capped at $2^0$C.
- Regional cooperation at SAARC level necessary to protect the Himalayan ecosystem
Adaptation…

National-

• Multiple food and livelihood strategies
• Food inflation must be contained at all costs
• Strategic research, along with dedicated funding to develop solutions
• Mitigating emissions to reduce input costs
• Reduce vulnerabilities, strengthen resilience
Adaptation…

• Sustainability rather than maximising outputs

• Ecosystem approach with crop rotations, bioorganic fertilizers and biological pest controls.

• Diverse agro ecosystems, have more efficient network of insects & microorganisms that control pests and disease.
Adaptation…

• Conserve Agriculture biodiversity
• Special package for rainfed areas
• Diversify production to include crops, livestock, fisheries, poultry and agro forestry
• Farm ponds, fertilizers trees and biogas plants
• Knowledge-intensive, rather than input-intensive approach.