Climate Change and Its Impact on Food and Energy Supply



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A11- Potential of microalgae in the fight against climate change

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Introduction: The Interconnected Crisis

Climate Change: A Fundamental Threat to Our Core Systems

Climate change signifies long-term alterations in the average weather patterns that characterize Earth's local, regional, and global climates.

Food and energy systems form the bedrock of modern human civilization. These two systems are deeply intertwined and critically dependent on stable climatic conditions.

Climate change acts as a potent threat multiplier, exacerbating existing stresses on these vital systems.

The Driver: Escalating Greenhouse Gases & Warming

Unprecedented Changes in Our Atmosphere

The primary driver is the increased concentration of heat-trapping greenhouse gases (GHGs) in the atmosphere, resulting principally from the burning of fossil fuels for energy.

Since pre-industrial times (around 1750), levels of CO2, CH4, and N2O have surged to levels unprecedented in at least the last 800,000 years.

Earth's global average surface temperature has risen by approximately 1.1°C between the pre-industrial baseline (1850-1900) and the decade 2011-2020. The rate of warming is accelerating, currently increasing by more than 0.2°C (0.36°F) per decade.



Impacts on Agricultural Production: A System Under Stress

Rising average temperatures, altered precipitation patterns and the increasing frequency and intensity of extreme weather events are already exerting significant stress on crop and livestock production worldwide.

- **Crop Yields:** Evidence indicates that climate change is negatively affecting crop yields in many regions. Anthropogenic warming has demonstrably slowed the rate of growth in global crop yields.
- **Livestock:** Direct heat stress negatively affects animal health, welfare, fertility, and productivity warming temperatures are changing the geographic range of various livestock parasites and vector-borne diseases.
- **Water Scarcity:** Agriculture accounts for ~70% of global freshwater withdrawals; climate change increases crop water requirements while reducing supplies in many areas.



Climate-Induced Food Deficits

Increased Crop Failures

Rising temperatures and unpredictable weather patterns lead to **increased crop failures**, threatening food security globally.

Rising Food Prices

As supply decreases due to climate impacts, **food prices rise**, making it harder for vulnerable populations to access necessary nutrition.

Nutritional Deficiencies

Climate change results in **nutritional deficiencies**, as staple crops fail, leading to reduced food diversity and increased health risks for communities.

The Energy Connection

Compounding Food System Vulnerabilities

Energy is indispensable throughout the agrifood value chain, powering irrigation pumps, farm machinery, fertilizer production, food processing facilities, refrigeration and transportation.

Climate impacts on energy generation:

- **Thermal Plants (Fossil/Nuclear):** Reduced efficiency and shutdowns due to insufficient cooling water during droughts/heatwaves.
- **Hydropower:** Highly vulnerable to drought, altered streamflow, and snowmelt patterns.

A climate-induced drought can simultaneously reduce crop yields decrease water availability for cooling thermal power plants and increase the energy required for pumping groundwater for irrigation.



The Food-Energy-Water (FEW) Nexus: Amplified Stress

Actions taken within one sector inevitably have consequences – either positive (synergies) or negative (trade-offs) – for the others.

Fact:

Climate change significantly intensifies the pressures on the FEW nexus.

Water Competition:

As climate change alters precipitation patterns, competition for these limited water resources intensifies between agriculture, energy, cities, and ecosystems.

Biofuel Conundrum (Food vs. Fuel):

Diverting substantial amounts of arable land, water, and crops from food production to fuel production can exert upward pressure on global food commodity prices. This can also lead to "indirect land-use change" (ILUC), potentially negating GHG savings.

Solutions Part 1: Adaptation & Mitigation in Food Systems



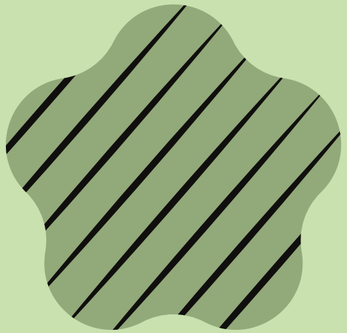
Climate-Smart Agriculture (CSA)

Aims to sustainably increase productivity, adapt to climate change, and reduce emissions. Examples: Heat/drought-tolerant crops, efficient irrigation, soil conservation, agroforestry.



Reducing Food Loss and Waste:

25-30% of all food produced globally is lost or wasted. Tackling food loss and waste is a powerful strategy with dual benefits for climate mitigation and food security.



Sustainable Dietary Shifts:

Diets high in animal products are generally associated with higher GHG emissions Shifting towards more balanced, sustainable dietary patterns offers major potential for climate mitigation.

Solutions Part 2: Broader Strategies & Energy Transition

Ecosystem-Based Adaptation (EbA)

"Protecting, restoring, and sustainably managing ecosystems such as forests, wetlands provides natural solutions that enhance resilience.

Energy System Transition:

Rapid and massive scaling up of electricity generation from low- and zero-carbon sources, primarily solar PV and wind power.

Energy efficiency is often the most cost-effective way to reduce emissions and energy demand.

The Imperative: Integrated Action & Policy

Coordinated Efforts for Systemic Change

- **Nexus Planning:** Adopting a WEF nexus approach in policy development helps to identify potential synergies and manage trade-offs.
- **Policy Levers:** Clear targets, carbon pricing, financial incentives for clean technologies, removing fossil fuel subsidies, investing in RD&D.
- **Co-Benefits:** Many adaptation and mitigation actions offer significant co-benefits beyond climate goals for human health, biodiversity, economic development, and overall well-being.



Conclusion: The Urgency of Now

A Narrowing Window for Action

- Climate change poses profound and escalating risks to food and energy.
- Vulnerable populations are disproportionately bearing the brunt of these impacts.
- Pathways towards resilience exist and are within reach.
- The urgency for deep, rapid, and sustained action within this decade cannot be overstated.
- Transforming our food and energy systems is a fundamental requirement for ensuring global stability, human well-being, and sustainable development.



Thank you for your attention!

Any questions? I’ll be glad to answer.

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