

Climate, Agriculture and Air Pollution impacts combine to affect Public Health: Study

Policy must take interdisciplinary approach, say scientists

Hyderabad, September 17: A new research explores interconnections between climate, air quality and agriculture and their combined impact on public health. The paper titled, 'A systems lens to evaluate the compound human health impacts of anthropogenic activities', published in the journal 'One Earth' today, categorises health impacts into heat-related illnesses (such as exhaustion, heat strokes, and cardiovascular events), pollution-related illnesses (such as asthma, enhanced risk of lung cancer, chronic pulmonary diseases), and nutrition-related illnesses (such as anaemia in women of reproductive age, iron and zinc deficiency). This interaction between climate, agriculture, and air quality to specific health impacts creates a composite picture of the effects on public health due to anthropogenic (human-induced) environmental changes. The study calls for attention of policymakers to consider these diverse and dynamic inter-linkages and approach public health through a comprehensive scientific lens. Using examples from India, the scientists emphasised the need for better tools and local, high-resolution data on health, weather, emissions, air pollution, and land use to evaluate human and environmental impacts on public health.

Prof Ashwini Chhatre, Associate Professor, Public Policy, Indian School of Business, who led the research in South Asia said, "Agricultural practices impact air quality, but air quality also impacts agriculture, all amplified by the human-induced climate effect. In complex human-environment systems, these evolving, multifaceted interactions must be factored into policymaking. The study points out how useful and effective policy responses need to take multiple factors and interactions into account, and highlights the need to avoid simplistic explanations."

Along with ISB, researchers from Columbia University, University of Washington, Boston University, and the University of Delaware collaborated on this multidisciplinary research. "Climate and agriculture interactions are critical to understanding health impacts in South Asia due to the region's extensive agriculture-driven land-use change, cropping patterns, and high prevalence of livelihoods based in smallholder farming," explains Kyle Davis, co-author of paper and Assistant Professor, University of Delaware. "The work sheds new light on the ways that food systems affect, and are affected by, climate change and air pollution," Davis adds.

India, the research says, is one of the most vulnerable regions to environment-related health hazards, owing to its high population density, high poverty rates, severe food insecurity, and over-reliance on agriculture. Such a systems approach can greatly facilitate policy development and decision making, especially for developing countries in the South Asian region.

Dr Deepti Singh, Assistant Professor, University of Washington and lead author of the paper said, "We're offering a framework to assess the overall health impacts from multiple parts of Earth's natural systems, which are all changing at the same time because of human impacts. These changes must be carefully and comprehensively scrutinised to drive effective policy changes at the country as well as global level." The authors expect that an integrated region-specific understanding of these interactions could support the decision-making and adaptation planning of countries, and inform sustainable policy development.

Talking about the significance of the study, experts said:

Dr Roxy Mathew Koll, Scientist, Indian Institute of Tropical Meteorology:

“We are going through rapid environmental changes that are complex and multi-faceted. For example, simultaneous exposure to extreme weather events due to largescale climate change, poor air quality due to local air pollution, and food-water crises can lead to complex and compound health issues in developing nations. Another example is when seawater intrusion along coastal regions leads to diseases like cholera but also compromises the agriculture (food) and water quality over the region. Often, we try to examine and address these issues individually, thereby underestimating the overall impact on health. The study highlights that we urgently need interdisciplinary scientific efforts that can accurately quantify the risk of these simultaneously increasing environmental hazards and their related health risks. This will require scientists, medical experts and local administration working together and sharing data-which is a challenge that we have to address.”

Dr Anjal Prakash, Research Director, Bharti Institute of Public Policy and coordinating lead author, IPCC Special Report on Ocean and Cryosphere, 2019:

“The IPCC’s physical science report which was released recently showed that there has been an unprecedented change in the climate induced by human intervention. This study takes the issue further and links climate change with public health that is mediated through air quality, agricultural land use management and human induced environmental challenges in South Asia. Such studies are rare and this one fills the gap in our understanding of the human-environment system interaction. The study is timely as the meeting of conference of parties (COP26) is round the corner and the pathways shown in this research can inform policy makers to make some tough decision to course correct the present pathways”

Major concerns:

- a) GHG Emission in India is up by 260% since 1990: Largely driven by the growth in the energy sector, GHG emissions in 2014 were up by 260% over 1990 levels. Factors such as emissions from residential and agricultural biomass burning, coal-power plants, and vehicles have resulted in an increase in aerosol concentrations of noxious pollutants in the atmosphere. GHG emissions from agriculture alone add up to 19% of the GHG budget in South Asian countries contributed by nitrous oxide emissions from fertilizer use, CO₂ emissions from tractors and pumps, methane emissions from flood irrigation, soil and manure management, and enteric fermentation, and contributions from the ubiquitous paddy rice cultivation in the region. The rapidly altering climate patterns and the rising CO₂ concentrations could potentially reduce the nutritional content of cereal grains and potatoes although there currently exists limited data around the magnitude of their impacts in low-income countries.
- b) Stubble burning in Punjab and Haryana contributed to declines in agricultural productivity: The study illustrates the case of elevated levels of fine particulate matter and nitrogen dioxide that have been observed at the end of the Kharif growing season (monsoon) in Punjab and Haryana due to extensive rice biomass burning. Similarly, elevated surface levels of ozone have also been attributed to be a major cause of declined crop productivity for

wheat, rice, cotton, and soybeans in India. All these, indicate that agriculture and aerosol emissions continue to be as important as GHG emissions in influencing regional environmental conditions and their collective consequences on human health.

- c) Climate change is detrimental to human health: The study categorized health impacts into heat-related illnesses (such as exhaustion, heat strokes, and cardiovascular events), pollution-related illnesses (such as asthma, enhanced risk of lung cancer, chronic pulmonary diseases), and nutrition-related illnesses (such as anaemia in women of reproductive age, iron and zinc deficiency). The analysis linked different interactions between climate, agriculture, and air quality to specific health impacts to create a composite picture of the collective health impacts of all interactions.

Major Recommendations:

The paper drew on hundreds of research studies on climate change, air quality, agriculture, and public health to propose a set of recommendations that connect health risks with simultaneous environmental changes driven by human actions:

- a) Creating open-access datasets on air pollution, agriculture, meteorological changes, and GHG emissions to quantify anthropogenic drivers and their environment impacts, and collecting long-term epidemiological data at high pollution concentrations to accurately evaluate health outcomes in South Asia and other developing regions
- b) A comprehensive environment-human health systems model built on an integrated assessment model (IAM) to capture local human health impacts from climate and air pollution exposure and predict future health hazards.
- c) Simulations of future climate and pollution trajectories to quantify the range of potential environmental changes and human health outcomes, that allows for identifying intervention points to minimize impacts at each step, and addresses economic implications of different policy interventions that feedback on anthropogenic drivers and the environmental system through a systems model.

The complete paper can be accessed [here](#).