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- Taking a Fine-Grained Approach to Investigating Climate's Impact on Crops
- Secondary Perils, Urban Risk & the Role of Re/Insurance

Read on to learn more.



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Taking a Fine-Grained Approach to Investigating Climate's Impact on Crops

Gradually rising temperatures, changing rainfall patterns, and extreme weather events are resulting in increasing losses in agriculture around the world, with rapid declines in crop production known as shocks. To study climate change's impacts on food and other crop systems, scientists have typically measured the change in crop yield in different weather scenarios. But when it comes to building a resilient food production system, it is valuable to look beyond this single metric. Are we missing part of the picture if we're only focusing on yield? Tracking other elements that play a role in food production, such as how much crop can be planted in a given area, could also offer valuable insights regarding crop shocks.

Digging Deeper

Crop production is calculated as the product of yield (crop per unit area) and the area of land harvested, which depends on how much land has been planted and what farmers and scientists term the "harvestable fraction"—the ratio of harvestable crop to planted crop. Each of these components—planted area, harvested area, and yield—can suffer losses independently and affect crop production. Yield is important, but the research shows that other components are also important for crop production. As climate change influences agriculture, and in turn food security, understanding how variations in yield, planted area, and harvested area affect crop production is critical to adaptation efforts. So far, resilience building has focused on stabilizing the yield component by developing drought-tolerant varieties of crops and improving the range of crops. But by looking only at yield you miss a lot of potential opportunities to adapt to climate variability and climate change impacts.

The research findings show that factors related to planting and harvesting area are important when it comes to increasing resilience in food production systems. This more comprehensive and nuanced analysis reveals other avenues to stabilize production, such as viewing food production from a landscape perspective and deciding the best place to plant crops. This research helps us to better understand opportunities to adapt to future crop production shocks. Recognizing large-scale patterns across each of the components that contribute to food production will also help governments and institutes in their efforts to encourage more climate-resilient cropping strategies.

The research also helps us to better understand historical farmer decision-making, as well as opportunities to adapt to future crop production shocks.

Source - <https://eos.org>



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Secondary Perils, Urban Risk & the Role of Re/Insurance

Urban population has grown tremendously in the 19th and 20th centuries and will continue to rise in future. After the end of World War 2, with many countries freed from colonial rules, economic activities started, and cities offered opportunities to prosper. Subsequently, many cities experienced phenomenal growth in population and expanded vastly, mostly without long-term planning and ensuring the safety of inhabitants.

The migrants, especially the poor, generally, find shelter in the hazard-prone areas like those prone to water-logging, unstable slopes, unhygienic areas, thereby increasing their own vulnerabilities.

According to the UN-Habitat World Cities Report 2022 report, by 2025, 37.4 % of India's population – over 542 million people – would be living in Urban country and area.

Going forward, urban risks are expected to be driven by three main underlying trends: first, climate change and a rising frequency and severity of extreme weather events; second, smart urbanization and the risk of systemic and catastrophic disruptions; and third, socio-demographic shifts such as income and wealth inequality and the rapid ageing of rich-world populations and infrastructures.

An urban area can experience the following hazards:

1. Natural hazards e.g., Cyclone, Earthquake, Floods, Wildfires etc.
2. man-made unintentional hazards e.g., transportation and industrial accidents or fires
3. intentional man-made hazards e.g., war, terrorism, rioting and cyberattacks on critical infrastructure.

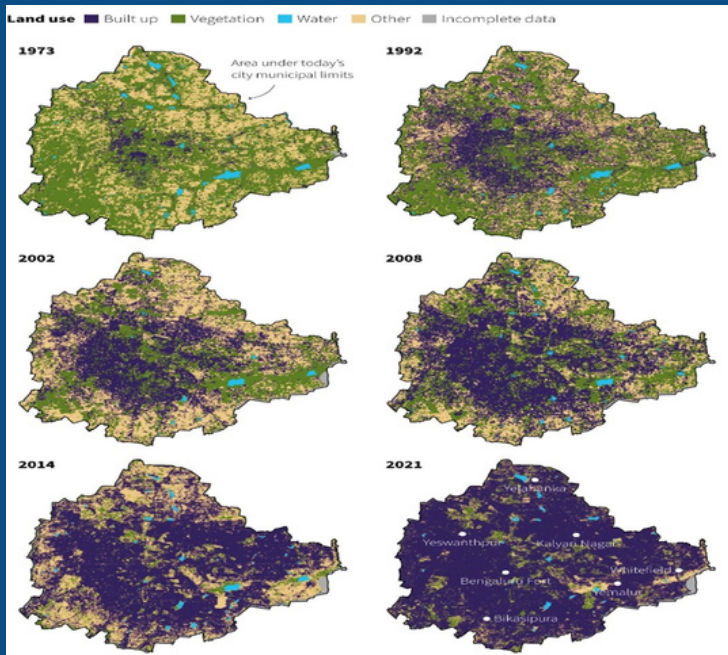
However, due to negligence, poor planning and lax implementation of construction guidelines results in blurring of the above hazards.

Take example of Bangalore, India. Experts believe the floods in early September 2022 happened due to:

- Hasty urban urbanization
- Encroachment of natural drains
- Depletion of wetlands
- Topography change caused by constructions.



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The built-up area was about 86% of city area in 2021 compared to just 21 % 3 decades back as shown in Fig 1 above

Urban risk which depends on hazards, vulnerabilities and exposure is increased by various factors among which climate change is important as its impacts are more visible now than ever before. Extreme heat, snowstorms, wildfires, cyclones with potential to reach further inland and floods - riverine or urban or coastal - are impacting various cities in different continents and countries.

A 2016 study showed that flood risk is heavily concentrated in a few cities as shown in table below and most of them located in developing world and significant percentage of population is exposed.

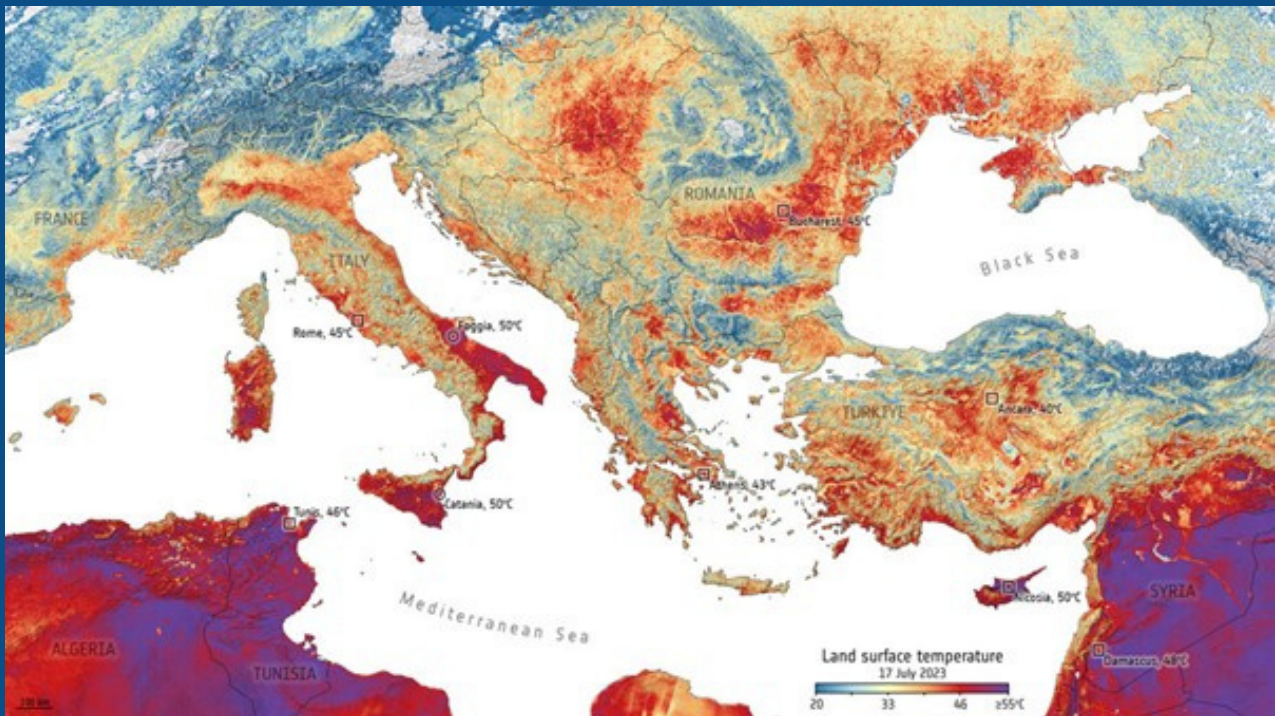
City	Country	Exposed population, 2015	Percentage of population exposed, 2015
Shanghai	China	21,503,000	88
Guangzhou	China	17,640,000	43
Kolkata	India	17,164,000	79
Dhaka	Bangladesh	15,269,000	64
Bangkok	Thailand	14,647,000	99
Delhi	India	14,151,000	53
Cairo	Egypt	9,251,000	47
Tianjin	China	6,642,000	100
Wuhan	China	6,338,000	86
Suzhou	China	5,418,000	63
Surat	India	5,330,000	97
Seoul	South Korea	5,268,000	24
Baghdad	Iraq	5,140,000	96
Ho Chi Minh City	Vietnam	4,958,000	43
Osaka-Kyoto	Japan	4,827,000	31
Hanoi	Vietnam	4,533,000	85
Jieyang	China	4,425,000	42
Mexico City	Mexico	4,398,000	22
Chattogram	Bangladesh	3,418,000	65
Khartoum	Sudan	3,270,000	56

Source: Florczyk¹⁶



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In addition to floods, heatwaves also pose significant risks in urban areas and can impact various sectors. Recent heatwave in Europe is an example where various regions have recorded unprecedented high temperatures. According to the World Meteorological Organization (WMO), these are driven by climate change and the early stages of an El Niño weather pattern. The UN body said there is a 90% probability of the El Niño event continuing during the second half of 2023, and it is expected to be at least of moderate strength.



Temperature of the surface of the land as on July 17, 2023 | Image Source: The European Space Agency

As the image shows, temperature in cities such as Rome (45 degree Celsius), Foggia (50 degree Celsius), Bucharest (45 degree Celsius), has reached a historic high. Research shows Rising temperatures generate heat-related stress and very likely increase the short-term mortality rate from heatstroke, not least in developing countries, where urban areas continue to grow rapidly, exposing more people to the risk of heatwaves and heatstrokes due to so-called heat island effect.

Secondary perils are those for which relevant data is not available and they generate small to mid-sized losses, such as hail, flood, tsunami, storm surge or bushfire (Australia, California, southern Europe). Storm surge, tsunami and hails have limited regional impact; however, floods - whether riverine, urban, or flash - have become universal occurrence.

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It is noteworthy that the difference between loss caused by primary and secondary perils is not as it used to be some years back. Factors such as climate change and human-triggered factors such as poor planning, haphazard growth are responsible for increase in loss due to secondary perils.

The table below shows comparison of Nat Cat Losses caused by Primary and Secondary perils.

Year	Insured Loss Due to Nat Cats (Bln USD)	Loss caused by Primary Perils (Bln USD)	Loss caused by Secondary Perils (Bln USD)
2022	125	71	54
2021	121	77	44
2020	90	63	27
2019	52	52	N/A
2018	76	Less than 40%	Over 60%

Each Risk Brings Opportunities

As risk control measure against heat and flood, cities are working on innovative solutions. Green Infrastructure such as trees, parks, rooftops or living walls would help to buffer heat and to keep air cool as well as rejuvenation of water-table, lessen ground erosion and flood risk. Governments at different levels are now devising new ways of revenue generation such as Green Bond to fund neighbourhood efficiency and resilience programmes like retrofitting and district heating or combined heat and power.

Following Gothenburg, Sweden’s initiative of issuing “Green Bond” in 2013, city of Ghaziabad in Uttar Pradesh, India became the 1st Indian city to issue a successful municipal green bond to fund a water treatment plant to turn wastewater into drinking quality and to extend the piped water network. Other cities could follow suit.



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Through Smart City initiative, the governments can harness new technologies and platforms, like machine intelligence, IoT, distributed ledger technologies (such as blockchain) and big data, to provide new risk insights. Involving inhabitants as partners can result in identifying low-lying areas susceptible to floods or identification of creating a public park which could be used to recharge water and plant trees.

Role of Re/Insurance

Already re/insurers are working with various governments to provide solutions to mitigate impacts of Nat Cats e.g., partnership of African Risk Capacity (ARC) with African countries to provide cover against tropical cyclones.

In India, the Central Government is working with re/insurance companies to device a parametric cover for urban dwellers against Cyclone, Earthquake and Flood.

As insurance penetration and its utility are higher in cities compared to rural areas, re/insurance has immense new opportunities both for retail/personal as well as corporate clients. With advent of new technology and increasing awareness among authorities to protect cities as hub of revenue generation as well as intellectual capital, re/insurers' job is a bit easier now. Development and customization of insurance cover is already being done. Some insurtech firms are providing specific features of buildings which will help underwriters to price risk more effectively and rationally. Overall, challenges posed by climate change induced secondary perils do exist, and so do innovative solutions using collective wisdom and experience of various stakeholders.

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