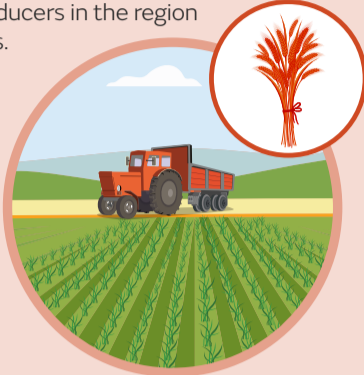


# Climate risks identified for the South Asia region by the 2050s

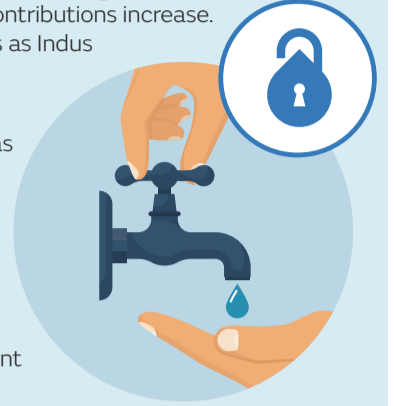
## Agriculture and food security

- Crop yields in most areas of South Asia will decline by 5-15% to 2050 with no adaptation due to rising temperatures and heat-water stress. The region's deltas are additionally exposed to rising sea levels, more intense storms and sea surges, and soil-water salinisation, reducing the productivity of rice aquaculture.
- Inland aquaculture and livestock across South Asia will be negatively affected by rising temperatures and more frequent droughts and floods, threatening food and income needs. India and Bangladesh are the biggest aquaculture producers in the region and face the highest risks from production and income losses.
- The productivity of agricultural workers in South Asia will be negatively affected by rising temperatures and heat extremes, reducing the capacity for agricultural labour, especially in Bangladesh, India, and Pakistan as areas of peak heat-humidity stress.
- Food insecurity could increase in South Asia as the effects of greater climate variability and extremes translate into more unstable production and consumer prices, with the potential for longer-term price rises and greater market volatility.



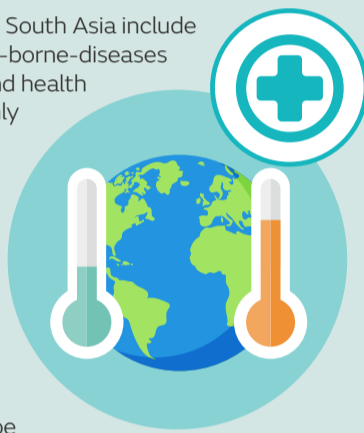
## Water resources and water-dependent services

- River flows in South Asia's three major basins, the Indus, Ganges, and Brahmaputra, will become more variable as slow-release meltwater contributions from glaciers and snowpack diminish from the 2050s, and monsoon rainfall contributions increase. Irrigation economies in the Indus Basin face the biggest risks as Indus flows are dominated by meltwater.
- The role of groundwater storage in buffering more variable rainfall and river flow will grow in importance in South Asia as meltwater flows diminish from the 2050s, especially on South Asia's Indo-Gangetic Plain spanning large parts of Pakistan, India, Nepal and Bangladesh.
- Water contamination linked to higher temperatures, floods, droughts, and rising sea levels is likely to increase in South Asia, posing risks to drinking water quality from the growth and spread of dangerous pathogens, and irrigation-dependent crops affected by rising soil-water salinity.
- Transboundary risk management will grow in importance in South Asia as countries have to share more variable water supplies, and/or the benefits that flow from them, within and across national boundaries. Greater cooperation between upstream and downstream jurisdictions will be needed to address tensions over allocation priorities, flood and drought management, and the maintenance of sediment and salt-flushing flows to deltas.



## Health

- The regional health outcomes sensitive to climate change in South Asia include heat stress and heat-related mortality, diarrhoeal and water-borne-diseases linked closely with undernutrition, vector-borne diseases, and health conditions associated with air pollution. Risks will be unevenly spread, exacerbating health inequalities linked to economic status, location, gender, and age.
- South Asia will experience the largest cumulative exposure to heatwave events (measured in person days) and heat-related mortality of any global region. Combinations of heat and humidity pose the biggest risks to health, with impacts falling mainly on the elderly, infants, pregnant women, people living in informal settlements, and outdoor labourers.
- Air pollution from fires, dust storms, and surface ozone will be exacerbated by higher temperatures and heatwaves in South Asia. South Asia is home to 37 of the world's 40 most polluted cities, with air pollution now the leading risk factor for all-cause mortality across the region (excluding Sri Lanka and Maldives).
- The prevalence of diarrhoeal and water-borne diseases, key contributors to undernutrition, will increase because higher temperatures, more intense rainfall events, and floods can accelerate the growth and spread of dangerous pathogens in South Asia. South Asia already has one of the highest rates of undernutrition in the world (31%) with peaks in India and Pakistan.
- The seasonality and spatial range of vector-borne diseases such as malaria and dengue will change across South Asia, with new areas of exposure in cooler mountains and potential declines in some hotter lowlands. Malaria incidence has declined by over 80% in the last two decades despite a broadly more favorable climate for disease spread because of effective vector control.



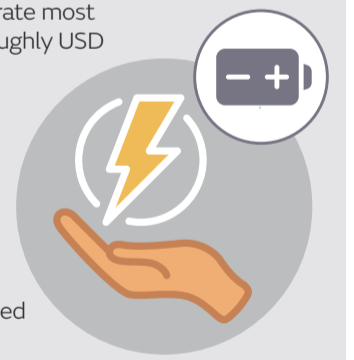
## Infrastructure and settlements

- Climate risk and poverty will increasingly coincide in South Asia's growing urban areas where robust infrastructure provision lags behind urban expansion. Households living in informal settlements are most exposed to climate-related risks, especially flash floods and extreme heat.
- In densely populated coastal areas of South Asia risks to infrastructure and settlements will be exacerbated by more intense cyclones, storm surges and rising sea levels. Roughly 370 million people in South Asia are already exposed to significant flood risk, mostly in low-lying coastal areas of India, Pakistan, and Bangladesh. Damage to coastal infrastructure in Bangladesh could double to USD 600 million per year by 2050.
- Transport and communications systems in South Asia will face greater damage and disruption from floods and cyclones. Annual damages to road and rail networks as a share of GDP are highest in Bhutan and Nepal, where heavy rainfall events will increasingly trigger land and mudslides.
- South Asian coastal ports important for maritime trade face threats from more intense cyclones, storm surges and floods, as well as sea-level rise. Current risks are highest for the Indian ports of Mumbai and Mormugao (west coast), and Visakhapatnam, Paradip, and Haldia (east coast).



## Energy

- Electricity generation from South Asian thermal power plants may be reduced or disrupted by growing water constraints. Thermal power plants burning fossil fuels generate most electricity in Bangladesh, India, Sri Lanka, and Maldives, but need reliable water supplies for cooling. In India, shutdowns forced by water shortages cost power utilities roughly USD 1.4 billion in lost revenue between 2013 and 2016.
- Risks to South Asian hydropower arise from greater river flow variability, warming-induced landscape instability in mountain areas, and the need to balance power generation with other (transboundary) priorities including irrigation, sediment and salt-flushing flows to deltas, and flood-drought management. Hydropower plays an important role in electricity production in Nepal, Bhutan, Afghanistan, Sri Lanka and Pakistan.
- Solar and wind power across South Asia will be less affected by climate change, although power outputs from solar projects are sensitive to changes in the frequency of very warm, cloudy and/or hazy conditions, and higher wind speeds and heat extremes could disrupt power generation from wind turbines.
- Higher cooling needs linked to rising temperatures and heatwaves in South Asia will increase average and peak electricity demands, requiring greater grid flexibility, storage capacity, peak generation capacity, and network resilience to heat. In India, overall energy demand is projected to rise by 15% to 2050 because of warming-related air conditioning alone, with daily summer demand peaks increasing by 20-30%.



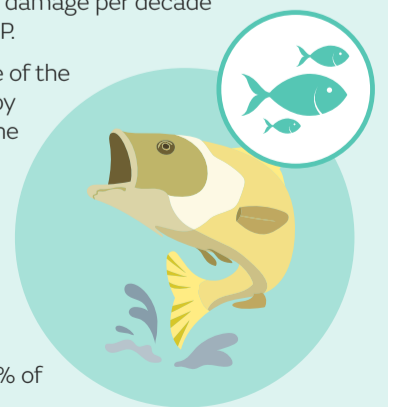
## Environment

- South Asia's ecosystems, including three of the world's biodiversity hotspots (eastern Himalayas, Indo-Burma, Western Ghats) have come under intense pressure from agricultural expansion, urban encroachment, pollution and wildlife trade. Climate change is acting as an additional stressor on remaining habitats.
- Biome boundaries across South Asia will shift northward and mountain treelines will move upward as temperatures rise, squeezing alpine habitats and potentially increasing human-wildlife conflict. Shrinking alpine grasslands support both livestock grazing for pastoralists and endangered species such as the snow leopard.
- Ecosystems that are fragmented in South Asia, either naturally or as a result of habitat destruction, are most at risk from climate-related species loss. Flora and fauna unable to survive changes in climate may become regionally extinct if they are unable to disperse or migrate along elevational (temperature) gradients.
- Ecosystems across South Asia, including remaining wetlands, provide valuable services that sustain local livelihoods and contribute to wider socio-economic support functions. In the Hindu Kush Himalayas, ecosystem services threatened by climate change and other pressures support around 240 million people and benefit around two billion people living in downstream basins.



## Blue economy and the marine environment

- South Asia's coastal and marine environments are threatened by compounding problems of habitat destruction, over-exploitation of aquatic/coastal fauna and flora, and climate change, but continue to play a key role in supporting livelihoods, local economies, and food security.
- South Asia's coral reefs provide vital ecosystem services but are threatened by rising sea temperatures, marine heatwaves, and ocean acidification. In Maldives, coral reefs are estimated to prevent around USD 3.6 billion of flood-related damage per decade and support tourism industries contributing over 25% of GDP.
- South Asia's mangrove forests and seagrass meadows, some of the most extensive and biodiverse in the world, are threatened by rising sea levels, more intense cyclones, and storm surges. The world's largest mangrove forest (the Sundarbans) located in the Bay of Bengal provides cyclone shelter, flood protection, and carbon storage benefits estimated at USD 10 billion.
- Fish catch potential is projected to decline in the Arabian Sea, Bay of Bengal and East Indian Ocean, in South Asia, due to climate-driven changes in ocean conditions and coastal-oceanic food webs. In Bangladesh, marine and freshwater fisheries (including aquaculture) account for 7-8% of employment, and 60% of dietary animal protein.



\*footnote: Unless otherwise stated, all statements refer to the South Asia region and up to the 2050s time period.