Fact sheet - Biodiversity

Observed impacts Climate Change Impacts and Risks

Climate change has altered marine, terrestrial and freshwater ecosystems all around the world.

Climate change has caused local species losses, increases in disease, and mass mortality events of plants and animals (very high confidence), resulting in **the first climate driven extinctions**, ecosystem restructuring, increases in areas burned by wildfire, and declines in key ecosystem services. Climate driven impacts on ecosystems have caused measurable economic and livelihood losses and altered cultural practices and recreational activities around the world.

Extreme climate events comprising conditions beyond which many species are adapted are occurring on all continents, with severe impacts (very high confidence). The most severe impacts are occurring in the most climate-sensitive species and ecosystems, characterized by traits that limit their abilities to regenerate between events or to adapt, and those most exposed to climate hazards.

Future risks

Threats to species and ecosystems in oceans, coastal regions, and on land, particularly in biodiversity hotspots, present a global risk that will increase with every additional tenth of a degree of warming. The transformation of terrestrial and ocean/coastal ecosystems and loss of biodiversity, exacerbated by pollution, habitat fragmentation and land-use changes, will threaten livelihoods and food security.

Threats to species and ecosystems in oceans, coastal regions, and on land, particularly in biodiversity hotspots, present a global risk that will increase with every additional tenth of a degree of warming. The transformation of terrestrial and ocean/coastal ecosystems and loss of biodiversity, exacerbated by pollution, habitat fragmentation and land-use changes, will threaten livelihoods and food security.

Without urgent and deep emissions reductions, some species and ecosystems, especially those in polar and already-warm areas, face temperatures beyond their historical experience in the next decades (e.g., >20% of species on some tropical landscapes and coastlines at 1.5°C global warming). **Unique and threatened ecosystems are expected to be at high risk in the very near term at 1.2°C global warming levels due to mass tree mortality, coral reef bleaching, large declines in sea-ice dependent species, and mass mortality events from heatwaves.**

Species extinction

Climate-caused local population extinctions have been widespread among plants and animals, detected in 47% of 976 species examined and associated with increases in hottest yearly temperatures. The white sub-species of the lemuroid ringtail possum (Hemibelideus lemuroides) in Queensland, Australia, disappeared after heatwaves in 2005: intensive censuses found only 2 individuals in 2009. The Bramble Cays Melomys (Melomys rubicola), was not seen after 2009 and declared extinct in 2016, with sea-level rise and increased storm surge, associated with climate change, the most probable drivers.

At warming levels **beyond 2°C** by 2100, risks of extirpation, extinction and **ecosystem collapse escalate**. Climate impacts on ocean and coastal ecosystems will be exacerbated by increases in intensity, reoccurrence and duration of marine heatwaves, in some cases, leading to species extirpation, habitat collapse or surpassing ecological tipping points**. The risk of species extinction increases with warming in all climate change projections** for native species studied in hotspot , being about ten-times greater for endemic species from 1.5°C to 3°C above pre-industrial leve. Very high extinction risk

in biodiversity hotspots due to climate change is more common for endemic species than other native species. For these endemic species, considering all scenarios and time periods evaluated, ~100% on islands, ~84% on mountains, ~12% on continents and ~54% in the ocean (notably the Mediterranean) are projected to be threatened with extinction due to climate change.

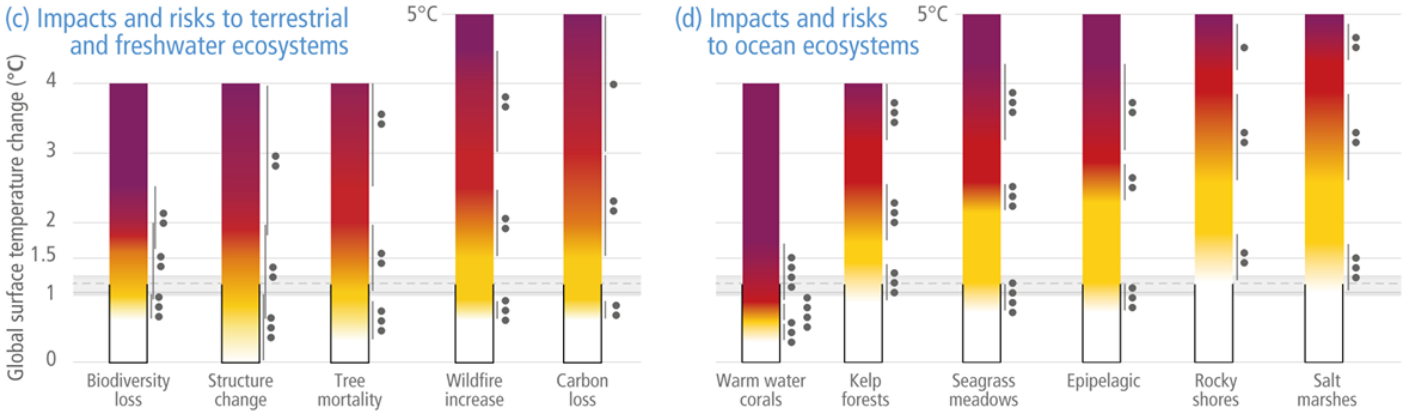

Figure 2: Synthetic diagrams of global and sectoral assessments. Diagrams show the change in the levels of impacts and risks assessed for global warming of 0-5°C global surface temperature change relative to pre-industrial period (1850-1900) over the range. Risks for (c) terrestrial and freshwater ecosystems and (d) ocean ecosystems. For c) and d), diagrams shown for each risk assume low to no adaptation. The transition to a very high risk level has an emphasis on irreversibility and adaptation limits. {Figure TS.4, panels (c) and (d)}

Sea-level rise

Risks from sea-level rise for coastal ecosystems and people are very likely to increase tenfold well before 2100 without adaptation and mitigation action as agreed by Parties to the Paris Agreement. Sea-level rise under emission scenarios that do not limit warming to 1.5°C will increase the risk of coastal erosion and submergence of coastal lan, loss of coastal habitat and ecosystems and worsen salinisation of groundwater, compromising coastal ecosystems and livelihoods. The ability to adapt to current coastal impacts and to cope with future coastal risks, depends on immediate implementation of mitigation and adaptation action.

Marine heatwaves

Marine heatwaves have become more frequent over the 20th century, approximately doubling in frequency and becoming more intense and longer since the 1980s. [added from AR6 WG2]

Marine heatwaves, including well-documented events along the west coast of North America (2013–2016) and east coast of Australia (20152016, 2016–2017 and 2020), drive abrupt shifts in community composition that may persist for years, with associated biodiversity los, collapse of regional fisheries and aquaculture and reduced capacity of habitat-forming species to protect shorelines. Some habitat-forming coastal ecosystems including many coral reefs, kelp forests and seagrass meadows, will undergo irreversible phase shifts due to marine heatwaves with global warming levels >1.5°C and are at high risk this century even in scenarios that include periods of temperature overshoot beyond 1.5°C. Under best-case SSP12.6, coral reefs are at risk of widespread decline, loss of structural integrity and transitioning to net erosion by mid-century due to increasing intensity and frequency of marine heatwaves.

Biodiversity hotspots

All biodiversity hotspots are impacted, to differing degrees, by human activities. Climate change impacts are compounded by other anthropogenic impacts, including habitat loss and fragmentation, hunting, fishing and its bycatch, overexploitation, water abstraction, nutrient enrichment, pollution, human introduction of invasive species, pests and diseases, all of which reduce climate resilience.

Ecosystem services

Climate change is affecting ecosystem services connected to human health, livelihoods, and well-being. Deforestation, draining and burning of peatlands and tropical forests, and thawing of Arctic permafrost have already shifted some areas from carbon-sinks to carbon sources. The severity and outbreak extent of forest insect pests increased in several regions. Woody plant expansion into grasslands and savannas, linked to increased CO2 , has reduced grazing land, while invasive grasses in semi-arid land increased the risk of fire. Ecosystem services that are at threat from a combination of climate change and other anthropogenic pressures include climate change mitigation, flood risk management, food provisioning and water supply.

Wildfire

Regional increases in area burned by wildfires (up to double natural levels), tree mortality up to 20%, and biome shifts up to 20 km latitudinally and 300 m upslope, have been attributed to anthropogenic climate change in tropical, temperate and boreal ecosystems around the world, damaging key aspects of ecological integrity. Wildfires generate up to one-third of global ecosystem carbon emissions, a feedback that exacerbates climate change. Increases in wildfire from levels to which ecosystems are adapted degrades vegetation, habitat for biodiversity, water supplies, and other key aspects of the integrity of ecosystems and their ability to provide services for people. Risk of wildfires increases with global temperature.