

Climate change

Anthropogenic causes of climate change

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Five positive feedback cycles in global warming

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How does loss of snow and ice cause further warming?

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Legacy carbon

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Why could boreal forests become a net carbon source?

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Threat to emperor penguins

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Threat to walruses

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Effect of warmer surface water on upwelling

CO₂ from deep ocean; loss of reflective ice; decomposition of peat and permafrost; methane from permafrost; droughts and forest fires.

Human increases in atmospheric CO₂ (fossil fuels, deforestation) and methane (livestock, rice fields, landfill).

Old organic carbon in deep boreal forest soils that survived earlier fires; burned by more intense fires.

Darker land and sea absorb more solar radiation than reflective ice.

Early breakout of landfast ice before chicks fledge destroys breeding grounds.

Warmer, less snowy winters cause drought, lower primary production, forest browning and more intense fires.

Prevents nutrient upwelling, decreasing ocean primary production and energy flow through marine food chains.

Loss of Arctic sea ice used for resting and nursing between feeding dives.

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Ocean acidification and corals

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Coral bleaching

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Upslope range shift example

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Range shifts in North American trees

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Why are mountain-top species at risk?

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Three approaches to carbon sequestration

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Why does peat store carbon?

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The debate over tree planting for carbon

Higher water temperature makes corals expel symbiotic algae; prolonged bleaching kills corals and the reef ecosystem collapses.

More dissolved CO₂ lowers pH and carbonate availability, suppressing calcification.

Range contraction at the warm southern edge and northward spread at the cool edge.

Tropical-zone montane bird species in New Guinea now live higher up mountains.

Afforestation, forest regeneration, restoration of peat-forming wetlands.

As ranges shift upslope they have nowhere higher to move.

Non-native plantations absorb CO₂ fast but have low biodiversity; native rewilding is more biodiverse and resilient.

Waterlogged soil is anaerobic, so dead plant matter decomposes very slowly and accumulates.