

Combating ecosystem collapse from the tropics to the Antarctic

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Eminent scientists warn that key ecosystems around Australia and Antarctica are collapsing, and propose a three-step framework to combat irreversible global damage.

Their report, authored by 38 Australian, UK and US scientists from universities and government agencies, is published today in the international journal *Global Change Biology*. Researchers say it heralds a stark warning for [ecosystem collapse](#) worldwide, if action is not taken urgently.

Lead author, Dr. Dana Bergstrom from the Australian Antarctic Division, said that the project emerged from a conference inspired by her ecological research in polar environments.

"I was seeing unbelievably rapid, widespread dieback in the alpine tundra of World Heritage-listed Macquarie Island and started wondering if this was happening elsewhere," Dr. Bergstrom said.

"With my colleagues from the Australian Antarctic Division and the University of Queensland we organized a national conference and workshop on "Ecological Surprises and Rapid Collapse of Ecosystems in a Changing World," with support from the Australian Academy of Sciences."

The resulting paper and extensive case studies examine the current state and recent trajectories of 19 marine and [terrestrial ecosystems](#) across all Australian states, spanning 58° of latitude from coral reefs to Antarctica. Findings include:

- Ecosystem collapse (defined as potentially irreversible change to ecosystem structure, composition and function) is occurring now in 19 case studies. This conclusion is supported by empirical evidence, rather than modeled predictions.
- No ecosystems have collapsed across their entire range, but for all case studies there is evidence of local collapse.
- The 19 ecosystems include the Great Barrier Reef, mangroves in the Gulf of Carpentaria, the Mediterranean forests and

woodlands, the arid zone of central Australia, Shark Bay seagrass beds in Western Australia, Great Southern Reef kelp forests, Gondwanan conifer forests of Tasmania, Mountain Ash forest in Victoria, and moss beds of East Antarctica.

- Drivers of ecosystem collapse are pressures from global climate change and regional human impacts, categorized as chronic 'presses' (eg. changes in temperature and precipitation, land clearing) or acute 'pulses' (eg. heatwaves, storms, fires and pollution after storms).

Michael Depledge CBE, Emeritus Professor at the University of Exeter and former Chief Scientific Advisor to the Environment Agency of England and Wales, said the research had particular significance following the UK Government commissioned Dasgupta Review , which recently highlighted the catastrophic economic damage associated with biodiversity loss.

Professor Depledge said: "Our paper is a further wake-up call that shows ecosystems are in varying states of collapse from the tropics to Antarctica. These findings from Australia are a stark warning of what is happening everywhere, and will continue without urgent action. The implications for human health and wellbeing are serious. Fortunately, as we show, by raising awareness, and anticipating risks there is still time to take action to address these changes.

"Our paper will hopefully increase awareness that our ecosystems are collapsing around us. We can already observe the damaging consequences for the health and wellbeing of some communities and anticipate threats to others. Taking stronger action now will avoid heaping further misery on a global population that is already bearing the scars of the global pandemic."

The paper recommends a new '3As' framework to guide decision-

making about actions to combat irreversible damage:

1. Awareness of the importance of the ecosystem and the need for its protection;
2. Anticipation of the risks from current and future pressures
3. Action on reducing the pressures to avoid or lessen their impacts

Example:

Protecting pencil pines from fire in the Southwest Tasmanian Wilderness World Heritage Area: by mapping vegetation values against fire sensitivity (to identify fire-prone Gondwanan conifer communities), maintaining an area specific awareness of the shifting causation of bushfires (increasing frequency of dry lightning strikes), and developing new action strategies to lessen the pressure of unregulated fire (installing sprinkler systems), conservation managers established and used Awareness and Anticipation to formulate positive Action.

The scientific team concluded that in the near future, even apparently resilient ecosystems are likely to suffer collapse as the intensity and frequency of pressures increase.

"Anticipating and preparing for future change is necessary for most [ecosystems](#), unless we are willing to accept a high risk of loss," Dr. Bergstrom said.

"While the [environmental change](#) we see can be disturbing, I'm pleased to be part of a team sharing information that can guide decision-making to future-proof the ecological wealth that underpins our society."

The report is titled "Combating ecosystem collapse from the tropics to the Antarctic."

More information: Dana M. Bergstrom et al. Combating ecosystem collapse from the tropics to the Antarctic, *Global Change Biology* (2021). [DOI: 10.1111/gcb.15539](https://doi.org/10.1111/gcb.15539)

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