The world's coral reefs are undoubtedly in deep trouble. But as we and our colleagues argue in a review published today in Nature , we shouldn't give up hope for coral reefs, despite the pervasive doom and gloom.

Instead, we have to accept that coral reefs around the world are transforming rapidly into a newly emerging ecosystem unlike anything humans have experienced before. Realistically, we can no longer expect to conserve, maintain, preserve or restore coral reefs as they used to be.

This is a confronting message. But it also focuses attention on what we need to do to secure a realistic future for reefs, and to retain the food security and other benefits they provide to society.

The past three years have been the warmest on record , and many coral reefs throughout the tropics have suffered one or more bouts of bleaching during prolonged underwater heatwaves.

A bleached coral doesn't necessarily die. But in 2016, two-thirds of corals on the northern Great Barrier Reef did die in just six months, as a result of unprecedented heat stress . This year the bleaching happened again, this time mainly on the middle section of the reef .

Reefs are being degraded by global pressures, not just local ones.Terry Hughes, Author provided

In both years, the southern third of the reef escaped with little or no bleaching, because it was cooler. So bleaching is patchy and it varies in severity, depending partly on where the water is

hottest each summer, and on regional differences in the rate of warming. Consequently some regions, reefs, or even local sites within reefs, can escape damage even during a global heatwave.

Moderate bleaching events are also highly selective, affecting some coral species and individual colonies more than others, creating winners and losers . Coral species also differ in their capacity to reproduce, disperse as larvae, and to rebound afterwards.

This natural variability offers hope for the future, and represents different sources of resilience. Surviving corals will continue to produce billions of larvae each year, and their genetic makeup will evolve under intense natural selection.

In response to fishing, coastal development, pollution and four bouts of bleaching in 1998, 2002, 2016 and 2017, the Great Barrier Reef is already a highly altered ecosystem, and it will change even more in the coming decades. Although reefs will be different in future, they could still be perfectly functional in centuries to come – capable of sustaining ecological processes and regenerating themselves. But this will only be possible if we act quickly to curb climate change.

The Paris climate agreement provides the key framework for avoiding very dangerous levels of global warming. Its 1.5□ and 2□ targets refer to increases in global average land and sea temperatures, relative to pre-industrial times. For most shallow tropical oceans, where temperatures are rising more slowly than the global average, that translates to 0.5□ of further warming by the end of this century – slightly less than the amount of warming that coral reefs have already experienced since industrialisation began .

If we can improve the management of reefs to help them run this climate gauntlet, then reefs should survive. Reefs of the future will have a different mix of species, but they should nonetheless retain their aesthetic values, and support tourism and fishing. However, this cautious optimism is entirely contingent on steering global greenhouse emissions away from their current trajectory, which could see annual bleaching of corals occurring in most tropical locations by 2050
. There is no time to lose before this narrowing window of opportunity closes.

A crisis of governance

Reef governance is failing because it is largely set up to manage local threats, such as overfishing and pollution. In Australia, when the Great Barrier Reef Marine Park Authority was set up in 1976, the objective of managing threats at the scale of (almost) the entire Great Barrier Reef was revolutionary. But today, the scale of threats is global: market pressures for Australian reef fish now come from overseas; port dredging and shipping across the reef are spurred on by fossil fuel exports to Asia; a housing crisis in the United States can batter reef tourism half a world away; and record breaking marine heatwaves due to global warming can kill even the most highly protected and remote corals.

Increasingly, coral reef researchers are turning to the social sciences, not just biology, in search of solutions. We need better governance that addresses both local and larger-scale threats to coral reef degradation, rather than band-aid measures such as culling starfish that eat corals.

In many tropical countries, the root causes of reef degradation include poverty, increasing market pressures from globalisation, and of course the extra impacts of global warming. Yet these global issues desperately need more attention at just the time when some governments are reducing foreign aid , failing to address global climate change , and in the case of Australia and the US, trying to resuscitate the dying fossil fuel industry with subsidies for economically unviable projects .

Effective reef governance will not only require increased cooperation among nations to tackle global issues, as in the case of the Paris climate deal, but will also require policy coordination at the national level to ensure that domestic action matches and supports these larger-scale goals.

Quite simply, we can’t expect to have thriving coral reefs in the future as well as new coal mines – policies to promote both are incompatible.

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