

Ugandans, including religious leaders, have called for the spirit of love, peace and reconciliation in the new year 2018.

## Gwynne Dyer, London-based journalist

# Assisted evolution and geo-engineering

**W**henever I get the chance, I go diving. The whole family are divers, right down to the grand-children: it's one of the pretexts we use to get together. And we all know the coral reefs are dying.

There are still healthy reefs, and even after they have been bleached they can recover – but only until the next time that sea temperatures rise beyond their tolerance range. Half of the world's coral reefs are already gone, and the destruction continues relentlessly. The northern 750 km of Australia's Great Barrier Reef were largely killed by heat stress last year. Global warming will kill almost all of the world's coral reefs by 2050.

Prof. Madeleine van Oppen's work at the Australian Institute of Marine Science and the University of Melbourne is therefore good news. Her team is trying to breed hybrid coral animals and algae that can withstand higher temperatures.

"It is a story of hope, rather than saying: 'It's all going to die and there's nothing we can do about it,'" van Oppen said at Oxford University, where her team presented their latest research at a conference last week. People worry about major interventions in the reef life, she concedes, "but it's too late to leave them alone, given the pace at which we are losing corals.... It is only a matter of time before the next heatwave hits."

She calls what her team is doing 'assisted evolution', but it's really just a more intense version of the selective breeding that people have been doing with domesticated species for thousands of years. Van Oppen's team have been cross-breeding corals adapted to cooler waters with other species from warmer regions to create hybrids that can withstand the coming higher temperatures worldwide.

They are also working with the algae that live inside the coral animals and are their major source of food, because it is when the water gets too warm and the corals expel the algae that bleaching occurs. So one team member, Leela Chakravarti, pushed the algae through eighty generations in the lab, selecting the most heat-tolerant in each generation. The final generation can live in water at 31 degrees C.

The next step, obviously, is to transplant these modified coral animals and algae onto living reefs, which will require regulatory approval. That may not be forthcoming right away.

because there will naturally be concerns that these 'evolved' animals and plants will out-compete the existing reef life. They are not different species, however, and the one circumstance in which they are likely to out-compete the existing reef-life is precisely during bleaching events, when they are more likely to survive. But that, surely, is the point of the whole exercise, and there are enough parts of the world with damaged reefs that van Oppen's team will get permission for their experiments sooner or later. Probably sooner.

It is appropriate to deplore the fact that such experiments have become necessary, but that is where we are and it's foolish to deny it. Even if all the pledges of cuts in greenhouse-gas emissions made in the Paris climate-change agreement of 2015 are kept, and even if the hope that follow-on meetings will bring deeper cuts in emissions is fulfilled, we are heading for ocean temperatures that will kill most or all of the coral reefs eventually.

We are therefore already in the situation, at least with regard to coral reefs, that James Lovelock, the creator of the Gaia hypothesis, forecast almost forty years ago: that the human race will wake up one day to find that we have inherited "the permanent lifelong job of planetary maintenance engineer."

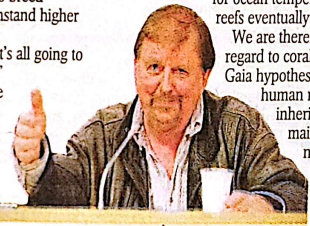
The self-regulating natural systems have been knocked out, and it's up to us to regulate and maintain them. Nobody would consciously choose such a job. We don't yet even fully understand the ways that the systems we will have to manage actually work. But the changes we have wrought in the environment are overwhelming the ability of natural systems to maintain themselves in their stable and familiar forms, and so it will be down to us to keep them going.

The word for this, if we are being honest, is 'geo-engineering'. It's a very gentle, low-tech kind of geo-engineering, with relatively little chance of major negative side-effects if we get it wrong. We are definitely still on the learner slopes.

The interventions in natural systems will get much bigger, and the penalties for mistakes much more costly, as time goes on. We are probably going to end up trying to regulate the temperature of the entire planet, with megadeaths as the penalty if we fail. But by then there will be no alternative.

Welcome to the future.

The writer is an independent journalist whose articles are published in 45 countries



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