

Ecologists urged to embrace the power of 'natural experiments'

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Researchers at The University of Western Australia are urging ecologists to increase the use of large-scale natural and manmade disasters as experiments to help solve the greatest environmental challenges facing the planet.

Earthquakes, tsunamis and oil spills such as Deepwater Horizon have created experiments, known as Large-scale Unreplicated Natural Experiments (LUNEs), that scientists have used to understand how the world works.

A paper by UWA researchers Dr Shanta Barley and Professor Jessica Meeuwig, published today in the journal *Ecosystems*, says using the

results of LUNEs is critical, especially at a time when investment in science is increasingly constrained.

Lead author on the paper, Dr Barley, said humans have caused the rapid demise of wildlife on Earth by altering the climate, cutting down forests and overfishing the oceans.

"Scientists recently named humans as a 'super predator' in recognition of our voracious consumption of the planet's wildlife: we are, for instance, 14 times more efficient than any other predator," Dr Barley said.

"Yet our understanding of how [human activity](#) influences ecological processes remains poor. This is partly due to overreliance on small-scale experiments, which lack the complex feedback loops found in real ecosystems."

Dr Barley and Professor Meeuwig said one solution is to let nature and/or human activity do the "dirty work" in terms of creating large-scale experiments. Shark fisheries, for example, have largely removed the predators on some coral reefs, allowing researchers to test hypotheses about their ecological role in marine systems.

"Large-scale natural experiments have many advantages in the current financial climate where investment in science is constrained – they're low budget, they're more ecologically realistic than lab experiments and they're often the only way to ethically and practically study some subjects," Dr Barley said.

However, LUNEs come with a catch: they are impossible to exactly replicate. The authors of the paper said this should not be viewed as a drawback but an evolution of the scientific method.

"There is a need to recognise that large-scale experiments provide

relevant insights not captured by small-scales experiments," Professor Meeuwig said.

For instance, algal blooms caused a decline in North America's freshwater systems in the 1960s. Whereas small-scale experiments implicated nitrogen and carbon, a large-scale "whole-lake", unreplicated experiment ultimately persuaded the Canadian government and several US states to ban phosphorus, the real culprit.

Similarly, it took the discovery of a single large hole in the ozone layer to drive a global consensus to ban chlorofluorocarbons.

The researchers concluded that LUNEs have played and will continue to play an important role in galvanising policy change, at a time when the planet urgently needs it.

More information: Shanta C. Barley et al. The Power and the Pitfalls of Large-scale, Unreplicated Natural Experiments, *Ecosystems* (2016).
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