Trends in Plant Science

CellPress

Letter

Conservation should not make 'perfect' an enemy of 'good'

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R.T. Corlett's recent paper [1] ('Achieving zero extinction for land plants') suggests that we should prevent all plant extinctions, if technically possible. Corlett notes numerous existing limitations to our knowledge and understanding of plant diversity. We remain unable to identify and monitor much of Earth's plant diversity due to limitations in resources and data. Without an unexpected flood of funding and resources, we seem very far away from preventing all extinction. Our conservation actions should be strategically aligned with the available resources and the desired outcome. Before declaring zero extinction as our desired outcome, we should examine how quickly conservation returns diminish with lower thresholds of extinction tolerance. Preventing all extinctions will require disproportionately more resources and capacity than preventing 90% of extinctions. Moreover, the goal of zero extinction, while in some ways laudable and potentially possible in the most ideal world, does not recognize the fundamental ecological and evolutionary processes that undermine its possibility. The goal could create adverse incentives that require more work and resources, accomplish less, and alienate potential allies.

Our efforts to reduce extinctions in the context of human-accelerated global change must be carefully developed. Even with respect to climate change, which is one of the gravest environmental threats facing species today, zero impact is not a recognized goal. The Intergovernmental Panel on Climate Change's loftiest goal aims to limit global warming to 1.5°C in the next century (https://www.ipcc.ch/sr15/), not 0°C and a return to pre-industrial conditions. Climate scientists recognize that the current levels of greenhouse gases in the atmosphere are going to cause warming. At the 2022 United Nations COP15 Biodiversity Conference, Goal A of the 'Kunming–Montreal Global Biodiversity Framework' (https://www.cbd.int/article/cop15-cbd-press-release-final-19dec2022) states that 'Human induced extinction of known threatened species is halted, and, by 2050, extinction rate and risk of all species are reduced tenfold.' This resolution recognizes that extinction occurs naturally in the Earth's ecosystems [2] and is vital to the adaptation process. Increases in extinction rates caused by a rapidly changing physical environment may be a sign of ecosystems adapting through species turnover [3]. Beyond the question of 'Should we try?' is the question 'Should we align ourselves against a basic force of nature?' If you choose to draw a line in the sand, it is best not to put it below the tide mark.

The goal of zero extinction also raises a simple question: what is being saved from extinction? The species is the currency of conservation, but no consistent, objective, and biologically meaningful way of defining a species exists across different organisms or through time [4]. The current barcode of life, while it helps organize our understanding of diversity, does not capture a meaningful biological reality [5]. This is primarily because species frequently experience introgressive hybridization, where genes are exchanged among recognized species [6]. An increasing amount of genomic evidence suggests that species are both largely reproductively isolated and occasionally interfertile [7]. Species are evolutionary mosaics.

Biologists should recognize that most species have a dual nature, both as cohesive diagnosable evolutionary entities and as interfertile networks of diversity. Until we can incorporate this duality into our understanding of diversity, discussions about zero extinction miss the mark. To what lengths should we sustain purity in a species? Given an ecologically fit individual that is only 80% Species B, should we attempt to return its offspring to 100% Species B through backcrossing? Species may even reemerge after apparent extinction through hybridization [8]. Ultimately, we should protect, enable, and manage the processes that generate adaptive functional diversity, not the current embodiment of diversity.

Finally, an extinction event is geographically explicit: a plant species has disappeared from the location where it grew. This simple definition hides the fact that many different processes can lead to that endpoint. Extinction caused by local processes, such as changes in land use and local human activity, should be prevented. Alternatively, if global environmental changes essentially make a habitat disappear, then the extinction event may reflect an ecosystem-scale response that cannot, and should not be prevented. That is, local turnover of species may be an ecologically 'rational' response to a large-scale environmental change [9]. It is, in effect, an augmented background extinction rather than a locally caused one. Fixating on zero extinction as a goal obscures the important differences in the causes of extinction (see Box 1).

Box 1. Causes of extinction

Extinction has both ecological and evolutionary elements that can occur at different scales (see Table 1 in main text). Ecological interventions at the local scale can be effective, whereas global efforts involve processes beyond our direct control. Evolutionary intervention trends in the opposite direction, by preventing introductions across continents, are more feasible than controlling hybridization in existing sympatric populations.

Table 1. Geographic scales of extinction events

Geographic scale	Ecological	Evolutionary
Local	Hunting, land use changes	Hybridization, introgression among sympatric species
Regional	Extreme weather events, fires	Shifts in the community composition of interfertile species and symbionts
Global	Shifts in latitudinal boundaries, such as subtropical conditions, global warming	Secondary contact of interfertile species through global transport

We are not advocating for surrender in the fight against extinction but rather for reasonable objectives and explicit metrics. Preserving 90% of the current species sounds wonderful to us. An attempt to stop all extinction focuses exclusively on what we are losing and sets a Herculean task for the conservation community. Hope and faith are core elements of the success of conservation [10]. An element of optimism is required. The challenge of today can be seen as a biodiversity bottleneck. To meet this challenge, we must understand diversity at multiple scales and the processes that create it so that we can squeeze as much biological potential through this global crisis as possible. A single-minded focus on species' identity may ultimately lead to more, rather than fewer, extinctions.

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