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RECOMMENDATION

## Are both very young and the very old plant lineages at heightened risk of extinction?

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**Based on reviews by:**  
Dan Greenberg and one anonymous reviewer

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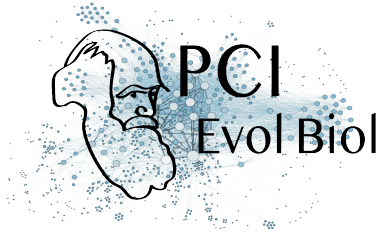
### A recommendation of

Tanentzap AJ, Igea J, Johnston MG, and Larcombe MJ. Range size dynamics can explain why evolutionarily age and diversification rate correlate with contemporary extinction risk in plants. *bioRxiv* 152215 (2018), ver. 5 peer-reviewed and recommended by PCI Evol Biol. DOI: 10.1101/152215

Human economic activity is responsible for the vast majority of ongoing extinction, but that does not mean lineages are being affected willy-nilly. For amphibians [2] and South African flowering plants [1], young species have a somewhat higher than expected chance of being threatened with extinction. In contrast, older Australian marsupial lineages seem to be more at risk [3]. Both of the former studies suggested that situations leading to peripheral isolation might simultaneously increase ongoing speciation and current threat via small geographic range, while the authors of the latter study suggested that older species might have evolved increasingly narrow niches. Here, Andrew Tanentzap and colleagues [4] dig deeper into the putative links between species age, niche breadth and threat status. Across 500-some plant genera worldwide, they find that, indeed, "younger" species (i.e. from younger and faster-diversifying genera) were more likely to be listed as imperiled by the IUCN, consistent with patterns for amphibians and African plants. Given this, results from their finer-level analyses of conifers are initially bemusing: here, "older" (i.e., on longer terminal branches) species were at higher risk. This would make conifers more like Australian marsupials, with the rest of the plants being more like amphibians. However, here where the data were more finely grained, the authors detected a second interesting pattern: using an intriguing matched-pair design, they detect a signal of conifer species niches seemingly shrinking as a function of age. The authors interpret this as consistent with increasing specialization, or loss of ancestral warm wet habitat, over paleontological time. It is true that conifers in general are older than plants more generally, with some species on branches that extend back many 10s of millions of years, and so a general loss of suitable habitat makes some sense. If so, both the pattern for

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all plants (small initial ranges heightening extinction) and the pattern for conifers (eventual increasing specialization or habitat contraction heightening extinction) could occur, each on a different time scale. As a coda, the authors detected no effect of age on threat status in palms; however, this may be both because palms have already lost species to climate-change induced extinction, and because they are thought to speciate more via long-distance dispersal and adaptive divergence than via peripheral isolation.

Given how quickly ranges can change, how hard it is to measure niche breadth, and the qualitatively different time scales governing past diversification and present-day extinction drivers, this is surely not the last word on the subject, even for plants. However, even the hint of a link between drivers of extinction in the Anthropocene and drivers of diversification through the ages is intellectually exciting and, perhaps, even, somehow, of practical importance.

## References

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- [2] Greenberg DA and Mooers AØ. Linking speciation to extinction: Diversification raises contemporary extinction risk in amphibians. *Evolution Letters* 1 (2017), 40–48. DOI: 10.1002/evl3.4.
- [3] Johnson CN, Delean S, and Balmford A. Phylogeny and the selectivity of extinction in Australian marsupials. *Animal Conservation* 5 (2002), 135–142. DOI: 10.1017/S1367943002002196.
- [4] Tanentzap AJ, Igea J, Johnston MG, and Larcombe MJ. Range size dynamics can explain why evolutionarily age and diversification rate correlate with contemporary extinction risk in plants. *bioRxiv* 152215 (2018), ver. 5 peer-reviewed and recommended by PCI Evol Biol. DOI: 10.1101/152215.

## Appendix

Reviews by Dan Greenberg and one anonymous reviewer, DOI: 10.24072/pci.evolbiol.100058