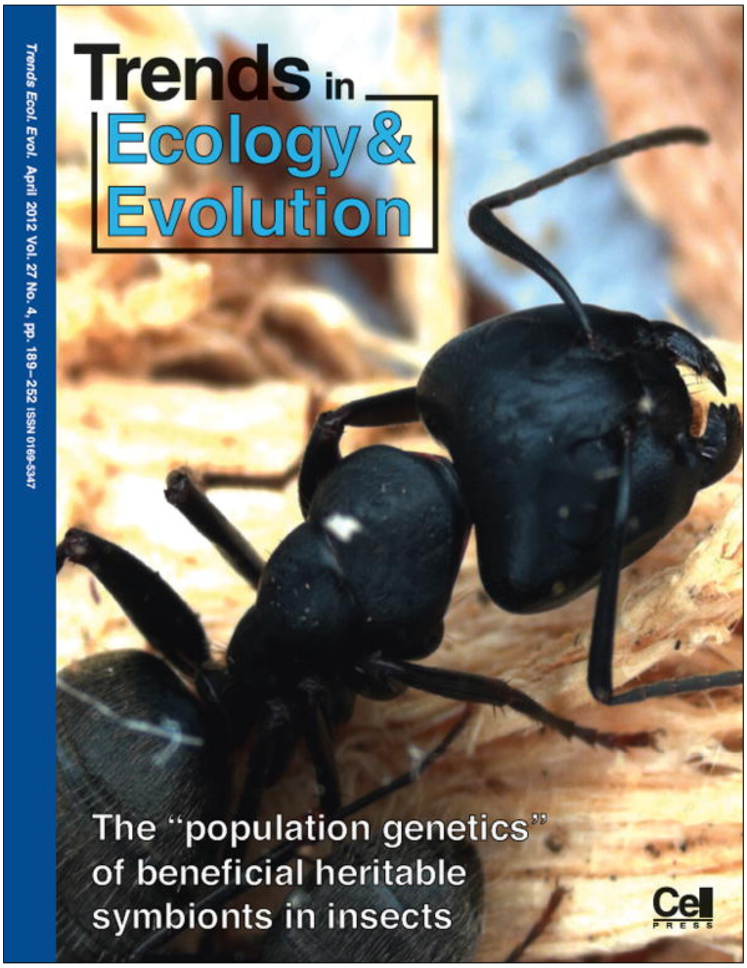
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Reduce, reuse, recycle scientific reviews

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A throw-away mentality in the industrialized world has placed a strain on natural resources and the environment. To lessen this strain, societies worldwide now promote the so-called three Rs: reduce, reuse and recycle. There is also strain on the scientific review process, a service crucial to science and society but reliant on a laborious system of reciprocal altruism ([1–3]; *Nature's* peer review debate, http://www.nature.com/nature/peerreview/debate/; Peerage of Science, http://www.peerageofscience.org/). Indeed, editors often nominate 10 referees to secure just three reviews, the average manuscript receives between five and ten reviews before being published [1,2], and referees are almost never compensated for their efforts. The burden of the review process is not limited to journals; as of 2012, programs within the Biological Directorate of the US National Science Foundation (NSF) have shifted to required pre-proposals and a once-a-year grant submission process partly because of the burden on reviewers (IPAMM Final Report, http://www.nsf.gov/od/ipamm/ipamm_jtornow_finalreportnsb_070808.pdf). Here, we propose that the strain on the scientific review process could be partly alleviated if we recycle rather than throw away scientific reviews.

We propose the following approach to review recycling. After having a manuscript or grant proposal rejected, an author would decide whether or not to forward the reviews, and a detailed response to the reviews, to a subsequent journal or granting agency or panel. The journal or granting entity would then choose to (i) ignore the previous reviews and secure different reviews, (ii) consider the previous reviews and secure more reviews, but perhaps fewer than they would if previous reviews were not provided, or (iii) make an editorial or funding decision based solely on the reviews and associated revisions supplied. We advocate options (ii) or (iii) because they use rather than ignore the expertise and effort of the previous reviewers, editors and grant panels, because they decrease the workload for any subsequent review process, and because they allow researchers to spend more time doing science than tinkering with manuscripts and grants.

Review recycling requires little change to the scientific infrastructure. Rather, it increases efficiency by getting the most out of the reviews that have already been conducted and disseminating scientific discovery more quickly. Indeed, if options (ii) and (iii) become common practice, then review recycling should decrease time to publication. This benefit is surely something that publishers would support because metrics of journal quality, such as impact factors, are based partly on publication rates. Society too would benefit because new knowledge would be available sooner. Although some researchers might balk at the thought of forwarding critical but fair reviews, the incentive would be that forwarding any reviews could accelerate publication of their work. Moreover, forwarding of reviews should reduce the likelihood that two grant panels would conflict over a proposal, a problem that sometimes arises at funding agencies that do not explicitly consider past reviews.

Now more than ever, review recycling should be beneficial because pressure to publish in the highest-impact journals is enormous and funding rates at most major granting agencies are exceptionally low [1,3]. For some journals, rejection rates routinely exceed 80%, and even papers and grants that receive favorable reviews are commonly rejected [3]. Review recycling from high-impact journals might be especially valuable because it is these journals that are probably best able to secure reviews from leaders of fields. Hence, review recycling might have the additional benefit to lower-impact journals of enhancing both the efficiency of their review process and potentially even the quality of science, cost-free.

Review recycling will be beneficial but it might have some drawbacks that should be considered before it is put into action. First, publishers and granting agencies might have to revise any policies regarding who owns reviews and some publishers might be unwilling to allow reviews to be forwarded if this enhances the reputation of their competitors (although the benefits might be reciprocal at all but the highest-impact journals). Second, manuscripts and grants would receive fewer reviews, which could reduce the quality of science if having many reviews genuinely improves a scientific contribution. However, a study by the NSF suggests that the quality of peer review improves as the burden on reviewers declines (http://www.nsf.gov/od/ipamm/ipamm_jtornow_finalreportnsb_070808.pdf) and thus the net effect of review recycling on the quality of science remains uncertain. Third, review recycling might foment fabrication of positive reviews, but stiff penalties for any fraud would provide a substantial deterrent to this deception.

In sum, we feel that review recycling will have distinct positive impacts on the efficiency and quality of the scientific review process, unique to proposed alternative

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approaches to scientific review, such as economic-based and open-access commenting models (http://www.nature.com/nature/peerreview/debate/; [4,5]). We feel that the benefits of review recycling far outweigh its limitations, and we hope that it becomes as commonplace in scientific publication and grant writing as are the three Rs in natural resource conservation.

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Tropical forest warming: looking backwards for more insights

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In his balanced and much-needed review on the effects of global warming on tropical rainforests, Richard Corlett [1] discussed gaps in knowledge, research needs and corresponding research methods. However, an important and powerful technique for studying the effects of climate change on tropical forests was not mentioned: the analysis of tree rings.

Among others, Corlett recommended an increase in the duration of permanent sample plot (PSP) studies and the frequency of re-measurements in those plots. Although PSP studies have been crucial in quantifying increased biomass and elevated dynamics of tropical forests, they have not provided much clarity on the drivers of these changes since the first reports in the 1990s [2,3]. Undoubtedly, intensification and extension of PSP studies will improve correlations between climatic variations and tree dynamics, but improvements will be slow as time series are extended at the pace of annual (or less frequent) plot re-measurements. The only way to extend time series more rapidly is to look backwards. Tree ring analysis allows this approach by reconstructing annual growth rates over the full lifetime of trees, easily spanning more than a century.

Tree ring research in the tropics is not new [4], but its wide application has been hampered by the common belief that tropical forest trees do not produce annual rings. Fortunately, tropical dendrochronology has developed rapidly over the last decade and has revealed that many tree species do form such rings (Figure 1) [4,5]. A quick scan of published studies revealed that annual ring formation has now been proven for almost 70 species from tropical lowland rainforests (1800–4200 mm of rain per year), as listed in Table S1 in the supplementary material online. For these species, the annual character of ring formation was proven using methods that included cambial wounding, radiocarbon (^{14}C) dating, climate–growth relationships and validation of ring counts for trees of a known age. We expect this species list to increase rapidly in the coming years, given that annual ring formation in many more species is currently being tested.

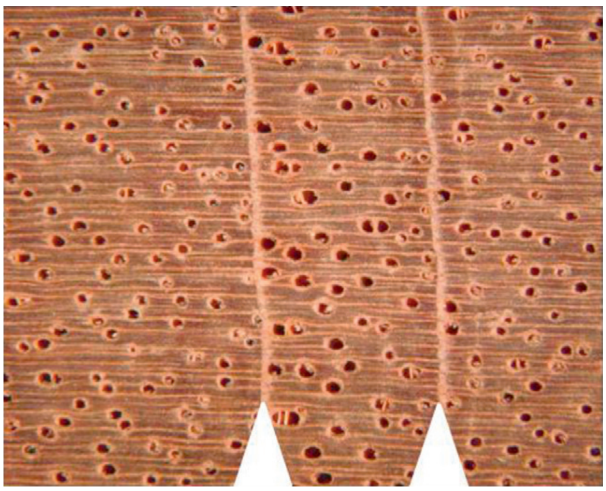

Figure 1. Example of annual rings in tropical cedar (*Cedrela odorata*), an Amazonian humid forest species that reaches more than 200 years in age. Photo by RJW Brienen.

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