Beyond impact factor

Citation rates are widely used as benchmarks for the impact of research, and the biological sciences are noteworthy for their low citation rates compared with other disciplines. Other commentators have noted this pattern, and have discussed the underlying causes and why we should not be concerned. While we may be satisfied that our research is relevant, we are missing the point. Impact factors only measure how successfully we communicate amongst ourselves. How do we ensure that our research informs the wider community and remains relevant to society generally?

The solution is the media and, rather than stifling our work, we can use this exposure to give it a higher profile. In these days of 24-hour news broadcasts and online news agencies, the media has attained unprecedented prominence. Zoos, medical research facilities, and space agencies have responded by engaging proactively with the media, thereby greatly boosting their access to the wider community. The biological sciences have not and, relative to other disciplines, we lag far behind. If we do not collectively acknowledge and address this shortcoming soon, we run the risk of irrelevance, despite the indisputable urgency of our work.

We could do well to learn from our medical colleagues. Any week of the year, there are several news stories about major breakthroughs in medicine. Whether an experimental medication showing promise, a success story of a critically ill patient saved by a new surgical procedure, or an analysis of trends that reveal a link between certain lifestyles and a particular disease, we are familiar with the format and reassured that medical research is progressing. Indeed, many television networks have specialized journalists assigned to medical stories and dedicated weekly timeslots.

How often do people see the news stories about breakthroughs in biodiversity research, advances in ecology, or insights into evolutionary biology? One could forgive the public for thinking space travel and medicine were far more important subjects than improving our understanding of the natural world. And we have only ourselves to blame. When we apply for grants or promotion, we often explain that we make our findings available and relevant to the wider community. While many of us may convince ourselves that we do this, collectively, we do not. Non-biologist friends of mine enjoy perusing my journals and are frequently fascinated with some of the findings reported. "New species of Kiwi discovered", "genetically modified plants used to detect land-mines", and "insects may have evolved several times" are some recent items that have captured their attention. Many of the findings reported in *Frontiers* and other journals are of great interest to the general public. In engaging more with the public, we not only improve our individual research profile, but improve the collective impact of biology and boost its role in society.

How do we bring about this change? While it is tempting to blame the media itself, this is unreasonable. Members of the media report what they are told and, while we pride ourselves on our ability to inform one another, we rarely go to the trouble of communicating directly with the media. Thus, the change needs to come from us, the researchers. Rather than considering a project finished once the journal articles are published and the conference presentations given, we should complement these contributions with associated media releases. A one-page summary including the most relevant figures is all that is needed. As most universities and research agencies have dedicated media officers, they can take it from there: contacting the press, providing background material, organizing follow-up interviews, or assisting with in-depth features.

While the Aldo Leopold Fellowship and several other media-related training internships in

Australia and the US are definitely steps in the right direction, this is something we as an entire discipline need to grapple with. Compared with the relatively small circulations of the journals in which we publish, the popular media reaches thousands of times more people. So, for a small additional effort, the exposure and overall impact of the research can be greatly magnified. Try it – you may be amazed at just how much real impact your research can have.

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Tropical rainforest disturbance and recovery

Deforestation and other anthropogenic disturbances present continuing threats to tropical biodiversity (Jepson *et al.* 2001; Laurance *et al.* 2001). Successful conservation strategies may include the restoration of degraded areas of tropical forest, in which case knowledge of the time that it will take for them to revert to "primary" forest will be of considerable interest. While modelling studies may be able to predict this timing, the most reliable method is through long-term monitoring of sample plots.

Brown and Gurevitch (2004) recently presented a paper examining the impacts of human disturbance and subsequent species invasion on tropical forest diversity. This is an interesting study and unprecedented in terms of the age of the disturbed plots (c. 150 years). However, the published descriptions of the forests

they studied are misleading, and this may have led them to overlook another interesting conclusion of their work.

Three main forest types were compared: unlogged, selectively logged 50 years earlier, and cleared for agriculture 150 years earlier. Brown and Gurevitch repeatedly refer to the forest cleared 150 years ago as "logged 150 years ago", but this is misleading, as forests regenerating from logging disturbances are different from those regenerating from clearance for agriculture (Chazdon 2003). Clearance for agriculture involves removal of all the vegetation and often burning, whereas logging removes some of the larger trees but leaves a number of smaller residual trees remaining. Logging is likely to have less impact on soil chemistry, and regeneration can proceed from seeds of remaining trees; cleared areas rely on seed rain from outside for tree regeneration. Brown and Gurevitch were therefore comparing two different disturbance types, and it is misleading to label them both as "logged". Future studies must be careful in distinguishing between secondary forests that have recovered from completely cleared land and logged forests that have experienced a wide range of disturbance intensities.

The regeneration of the two disturbed forest types proceeded differently over the preceding time period and both are subject to invasions by non-native tree species. Brown and Gurevitch found that cleared forests take around 150 years to recover tree species richness and diversity equivalent to that of a forest logged 50 years previously. I have found that it takes 55 years for a secondary forest cleared for agriculture to achieve approximately 80% of the biomass of primary forest, but there are still marked differences in species richness and floristics (Brearley 2004); it has been estimated that full recovery may take up to 500 years (Kartawinata 1994). One interpretation of the study by Brown and Gurevitch is that forest recovery from severe disturbances, such as clearance for agriculture, may take at least three times longer than recovery from a less severe disturbance, such as selective logging, to reach a similar state.

Brown and Gurevitch's study is valuable because it allows us to quantify this difference, but it must be noted that differing intensities of disturbance at different sites may affect the timing of recovery, especially given the destructive practices of many current logging operations.

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