

## Ethical Publishing in Biodiversity Conservation Science

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### Abstract

For many researchers, particularly in academia, publishing in peer-reviewed journals is a necessity, with major implications for their career progression. Yet, it is increasingly recognised that the current scientific publishing model is not fair and equitable, which can have severe consequences for the way science is accessed and used in nature conservation. We evaluated the publishing model of 426 conservation science journals against the Fair Open Access (FOA) principles. Two-thirds of journals, together publishing nearly half of all articles, complied with only two or fewer FOA principles. Only twenty journals (5%), publishing 485 articles per year (<1%), complied with all five principles. We uncovered a weak negative correlation between journal impact factor and the number of FOA principles fulfilled. Lastly, we found that Elsevier, Wiley, Taylor & Francis, and Springer represented 48% of all journals, but 80% of the 25 journals with the highest impact factor. Our results show that conservation science journals largely fail to meet the FOA standards. Conservation researchers are likely to face obstacles such as limited access to published literature, high publishing charges, and lack of ownership of their research outputs.

**Keywords:** article processing charge, commercial publisher, ethical publishing, journal, nature conservation, open access, paywall, publishing model, Plan S

### INTRODUCTION

For many researchers, particularly in academia, publishing their work in peer-reviewed journals is a necessity, with major implications for the dissemination of their work, their scientific reputation, ability to obtain funding, and promotion prospects. The fundamental, career-making importance of publishing has created opportunities for exploitation in ways that disadvantage both the researchers producing new knowledge and those

who seek to utilise this knowledge. Currently, the publishing system is dominated by a model where authors must either find a way to cover article publishing fees, or readers must pay to access articles (sometimes both); both these costs are steadily on the rise (Frazier 2005; Madras 2008). Combined with a decrease in publication costs as many journals switch to an online-only model, commercial publishers increasingly benefit from high-profit margins, often above 30% (Van Noorden 2013; Tennant et al. 2016; Matthews 2018). In addition, high costs of both publication and access can create imbalances in who participates in, and benefits from, research publication, particularly in limited resource contexts (Tennant et al. 2016).

To bypass costs on the reader's end, researchers often use alternative channels to access publications, such as emailing authors directly or installing browser extensions (e.g., Unpaywall) that search for legal copies elsewhere on the internet (e.g., ResearchGate Academia.edu, etc.). However,

Access this article online	
Quick Response Code:	Website: <a href="http://www.conservationandsociety.org">www.conservationandsociety.org</a>
	DOI: 10.4103/cs.cs_19_56

these methods have significant limitations. Half of all email addresses listed by corresponding authors in one database were found to be inactive five years after publication (Wren et al. 2006). Similarly, only 47% of papers were found to be accessible using browser extensions (Piwowar et al. 2018). Some researchers turn to illegal alternatives such as Sci-Hub, but these also offer incomplete access (i.e., 15% of papers are still inaccessible) and carry the possibility of legal or reputational repercussions (Himmelstein et al. 2018). These methods should therefore not be seen as a solution to accessing scientific literature.

In response to these issues, in 2017 the Fair Open Access (FOA) Alliance, a group of scholars and librarians representing multiple institutions across all realms of knowledge, described five principles which, in their view, describe journals whose publishers are doing right by authors and those trying to access research ([fairopenaccess.org](http://fairopenaccess.org)). These principles (described in the Methods section) define a model of academic publishing where authors retain copyright and do not pay any fees to publish, all articles are made open access, and fees paid to the publisher are transparent and proportional to the actual cost of publication. While the combination of these features might seem difficult to attain, given the dominance of the ‘traditional’ pay-to-play publishing model (Burgman 2018), some publishing consortia have already been created where private funding is used to support journals operating under the Fair Open Access principles (e.g., LingOA for Linguistics, MathOA for Mathematics, PsyOA for Psychology and the Open Library of Humanities) (Eve et al. 2017).

In the last decade, there have been several initiatives that embrace one or more of the FOA principles in an effort to change the publishing landscape. One example is the mainstreaming of the ‘hybrid’ journal model, which gives authors the choice between publishing without APCs (article processing charges) (meaning their articles remain behind a paywall) or paying to make their article open access. There are also “transformative agreements” which aim to shift the contracted payment from a library or group of libraries to a publisher away from subscription-based reading and towards open access publishing (Schiltz 2018). Yet the major initiative has perhaps been Plan S ([www.coalition-s.org](http://www.coalition-s.org)), a large-scale initiative launched in September 2018 by several leading research funding bodies in Europe (Schiltz 2018). Plan S requires that by 2021, researchers funded by these institutions have to make all of their work immediately available upon publication through open repositories or open access journals (Rabesandratana 2019a). This initiative has generated intense controversy, on the one hand receiving support from some of the nations with the highest volume of published research such as India and China (Rabesandratana 2019b), but on the other hand facing fierce opposition from many of the leading learned societies in Europe and North America, which often rely on revenue from journal subscriptions (Brainard 2019; McNutt 2019; but see Kiley and Smits 2019).

In this paper, we evaluated journals that publish research related to nature conservation against the FOA principles

and examine how metrics such as journal impact factor may be a barrier to the mainstreaming of these principles. Conservation is a rapidly expanding field where more than 90% of the literature remains behind a paywall (Fuller et al. 2014). It is important to consider how this lack of access impacts conservation as a discipline, considering that it disproportionately affects researchers and conservationists from developing countries, where the majority of biodiversity is located (Smith et al. 2009; Fuller et al. 2014). We thus place our results in the context of the ongoing debate in the conservation science literature (e.g., Burgman 2018; Lehtomäki et al. 2018) around the very real challenges of removing or reducing barriers for would-be authors and would-be readers to respectively publish and access scientific literature.

## METHODS

We started by carrying out a census of conservation journals. We did this by identifying journals indexed under the relevant categories in Google Scholar (Category: Biodiversity and Conservation Biology), SCOPUS (Category: Nature and Landscape Conservation), Directory of Open Access Journals (Category: Natural History, including Nature Conservation and Geographic Distribution), Web of Knowledge (Category: Biodiversity Conservation); as well as all the journals systematically examined by Conservation Evidence ([conservationevidence.com](http://conservationevidence.com)), a University of Cambridge project that creates synopses of the conservation literature.

These journals were then evaluated against the five FOA principles. The principles are detailed below (for additional details see [fairopenaccess.org](http://fairopenaccess.org)):

1. *The journal has a transparent ownership structure and is controlled by and responsive to the scholarly community*  
We used a broad definition of the ‘scholarly community’, including practitioners such as NGOs, learned societies, and government departments, with stated links to any of these being considered enough to fulfil the criterion. However, being published by a University Press did not automatically fulfil this criterion unless the university also owned the journal.
2. *Authors of articles in the journal retain copyright.*
3. *All articles are published open access, and an explicit open access license is used.*
4. *Submission and publication are not conditional in any way on the payment of a fee from the author or its employing institution (e.g., submission fee, article processing charges or page charges), or on membership of an institution or society.*  
The existence of ad hoc fee waivers was not enough to qualify as compliance with this criterion, as fees must be opt-in, not opt-out.
5. *Any fees paid on behalf of the journal to the publisher are low (USD 1,000 or less), transparent, and in proportion to the work carried out.*

When the institution that owned the journal was also the publisher, we considered this criterion immediately fulfilled.

Two researchers independently marked each journal as 0 (not fulfilling) or 1 (fulfilling) each of the five principles. Where there were disagreements, a third researcher made the final decision. Information was obtained from the journal's website. If information relevant to one of the principles was missing, the journal was marked as not fulfilling the principle. The exception was principle four; if fees were not mentioned anywhere on the journal's website, we assumed that fees were not charged.

## RESULTS

Our search yielded 426 unique, active peer-reviewed journals with accessible websites (full listing in Appendix 1). These journals collectively published 65,591 articles on average each year between 2016 and 2018 (inclusive). Our results show that approximately two-thirds of journals, together publishing nearly half of all articles, complied with only two or fewer FOA principles (Figure 1). Only twenty journals (5%), collectively publishing 485 articles per year (<1%), complied with all five principles. Results by journal are available in Supplementary Material.

Compliance was highest with principles one (transparent ownership structure) and four (no publication charges); over two-thirds of journals adhered to these principles. Compliance with principle two (author ownership of copyright) was lowest, with less than a quarter of journals complying (Figure 2). Because the primary barrier to would-be authors and readers presents itself at the level of individual articles, we also documented total number of articles each journal published in the 2016-2018 period to determine the proportion of articles that adhered to each of the FOA principles. Per article, compliance is highest with principles one (transparent ownership structure) and five (fair publishing cost), with over two-thirds of articles meeting their criteria. Still looking at the number of articles, compliance was lowest with principle three (open access), although the proportion of articles meeting this criterion was higher than the proportion of journals that did.

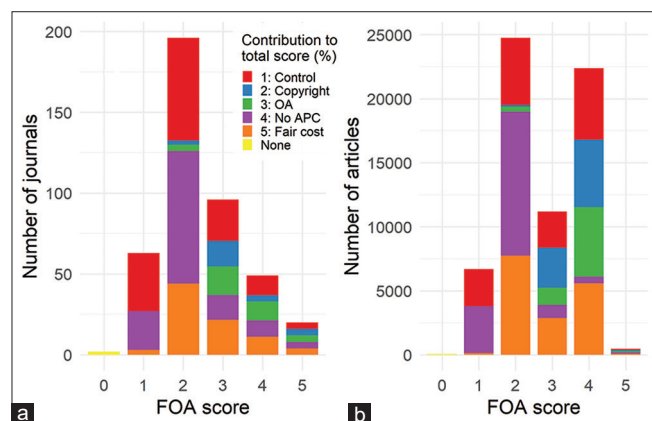


Figure 1

Publications fulfilling different Fair Open Access principles. (a) Number of Journals. (b) Number of Articles associated with those Journals

We also investigated how compliance with FOA principles varied with a proxy measure of perceived journal prestige, namely impact factor (Coomes et al. 2017). The impact factor has been widely criticised, most notably in the Declaration on Research Assessment (DORA) for its lack of transparency and its inability to measure research quality (McKiernan et al. 2019). Yet, it is still perhaps the most widely used proxy for measuring the academic prestige of journals, articles, and even individual researchers (Catling et al. 2009). We found that while 73% of journals and 95% of articles in our analysis had been assigned an impact factor, only 25% of journals and 44% of articles which fulfilled all five FOA principles had an assigned impact factor, all of them below 1. Journals without an impact factor complied with a mean of 3.1 (SD = 1.12) FOA principles, while those with an assigned impact factor complied with fewer principles (mean = 2.2, SD = 0.88).

We also found a weak negative correlation between a journal's impact factor and its FOA score ( $r_s(313) = -0.15$ ). However, considering individual principles, only three had strong correlations, principle one ( $r_s(313) = -0.24$ ) and principle three ( $r_s(313) = -0.29$ ) having negative correlations and principle five having a positive correlation ( $r_s(313) = 0.2$ ).

Lastly, we examined the extent to which major academic publishers are represented in our list of journals and how compliant their journals are with FOA. We found that Elsevier, Wiley, Taylor & Francis, and Springer represented 48% of all journals (Figure 3). However, of the 313 journals that had an impact factor in 2017, 60% are represented by these publishers. These publishers represent 80% of the 25 journals with the highest impact factors. Journals from these four major publishers complied with a mean 1.9 (SD = 0.6) FOA principles, which was less than the average fulfilled by journals from all other publishers (mean = 2.9, SD = 1.1).

## DISCUSSION

Our results show that conservation science journals largely do not meet the FOA standards. This means that conservation

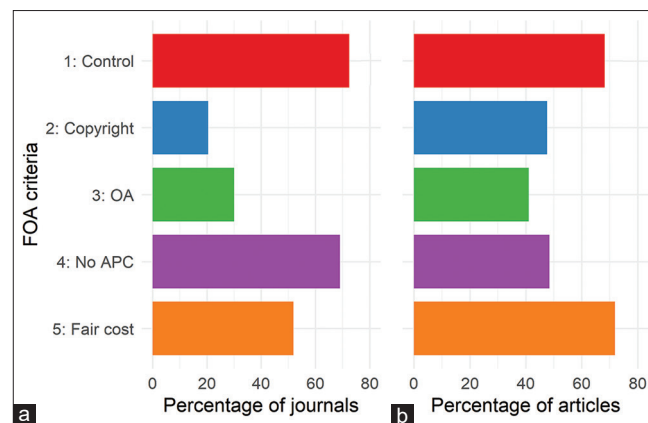
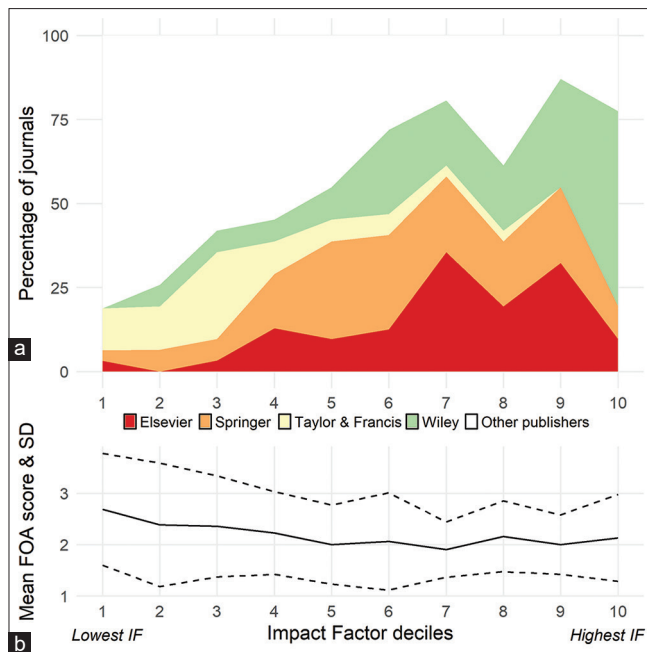


Figure 2

Proportional compliance with each of the five Fair Open Access principles. (a) Proportional compliance of journals. (b) Proportional compliance of articles published by those journals



**Figure 3**

*Impact Factor Scores. (a) Proportion of journals with an impact factor belonging to the four main academic publishers: Springer, Wiley, Taylor & Francis and Elsevier. (b) Mean Fair Open Access score of journals with different impact factors (as assigned in 2017)*

researchers and practitioners are likely to face obstacles such as limited access to published literature, high publishing charges and lack of ownership of their research outputs. These barriers may negatively impact the inclusivity of conservation science as a field and the real-world impact of conservation science research (Fuller et al. 2014).

Principle one, which focused on journal ownership, had the highest compliance among journals overall and second highest when accounting for article publishing volume. This reflects the widespread partnerships between academic publishers and the scholarly community, in particular, professional societies. Such partnerships may help keep research relevant and applied and can channel some of the revenue generated by commercial publishing back into conservation science. However, detailed information about partnerships between publishers and journal owners was rarely available on a journal's website. As a result, it was not possible for us, and would not be easy for the research community at large, to evaluate the nature of those partnerships. These partnerships suggest that civil society organisations have oversight over the activities of profit-seeking journals. Yet, the power balance within these relationships can vary, with partners sometimes co-branding the journal but having little editorial control. As a result, journals may appear to represent the interests of the research community when that is not the case. Greater transparency around the nature of these partnerships is necessary for researchers to make informed publishing choices.

Principle two, which focused on copyright, was the least complied with by journals, and second least complied with when accounting for publishing volume. This raises an ethical

question: is it fair for academic publishers to claim ownership of research outputs generated using funds they did not provide and produced by researchers they did not compensate? This is of particular concern when research is funded by taxpayers, making the costs of research public but its outputs private.

Regarding principle three, less than a third of journals were exclusively open access, with this being the least complied-with principle by publishing volume. The persistent barriers to access are particularly worrying for countries with high biodiversity, where research is most needed, but which most often have limited resources (Peterson et al. 2013). Some publishers have tried to counter this issue through programs such as Research4Life, which provide access to a range of journals to researchers across many developing countries (Koehlmoos and Smith 2011). Yet, these initiatives have been criticised for their limited geographical and institutional coverage and their vulnerability to the unilateral decisions from large publishers to withdraw access (Koehlmoos and Smith 2011; McGrath 2019).

Principle four examined the fees levied by journals on authors, either as page charges or article processing fees. These fees have long been criticised for obstructing authors, who have access to limited resources, from being able to publish their work. This obstacle is particularly salient for those working in institutions with limited funding, NGOs that do not prioritise funding publication costs, and early career researchers. In evaluating fulfilment of this principle we gave the benefit of the doubt to journals whose instructions to authors explicitly failed to mention fees or charges, assuming that absence of any information meant there were no fees. This may be why journal compliance rates for this principle are the highest among all principles. While more than two-thirds of journals did not appear to levy fees, it should be noted that most are not open access, which means that the research they publish is still locked behind a paywall. Interestingly, Plan S does not have an explicit cap on article processing fees but instead demands the disclosure of the different costs included in article processing charges. This means that Plan S may not do much to advance compliance with this specific FOA principle (Rabesandratana 2019a), although there is still uncertainty over some of the specifics of Plan S implementation.

Over 50% of journals, and over 70% of articles published in these journals, appeared to comply with principle five, which examined costs paid by journals to publishers. However, this result reflects the fact that many journals are owned and managed by the same entities (including professional societies, universities, and commercial publishers) and so were considered to uphold this principle by default. In nearly all other cases, the commercial relationships between the publishers and the journal owner were not transparent, which is a necessary condition for meeting the criteria of principle five.

Several considerations must be taken into account when interpreting our results. Firstly, although some principles may be considered more important than others, we found no published consensus on this prioritisation, and so applied equal weighting to all principles. Some researchers have



questioned the specifics around particular principles, such as the cost threshold that is part of principle five (Hunter et al. 2012; Batterbury 2017). Secondly, we used a binary classification to categorise compliance with each principle, since the information required for a more graded classification was not consistently available. As discussed above, this lack of transparency should be a concern to the research community, as well as a limiting factor in the depth of our analysis. Finally, we included all articles published by the selected journals. Although most of these journals focus on conservation, some publish across disciplines, and so the results may not be fully representative of conservation articles.

### Scanning the Horizon

The five FOA principles are only likely to fulfil their mission when adopted as a complete package, so partial or uneven adoption does not necessarily represent a positive step towards fair publishing. Indeed, many prestigious journals have co-opted individual principles to extract more value from either authors or readers. For example, in order to publish open access articles, many journals now charge fees to article authors. While our results highlight the lack of compliance with FOA principles within conservation science overall, the principles have been fully adopted by several academic journals. Some of these came together in 2018 to form the Free Journal Network ([freejournals.org](http://freejournals.org)). This network currently contains 49 journals, including Conservation and Society, across the natural and social sciences as well as the humanities. However, it remains to be seen if this business model is viable at the scale needed to represent a sizable proportion of the scientific literature. There are also outstanding questions around the ability of these journals to attract authors, given their relatively modest performance on perceived prestige metrics such as impact factor, which is still widely used by conservation scientists when deciding where to publish (Fuller et al. 2014). However, the launch of Plan S, which broadly aligns with the FOA principles, may change these incentive structures (Else 2018). That said, it should be noted that Plan S also presents substantial challenges to many of the journals currently complying with all FOA principles, as these tend to be community-run and could struggle to comply with the technical requirements, such as the recommendation to store full-text XML in JATS standard or equivalent (McNutt 2019).

Considering the implications for individual researchers, our results uncovered a negative relationship between impact factor and the number of FOA principles a journal fulfils, suggesting that authors may face a trade-off between perceived prestige and ethical publishing. This is particularly challenging for early-career researchers, when opportunities for career advancement may depend on publishing in journals perceived to be prestigious (Edwards and Roy 2017). In this context, it is also worth noting the very strong position of the publisher Wiley, which controls 80% of the top 25 journals in the field. Moreover, this publisher is likely to

further increase its market share with the launch of two new journals in 2018, which may elevate trade-offs between ethical publishing and perceived prestige, unless publishers embrace FOA principles.

### The Role of the Researcher

As authors, editors, and reviewers, we have a collective agency to shape the publishing landscape. When we decide where to publish our work, or where to volunteer time as a reviewer, we can choose to invest in the long-term sustainability of academic publishing. This applies not only to journal articles but also to all research publications such as books, book chapters, and monographs. Our collective choice to publish ethically can help to shift norms and perceptions of prestige. Openly available information about the FOA compliance of various journals, such as we have provided in this paper, can help us to make these choices (Appendix 1 shows this information for each journal). Nevertheless, we should bear in mind the trade-offs (i.e., reduced prestige, career progression, name recognition) this choice entails, particularly for early career researchers and academics in the global south; and recognise that this presents a structural barrier to most academics. As such, the ethical choice in terms of publishing outlet will not always be possible, but taking into account the FOA principles as just one of many drivers in the selection of publishing outlet can still be beneficial. Senior academics who have greater freedom to choose FOA-compliant journals, having achieved job security and prestige, should prioritise such journals, increasing these journals' profile within the research community and signalling to other researchers that social norms are changing. For researchers at all career stages, whenever it is not feasible to publish in a journal that adheres to the FOA principles, preprint servers can be used to deposit research before publication. This strategy, which has been labelled 'Plan U', could provide broader access to research in the near-term (Sever et al. 2019).

These changes in publishing behaviours may help to drive change, but to achieve large scale reform of the publishing system, substantial systemic changes will also be required. This must be driven by powerful actors, such as institutional funders or governments. Prominent funder-driven initiatives such as Plan S, although not free from critique, will play an important role in driving the transformation of academic publishing. As with many other examples where change is needed at a global scale, it is clear that only action at multiple levels, from individual researchers to the universities, funding bodies, learned societies, and even publishers themselves can help tilt the balance in favour of more ethical publishing models. As researchers, we should continue to be advocates for this transformation.

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## LIST OF APPENDICES

Appendix 1: Individual scores of journals included in an analysis of compliance with the Fair Open Access principles across the fields of conservation science and ecology. This information can be found online in a searchable format at [https://cor-p.shinyapps.io/EP\\_database/](https://cor-p.shinyapps.io/EP_database/).