

Open Preprints in Ecology & Evolution

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I. INTRODUCTION

Public preprints servers allow authors to make their manuscripts publicly available before, or in parallel to, submitting them to journals for traditional peer-review. This idea gained popularity 20 years ago with the advent of arXiv, an open preprint server widely used in the physical sciences [?], but it also part of other fields' culture. Paul Krugman noted that, in economy, the *traditional model of submit, get refereed, publish, and then people will read your work broke down a long time ago. In fact, it had more or less fallen apart by the early 80s* [?]. In addition to a section in arXiv, economists have also the RePEc (Research Papers in Economics) initiative, which aims to create an archive of working papers, manuscripts, and book chapters.

The idea behind preprint servers is fundamentally simple: to make the results available to the scientific community as soon as possible rather than wait until the peer-review process is fully completed. The point of arXiv and open preprints servers is not to avoid the peer-review process. Almost all manuscripts on arXiv are submitted to peer-review. Sharing drafts of research papers on preprint servers has numerous advantages. These include rapid dissemination of work in progress to a wider audience that includes not only scientists and the general public, but also readers in developing countries where access to subscription journals are often a limiting factor. Further, preprints provide the opportunity to solicit feedback from a larger pool of reviewers. As a consequence, preprint servers increase the number of opportunities for review and revision prior to publication, resulting in higher quality submissions which could also alleviate reviewer burden.

Yet, despite the success of the approach in other fields of inquiry, most manuscripts in ecology and evolution are never submitted to any public archive. In this article, we will first highlight the advantages of open preprints

servers for both scientists and publishers. We will also debunk a few misconceptions, discuss the policies of major publishers in ecology an evolution, and briefly review the most popular open preprint servers.

II. THE CASE FOR OPEN PREPRINTS

The first and most often discussed advantage of arXiv and open preprints is speed ???. The time between submission and the official publication of a manuscript can be measured in months, sometime in years. For all this time, the research is only known to a select few: colleagues, editors, reviewers. Thus, the science cannot be used, discussed, or reviewed by the wider scientific community. It is a problem for both scientists and publishers. Manuscripts that are unknown cannot be integrated and thus take more time to be cited.

The review process as a whole is critically over-loaded, because the number of active scientists increases, because the pressure to publish increases, and because of an effect dubbed "the tragedy of the reviewers commons" REF. In the same times, rejection rates are high in most journals (REF), and when the not invited to submit a revisions, authors are left with the impression that they must start the whole process all over again. It's thus no surprise that different initiatives emerged over the last few years, to decrease the time spent in review. XXX et coll. (REF) called for the recycling and reuse of peer-reviews: by attaching previous reviews, and detailed replies, to a new submission, both the editor and the referees can gauge the work done on the manuscript, and perhaps evaluate it with less prejudice. In a similar way, the *Peerage of Science* initiative allows authors to seek anonymous pre-review by their peers. Some journals (LIST?) now accept to publish papers which received good evaluations, effectively outsourcing the review process. A widespread use of preprint servers can achieve the same goal of reducing the time spent in review. By putting a manuscript out there for open comments and criticisms, the authors will receive valuable feedback, and can improve the version which will be submitted. With a rich enough commu-

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nity of scientists depositing preprints, and commenting on them, the process of an open pre-review can become widespread, and will overall increase the quality of first submissions.



FIG. 1: It can take several months, and even a few years, before a submitted paper is officially published and citable. During this time, few people are aware of the research that has been done (typically, close colleagues are given access to the preprints). With public preprint servers, the science is immediately available and can be openly discussed, analysed, and integrated into current research. It benefits both science and publishers. Both want the papers to be well-known and cited, and public preprints make it possible to integrate research even before publication, greatly improving immediacy.

Preprint servers also establish priority in a fair way. Some manuscripts will spend much more time in the review process than others. Public preprint servers offer a much fairer way to establish intellectual priority by making the work available when done, even if the exact organisation of the manuscript may change. Surprisingly, there is a perception in biology that public preprints make it easier to steal ideas, as if scientific ideas only took form in published material. Mathematicians and physicists have embraced arXiv in part to establish priority in a fair way[?].

Some of the responses to public preprints are surprising since they are, essentially, the same as exchanging preprints among colleagues. Prepublication reviews by a small network of colleagues is an important part of the scientific process, which is attested by the fact that nearly all published papers acknowledge comments by people not listed as co-authors. Preprint servers simply offer a way to extend this network of colleagues to the entire scientific community. It ensures that science is not constrained by small networks of scientists exchanging ideas. Paul Ginsparg created arXiv.org in part for democratic reasons: he wanted everyone from students in small universities to Ivy-League professors to have access to the most recent scientific *ideas*. Ginsparg’s revolutionary idea was simply to use the power of the internet for

preprints, not just for the end product, so the process can be open from A to Z, instead of being just open at the end of the process.

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III. PREPRINTS, ECOLOGY & EVOLUTION

While submitting to public preprints servers is still uncommon in ecology and evolution, preprints are becoming more common in biological sciences. The quantitative biology section in arXiv is experiencing faster growth in submissions than any other fields [?]. Also, most scientific journals are preprint-friendly: Nature, PLOS, BMC, PNAS, Science (mostly) ??, and all the journals from Elsevier and Springer. Very recently, the Ecological Society of America recently changed its policy to allow public preprints (REF). In our field, few scientific publications will not consider a manuscript submitted to arXiv. Still, many ecology & evolution journals adopt a “by default” hostile attitude towards preprints, mostly due to the lack of clear policy of the publishers. As an example, Wiley-Blackwell, which publishes some of the leading journal in the field, has no official policy on the subject ??.

There are other “cultural” barriers to adoption of preprint servers by ecologists and evolutionary biologists. The most notable preprint server, arXiv, is designed to work best with T_EX, a nearly universal document preparation system among physicists and mathematicians. Jackson [?] further argues that T_EX introduced an “open source mindset” to its users, who now freely share their research findings as well as their software. Many biologists instead use proprietary software to prepare their research findings, and many ecology and evolution journals officially prefer Microsoft Word documents as submissions. The recent discipline-wide adoption of free software packages such as R and associated document generation systems [?], as well as interest in open access publishing, has coincided with recent rise in use of preprint servers by biologists, supporting Jackson’s claims. [?]

Physicists and other quantitative scientists have recently developed a great interest in evolutionary theory, quantitative ecological theory and epidemiological modeling. Unfortunately this has led to a lot of repeated work (“reinventing the wheel”; [?]) that could be avoided by better communication across disciplines. The near-universal adoption of preprint servers in physics provides this vital communication channel. We suggest that biologists reach out to physicists and mathematicians by post-

Publisher	Policy
Springer	Accept
BMC	Accept
Elsevier	Accept
Nature Publishing Group	Accept
Public Library of Science	Accept
Royal Society	Accept
National Academy of Science (USA)	Accept
Ecological Society of America	Accept
Oxford Journals	Accept
Science	Ambiguous
Wiley-Blackwell	No general policy
British Ecological Society	No answer to our query

TABLE I: Policies for important publishers in ecology and evolution.

ing papers to arXiv: a physicist who does not read *Evolution* certainly checks arXiv at least weekly. This benefits both disciplines, as biologists will reach new readers, and physicists will learn the terminology, tools and ideas common in existing evolutionary theory. A recent series of papers on the theory of natural selection was posted to arXiv simultaneously with its publication in the *Journal of Evolutionary Biology* [? ? ? ?].

IV. CURRENT OFFERINGS

We briefly discuss the main options to submit preprints to open servers: arXiv.org, Figshare, and the upcoming PeerJ and F1000Research.

A. arXiv

arXiv (<http://arxiv.org/>) is the most widely-used preprint server today, and its use is almost universal in mathematics and most branches of physics. Physicist Paul Ginsparg originated arXiv in 1991 for theoretical high-energy physicists to communicate preprints via email and ftp, and soon thereafter adopted the newly created world-wide web[?]. arXiv now receives over 7,000 submissions per month (http://arxiv.org/show_monthly_submissions). arXiv divides its submissions into subcategories of physics, mathematics, computer science, quantitative biology, finance and statistics. The quantitative biology category includes subcategories for Populations and Evolution, Quantitative Methods and other categories that may be of interest to ecologists and evolutionary biologists.

Submission to arXiv is fully automated via the world-wide web. Authors can submit T_EX/L^AT_EX documents that are compiled on the server, or directly submit in PDF/PS format (for example, as exported by a word processor). A moderation system was put in place in 2004: papers must be categorized by an “endorser.” At least one author of a paper must be an endorser that has previously submitted a paper or has received permission to

submit to a particular category. Many authors in mathematics and physics submit papers as soon as they are ready for review by colleagues, although another popular option is submitting simultaneously to a journal and arXiv.

Most papers posted to arXiv are eventually printed in journals. There are notable exceptions, including Perelman’s landmark paper leading to the proof of the Poincaré conjecture [?]. arXiv provides a reliable citation system for all eprints (see our citation [?]), lending a form of “intellectual priority” to works posted there. Despite these marks of arXiv functioning as a scientific journal, arXiv has never sought to replace scientific journals and explicitly states that it serves a different function as “an openly accessible, moderated repository for scholarly articles in specific scientific disciplines.”

arXiv is now administered by the Cornell University Libraries. Funding comes from voluntary pledges by academic institutions along with matching funds from the Simons Foundation [?]. One-hundred twenty six of the top two-hundred institutions in terms of downloads have provided the operating budget for arXiv over the next five years. This plan reduces the financial burden on Cornell University and transfers governance to a collaborative community in accordance with arXiv’s key principles. arXiv takes numerous measures to ensure that the repository will remain permanently available and submissions will be readable.

B. Figshare

Figshare (<http://figshare.com/>) is an open server that allows scientists to submit any research output: manuscript, figures, datasets, videos, theses, presentations, and so on. There are no rules to limit what constitutes a research output and, unlike arXiv, there is no endorser system (although the administrator reserve the right to remove inappropriate content). All figshare content (article, figures, datasets) have a unique digital object identifier (DOI) like any journal article. Tags are used to classify the content and new tags can be made.

All content can be commented and is licensed under the Creative Commons (CC-BY) license, except datasets which are published under CC0.

C. PeerJ

D. F1000Research

F1000Research is not a public preprint server like the previous three servers. Whereas arXiv, Figshare, and PeerJ offer an option to submit a manuscript without having it reviewed, papers submitted to F1000Research will eventually be reviewed. Thus, F1000Research offers a hybrid model with publicly available manuscripts at time of submission and standard peer-reviews. Manuscripts are considered “accepted” and will only be indexed after two positive referee response.

V. CONCLUSION

Responding to the rumour that they refused manuscripts submitted to arXiv, Nature responded that

“Nature never wishes to stand in the way of communication between researchers. We seek rather to add value for authors and the community at large in our peer review, selection and editing” [?].

Open preprints server offer a great opportunity for open science, especially if the community embrace the idea of discussing preprints. Initiatives like Haldane’s Sieve (<http://haldanessieve.org/>), a new blog discussing arXiv papers in population genetics, will help make arXiv attractive for scientists looking to promote their work. These initiatives are important to fully exploit the potential of open preprints servers.

Posting preprints online increases the community of available informal peer reviewers, and uses the internet for its original community-building purposes. Preprint servers also facilitate communication between disciplines, bridging cultural as well as geographic divides. The advantages are clear and the costs are low.