

The promise of community-driven preprints in ecology and evolution

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99 Publishing preprints is quickly becoming commonplace in ecology and evolutionary biology. Preprints can
100 facilitate the rapid sharing of scientific knowledge establishing precedence and enabling feedback from the
101 research community before peer review. Yet, significant barriers to preprint use exist including language
102 barriers, a lack of understanding about the benefits of preprints and a lack of diversity in the types of research
103 outputs accepted (e.g., reports). Community driven preprint initiatives can allow a research community to
104 come together to break down these barriers to improve equity and coverage of global knowledge. Here, we
105 explore the first preprints uploaded to *EcoEvoRxiv* ($n = 1216$), a community-driven preprint server for
106 ecologists and evolutionary biologists, to characterise preprint practices in ecology, evolution and
107 conservation. Our perspective piece highlights some of the unique initiatives that *EcoEvoRxiv* has taken to
108 break down barriers to scientific publishing by exploring the composition of articles, how gender and career
109 stage influence preprint use, whether preprints are associated with greater open science practices (e.g., code
110 and data sharing), and tracking preprint publication outcomes. Our analysis identifies areas that we still need
111 to improve upon but highlight how community-driven initiatives, such as *EcoEvoRxiv*, can play a crucial role
112 in shaping publishing practices in biology.

113 **1. Introduction**

114 Publishing preprints – papers communicating non-peer-reviewed research findings – is now an entrenched
115 practice across a multitude of scientific disciplines [1]. Preprints in biology have had a slower uptake relative
116 to other disciplines [2], but new discipline-specific preprint servers, such as *EcoEvoRxiv*
117 (<https://ecoevorxiv.org>), provide a means by which ecologists and evolutionary biologists can disseminate
118 research findings. Preprints attempt to break down barriers to scientific publishing by: 1) increasing the
119 visibility of research and the speed at which research findings become available, which can lead to more
120 citations [e.g., 3,4]; 2) helping establish the precedence of research findings; 3) removing financial barriers to
121 open access publication; and 4) enabling earlier feedback from the research community [5–7]. Ultimately,
122 preprints can facilitate the rapid sharing of scientific knowledge that can have significant impacts on
123 fundamental and applied knowledge globally [8].

124 Preprint servers can empower researchers to make their research findings more accessible, open, and
125 transparent but only if they are used as forums for spreading and discussing findings within a research
126 community. However, significant barriers to the widespread adoption of preprints remain, ranging from a
127 lack of clarity around preprint policies in journals [9] to a stigma within the research community that
128 preprints are of poor quality [10] (but see [11]). Nonetheless, we lack an understanding of the factors that
129 influence preprint use in ecology and evolution. Such an understanding may help improve current initiatives
130 (see below), inform future ones and allow us to work harder in further breaking down barriers to scientific
131 publishing.

132 *EcoEvoRxiv* is one of the few community-driven preprint servers that has paved the way for new initiatives,
133 by accepting multilingual preprints, registered reports, and non-traditional research reports. Such initiatives
134 are distinct from other preprint servers, such as *bioRxiv*, which only accept empirical research in English. In
135 addition, community-driven servers like *EcoEvoRxiv* aggregate papers presenting research on similar topics,
136 improving discoverability and opportunities for within-community debate compared with broader preprint
137 servers. *EcoEvoRxiv* also promotes peer review and community discussion in the hopes of improving the
138 quality of preprints and speeding up their peer-reviewed publication. For example, we encourage authors to
139 use peer community review services such as Peer Community In (PCI) [12], which allow for fast,
140 constructive peer review around a preprint with peer reviews being transparent and published online [12].
141 *EcoEvoRxiv* allows authors to submit both preprints and postprints (also known as author-accepted
142 manuscripts). While preprints are versions of manuscripts posted by authors before peer-review, postprints
143 are versions of peer-reviewed and accepted articles but without typesetting and formatting by a journal. The

144 main reason for publishing postprints on a preprint server is to ensure published articles are openly accessible
145 to everyone without a paywall (i.e., green open access). Even for articles published open access, depositing
146 the postprint in a repository (e.g. Zenodo) or a preprint server strengthens permanence and access to the
147 content of the article in the event of a journal's collapse or disappearance. Postprints can be published
148 anytime, if journals allow it (which many do; see <https://www.sherpa.ac.uk/romeo/>).

149 Here, we explore the first preprints/postprints ($n = 1216$) uploaded to *EcoEvoRxiv* to characterise preprint
150 practices in ecology and evolution. We aim to understand: 1) in what countries authors who use *EcoEvoRxiv*
151 are located; 2) the taxonomic diversity of study systems used across articles; 3) whether preprint server use
152 depends on career stage and gender; 4) the extent to which authors make use of preprint servers for reports
153 and community-driven peer review; 5) the extent to which data and code are shared in preprints; and 6) how
154 many preprints remain unpublished, and for those that are published, how long it took for them to become
155 published. In the process, we also provide a summary of what makes *EcoEvoRxiv* distinct from other preprint
156 servers to help further clarify the benefits of using community-driven preprint servers to disseminate research
157 findings.

158 **2. Getting to know your *EcoEvoRxiv* preprint server**

159 *EcoEvoRxiv* is run by the Society for Open, Reliable, and Transparent Ecology and Evolutionary Biology
160 (SORTEE)[13]. Originally launched in 2018 on the Center for Open Science preprint platform, *EcoEvoRxiv*
161 has become a popular preprint server for ecologists and evolutionary biologists. The server has since been
162 adopted by the California Digital Library (CDL). Editors are ecologists and evolutionary biologists from
163 across the globe who volunteer their time to screen submitted papers and push new initiatives in the preprint
164 space. To better understand preprint (and postprint) use on *EcoEvoRxiv*, we downloaded metadata on the
165 accepted articles available on *EcoEvoRxiv* as of 2023-09-30 (see Supplement for more details on methods).
166 We consider both preprints and postprints as 'articles'. After removing five duplicate titles (suggesting that a
167 few authors uploaded their articles as separate submissions rather than updating the existing article), we
168 extracted data for a total of 1216 articles over the last two years (figure 1A). For more details on the data
169 collection process, see the Supplement (https://daniel1noble.github.io/ecevo_1000/).

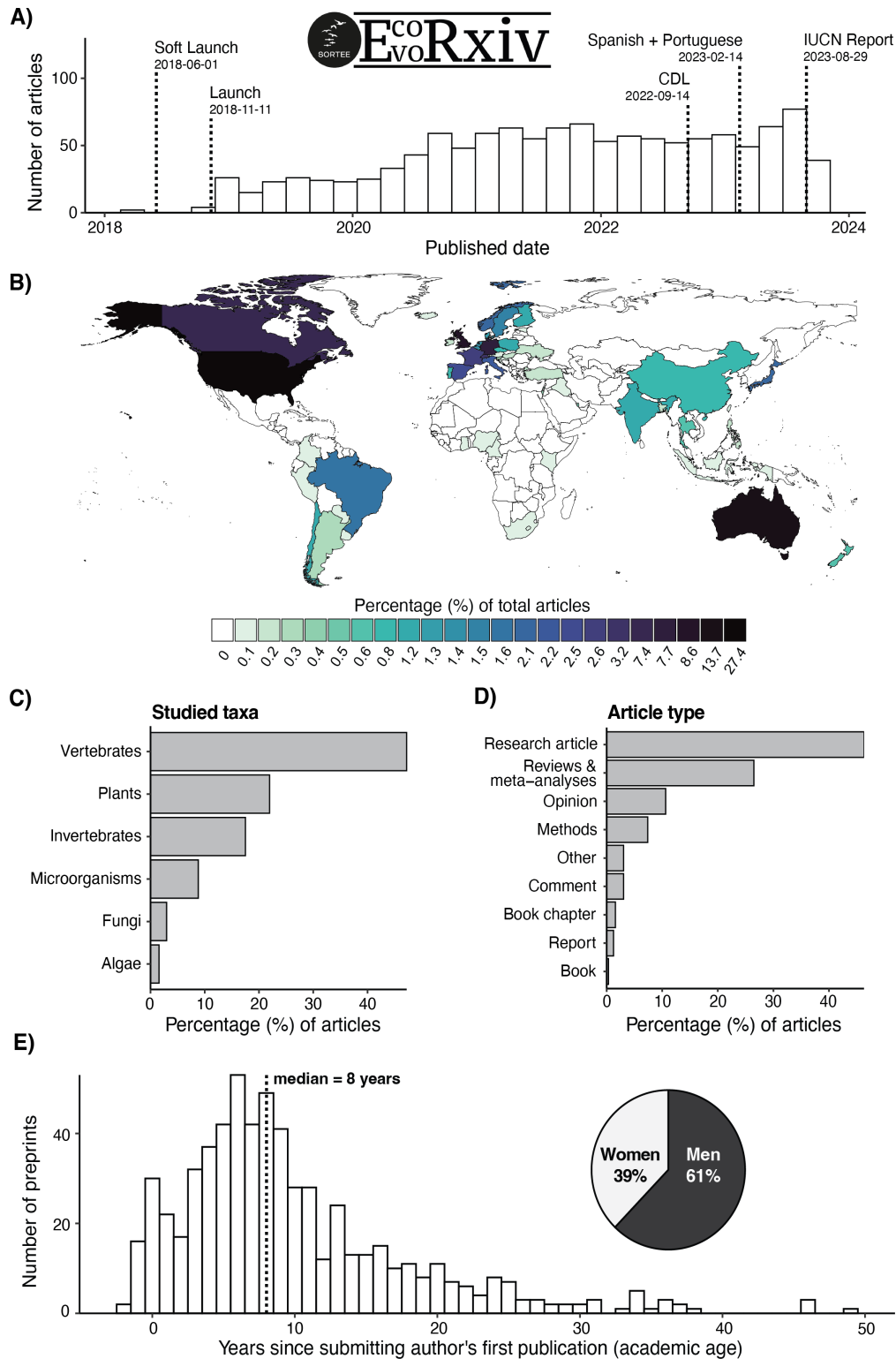


Figure 1- Summary of articles posted to *EcoEvoRxiv*. A) Number of articles (preprints and postprints) published on *EcoEvoRxiv* between 2018 and 2023. *EcoEvoRxiv* was established in June 2018 before the launch in November 2018. Notable milestones include *EcoEvoRxiv* transitioning to the California Digital Library (CDL), the acceptance of preprints and postprints in Spanish and Portuguese, and the acceptance of the first IUCN Red List Ecosystem report; B) Geographic origin of articles uploaded to *EcoEvoRxiv*, inferred from the country of affiliation of the submitting author; C) Taxa covered in the articles posted to *EcoEvoRxiv* ($n = 1080$ articles covering relevant taxa); D) Types of articles accepted on *EcoEvoRxiv* ($n = 1216$ articles); and E) Academic age of authors posting preprints to *EcoEvoRxiv* ($n = 1135$ published and

unpublished preprints) along with the gender of the submitting author. Values lower than zero are indicative of authors who uploaded preprints before their first scientific publication in a journal. Map base source: R Package maps v.3.4.2. Shapefile: Natural Earth <https://www.natureearthdata.com/about/terms-of-use/>.

170 **(a) Overview of *EcoEvoRxiv* preprints (and postprints)**

171 *EcoEvoRxiv* hosts articles from authors based in 56 countries, with 90% coming from just 17 countries.
172 North America, Australia, and European countries upload the most preprints, with many fewer coming from
173 countries in Africa, Central America, and parts of Asia (figure 1B). Articles covered all major taxonomic
174 groups, with the most common groups being vertebrates (47.2%), plants (21.9%), and invertebrates (17.5%)
175 (figure 1C).

176 **(b) Diversifying article types on *EcoEvoRxiv*: overcoming the ‘grey literature’ problem**

177 Accepting a greater diversity of article types allows *EcoEvoRxiv* to help deal with the ‘grey literature’
178 problem, whereby data that are relevant for research syntheses are not published in typical peer-reviewed
179 journals [14,15]. *EcoEvoRxiv* has made a concerted effort to diversify the types of articles hosted. This is
180 reflected by 6.2% of of the articles being books, book chapters, reports, and other research output types,
181 which are typically considered ‘grey literature’ in ecology and evolutionary biology. As a result, articles on
182 *EcoEvoRxiv* are more diverse than those on other preprint servers which have more restrictive submission
183 policies. For example, *bioRxiv* only accepts empirical research articles ([https://www.biorxiv.org/submit-a-](https://www.biorxiv.org/submit-a-manuscript)
184 [manuscript](https://www.biorxiv.org/submit-a-manuscript)).

185 Empirical research articles are still the most common type of article submitted to *EcoEvoRxiv* (46.3%),
186 followed by reviews and meta-analyses (26.5%) and opinion papers (10.6%) (figure 1D). Currently,
187 *EcoEvoRxiv* does not host many reports, particularly from government or industry, but has formed fruitful
188 partnerships with the International Union for Conservation of Nature (IUCN). For example, IUCN Red-list
189 Ecosystem Reports are now posted to *EcoEvoRxiv* and our community has been able to work closely with the
190 IUCN to ensure these documents meet the IUCN requirements. We authors to consider posting books, book
191 chapters, and reports to ensure that they are openly accessible and more easily found. Accepted *EcoEvoRxiv*
192 submissions are given a unique DOI and are indexed on Google Scholar. DOIs can be used in grant
193 applications, CVs, and other documents to provide a link to the work.

194 **(c) Breaking down language barriers to scientific communication: improving diversity and** 195 **data representation globally**

196 A significant barrier to the communication of research findings is the fact that they are primarily
197 communicated in English [16–18]. Research communication through a single language has major
198 consequences for the global distribution of knowledge, resulting in knowledge gaps across some of the most
199 biodiverse and threatened regions in the world [19,20]. Such gaps also impact research syntheses and meta-
200 analyses because they create a distorted picture of our knowledge base that can affect future research, policy
201 development and decision-making [20–23].

202 *EcoEvoRxiv* is the only preprint server to date that breaks down language barriers to scientific
203 communication by accepting not only English, but also Spanish, Portuguese and French language articles.
204 *EcoEvoRxiv* plans to expand to other languages as new non-English editors for different languages become
205 available. Such initiatives are incredibly important if we are to begin filling global gaps in scientific
206 knowledge. However, multilingual initiatives have been slow to take off on *EcoEvoRxiv*, with only a few
207 Spanish submissions, and a single Portuguese article posted since *EcoEvoRxiv* began accepting non-English
208 articles in 2023. Part of the challenge in getting authors to submit articles in non-English languages is a lack
209 of awareness of *EcoEvoRxiv* in non-English speaking countries, cultural differences in the perception of

preprints, and a strong reliance on traditional publishing models that typically mandate publishing in English [24].

(d) Generational and gender-based gaps in preprinting practices

Research can take a while to be published (see below). Early and Mid-Career Researchers (EMCRs) (~10 years post-PhD) are under pressure to publish rapidly to be competitive in job applications, promotions, and obtaining grants to progress their careers [7,25]. Preprints are especially useful for EMCRs because they can achieve faster dissemination and greater visibility [4]. EMCRs may therefore be expected to make use of preprints more than colleagues at later career stages because they are more often in charge of article submission and have developed their careers in an environment where preprints are a normal part of the publication process. We collected data on the ‘academic age’ of submitting authors by looking at Google Scholar profiles of authors (when available) and recording their first year of publication in a peer-reviewed journal. While this is a rough estimate of career stage, there was evidence that the number of preprints posted decreases with later career stages (negative binomial glm: year slope = -0.1, SE: 0, $p < 0.001$, $n = 50$ years). Most preprints were submitted by authors who published their first paper in the last ~10 years (figure 1E), with the median year since first publication being 2013 (mean = 2010.7; SD = 9.9, $n = 1133$). These patterns support the expectation that EMCRs may use preprints to make their work more visible and disseminate their findings more quickly. However, we acknowledge that to understand the reasons why EMCRs might adopt preprint servers more readily requires community surveys, as have been done in previous studies [e.g., 26].

Gender differences in preprint use and publication outcomes have also been observed in several research fields, including ecology and evolutionary biology [27,28]. For example, gender gaps in preprint submissions were observed during COVID-19 lockdowns [29], and previous surveys have shown that female participants are less likely to suggest posting articles as preprints, suggesting gender differences in views around preprints [26]. Therefore, such discrepancies are expected to manifest in preprint use on *EcoEvoRxiv*, but it is unclear to what extent. Understanding gender publishing patterns is challenging with observational data such as ours because we cannot know the gender of authors for certain, but we can use a data-driven approach to ascertain the probability that a particular name is of a given gender (man or woman). To obtain a rough idea of an author’s gender, we used the R package *gender* (v.0.6.0; [30]) to predict the most likely gender of the submitting author of a preprint. We used an algorithm to assign binary gender based on the submitting author’s name. We only used the algorithm-assigned gender when the gender of a given name was identified with 95% certainty. For the remaining names, we performed manual searches to determine gender based on the pronouns and photographs from professional and personal websites. We acknowledge that our approach does not capture self-assigned and non-binary genders. As such, our assumptions about an author’s gender identity may be incorrect. Our data on gender had only two missing values—one where the first name of the submitting author was missing and the other one for a collective submission. As expected, we found that women were less likely to post to *EcoEvoRxiv* compared to men (women: 38.5%, figure 1E), reinforcing existing disparities between male and female scientists. For example, studies have shown that female first authors have lower acceptance rates and are cited less (~2%) compared to males [e.g., 27].

3. Following the journey of a preprint on *EcoEvoRxiv*: from submission to publication

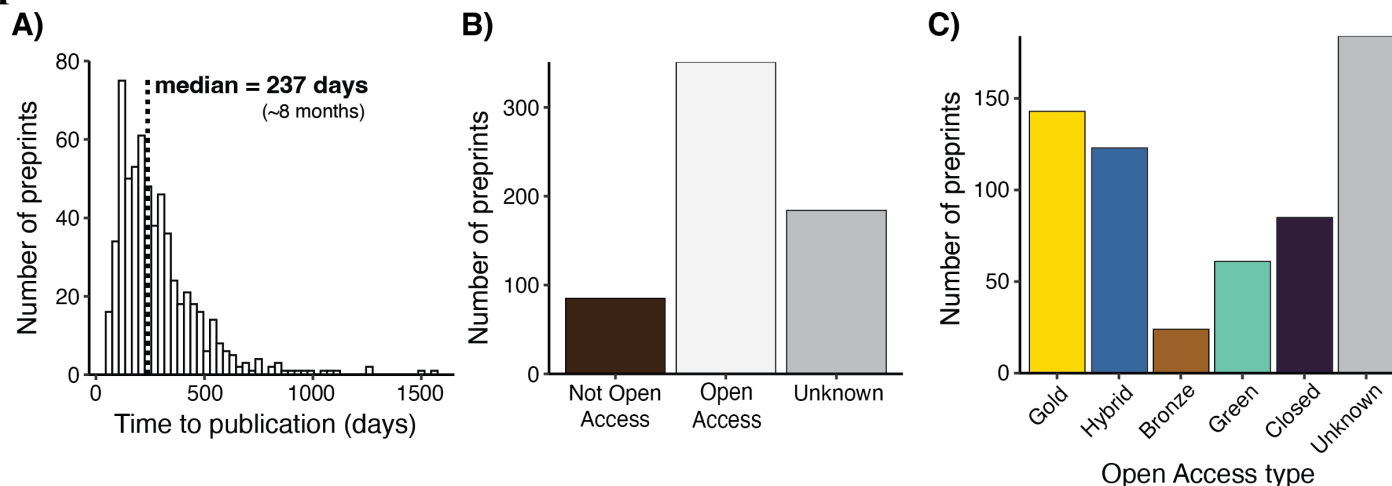


Figure 2- Summary of the publication status of preprints on *EcoEvoRxiv*. A) Time between uploading an preprint to *EcoEvoRxiv* and its publication as a peer-reviewed journal article. Preprints were considered those articles that were published in a journal a minimum of 2 months (60 days) after being posted to *EcoEvoRxiv*; B) Access status of published preprints on *EcoEvoRxiv* classified as “Open Access” or “Not Open Access”. “Unknown” status is for articles who status was unclear on the Unpaywall platform; and C) Sub-types of open access status of published preprints on *EcoEvoRxiv*. Sub-type meanings are as follows: ‘Green’, articles published in ‘toll-access journals but achieved in an open access repository; ‘Bronze’, articles are free to read on publishers website without a license but grants no other rights and can be delayed free-to-read; ‘Hybrid’, articles are free to read upon publication with an open access license; ‘Gold’, articles published in fully open access journals. For full details on the meaning of each category see <https://support.unpaywall.org/support/solutions/articles/44001777288-what-do-the-types-of-oa-status-green-gold-hybrid-and-bronze-mean>

249 (a) *Science takes time, but publication could take longer*

250 Increased competition in science has raised the bar with respect to the amount of data required for publication
 251 [7]. This requirement is a good outcome if it results in higher-impact research that better clarifies our
 252 understanding of the natural world, but it does come at a cost for the speed of research dissemination [7].
 253 Long publication times can adversely affect EMCRs who rely on publications for job applications,
 254 promotions, and obtaining grants. Getting research out quickly can also be critical for the development of
 255 new knowledge that can re-shape research landscapes, which was important during the COVID-19 pandemic
 256 [31]. Preprints have been proposed as a way to disseminate research more quickly as it can take a long time
 257 before results are ultimately published after formal peer review [6,7]. However, data on the time to
 258 publication is needed to quantify the real benefit of preprints in this context.

259 We estimated how long it takes to publish a preprint in ecology and evolution by recording the time between
 260 when a preprint was first posted on *EcoEvoRxiv*, and its final acceptance in a peer-reviewed journal. In total,
 261 515 preprints remained unpublished (45.4%, $n = 1135$) at the time when these data were collected. Not all of
 262 these preprints, however, are anticipated to be published in a peer-reviewed journal (e.g., reports).
 263 Nonetheless, the median time to publication for preprints was 237 days (8 months) for all preprints that
 264 ended up being published (mean = 286.4; SD = 193.9 days) with the maximum time to publication being
 265 1549 days or 4.2 years (figure 2A). For a full breakdown on the time to publication based on article type,
 266 refer to the Supplement (Table S1). Our results largely confirm the extended timeframes that most authors
 267 experience between writing their research papers and their publication.

268 (b) *Cautious ‘open’-mindedness of research in preprints*

269 In addition to speeding up dissemination, preprints and postprints can also be a useful way to ensure that
270 research remains open and accessible to the research community irrespective of the accessibility of the final
271 peer-reviewed paper [6,7]. We evaluated whether preprints and postprints hosted at *EcoEvoRxiv* and that
272 were also published in a journal were published open access. The open access status of each published article
273 was obtained using the R package *roadoi* (v.0.7.2) to connect to the Unpaywall platform [32]. Most of the
274 published preprints and postprints were open access [80.5% ($n = 351$ out of 436 where the status was
275 known); figure 2B]; however, 19.5% ($n = 85$) were published behind paywalls. Published articles behind
276 paywalls may otherwise remain inaccessible if it were not for *EcoEvoRxiv*. For preprints and postprints
277 published in open access journals, the type of open access also varied widely (e.g., Gold, Hybrid, Green OA
278 etc., figure 2C). Such a result may not be too surprising given that authors using preprint servers are probably
279 already ‘pro-open access’, particularly given that *EcoEvoRxiv* is run by the Society for Open, Reliable, and
280 Transparent Ecology and Evolutionary Biology (SORTEE).

281 Data and code sharing are also key components of open science [33]. In the spirit of ‘openness’, we expected
282 data and code sharing among preprints and postprints to be greater than in many papers published in research
283 journals [33,34]. Despite this, we found that 54.4% ($n = 398$) of articles relying on data (i.e., classified as
284 ‘research articles’) on *EcoEvoRxiv* did not share data, and 58.1% ($n = 425$) did not share code.

285 Authors may be reluctant to share data and code for preprints because of the perceived concern that others
286 may acquire and use their data and code before publication in a journal. Authors of 28.7% ($n = 123$) preprints
287 did not share data at the preprint stage but ultimately did share data when the article was published, whereas
288 authors of 35.2% ($n = 151$) never shared data and 36.1% ($n = 155$) shared data at both stages. The same was
289 true for code. Overall, 16.8% ($n = 72$) of preprints had no open code at the preprint stage, but ultimately did
290 share code at the published article stage. In contrast, authors of 45.2% ($n = 194$) preprints did not share code
291 at either stage while 38% ($n = 163$) shared code at both stages. Relatively low code and data-sharing
292 practices in our sample is consistent with analyses of sharing practices for published articles (e.g., [34]), even
293 for journals with strict public data archiving policies [33].

294 **4. Paving our future to open, transparent and community-driven science**

295 Our analysis has allowed us to better understand preprinting/postprinting practices in *EcoEvoRxiv*. Overall,
296 *EcoEvoRxiv* articles are diverse but with primary research articles on vertebrates comprising most of the
297 articles posted. North America, Europe and Australia use *EcoEvoRxiv* the most with very few non-English
298 language articles deposited to date. Submitting authors who were earlier in their career and more often with
299 ‘male-associated names’ tended to use *EcoEvoRxiv* the most. Articles posted to *EcoEvoRxiv* tend to take up
300 to 8 months to become published with many articles not being open access. Code and data sharing was also
301 relatively uncommon at the preprint stage. We attempted to collect data on community discussion around
302 preprints. However, no such data was found on preprint landing pages, likely reflecting inadequate
303 functionality and cross-linking with sources where such discussion is occurring. Based on the insights from
304 our analysis, we provide recommendations to authors and the scientific community on ways they can further
305 promote open and transparent research through preprints:

- 306 • First, share your data and code at the preprint stage. Sharing data and code early can help improve the
307 quality of research, establish precedence, and improve the transparency and computational
308 reproducibility of scientific findings [25,35]. Reassuringly, sharing data and code is rarely associated
309 with the ‘scooping’ of research findings [36]. If authors are worried about data being used
310 unintentionally, clear information surrounding its reuse can be included in a license (see
311 <https://choosealicense.com>). Data can also be archived with an embargo on its reuse [37].

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- Second, take advantage of peer-reviewing services such as Peer Community In (PCI). The time between posting a preprint and publication is still quite long (~8 months). One possible explanation is that preprints are not being sent to suitable journals or are struggling to get into review, slowing down constructive feedback that can improve the quality of a paper. Using PCI circumvents editorial decisions without review, yet only 1.8% ($n = 20$) used PCI. Using such services will ensure that authors receive faster feedback on a paper. Ninety-three journals currently accept PCI reviews and recommendations when considering a paper for publication (<https://peercommunityin.org/pci-friendly-journals/>).
 - Third, seek out and contribute to constructive feedback on preprints [6]. While it is clear that preprints help establish precedence and allow findings to be openly accessible, it still seems rare that constructive discussions form around preprints in an open forum (e.g. *bioRxiv* [38]). Unfortunately, the *EcoEvoRxiv* website does not provide opportunities for discussion given the limitations of the web server at this point in time. As such, we could not accurately assess how much discourse around a given preprint occurs. One way to facilitate such discussions may be to use open preprint peer-review services such as *Peer Community In* (PCI) or *PubPeer* (see also [39]) to provide feedback on preprints. Both *PCI* and *PubPeer* provide opportunities for open peer review around a preprint. Peer discussions are given a unique DOI which can then be associated with a preprint on *EcoEvoRxiv*. However, *EcoEvoRxiv* currently lacks connection to *PCI*, *PubPeer* and Altmetric data which would allow for discussion to be assimilated around a preprint in one place and make it easier for readers to follow discourse around a preprint. Clearly, as a community, we need to provide better platforms and workflows that document discussions around preprint findings. Such discussions help authors improve their work and communicate their findings more effectively (when done constructively, of course). Lack of discussion around preprints more generally might also be a function of time constraints researchers face and the lack of credit received for such community service. An important future goal of *EcoEvoRxiv* is to provide better community discussion forums and integration with existing preprint peer review services. We also need to find new ways to give credit to colleagues that contribute to community discussion.
 - Finally, keep your preprints updated. While most preprints get seamlessly connected and merged with their published version, some remain ‘disconnected’ as separate articles. Incorrect cross-linking by indexing platforms (e.g., Google Scholar) can create confusion and lead to frustration among authors. The reasons for unmatched preprints and publications are well-understood and usually easily rectified. They often result from a mismatch between preprint and published metadata (e.g., titles and author details). For example, nearly one-third of articles changed their title from preprint submission to publication [30.5% ($n = 229$)]. We found that mismatched metadata almost always contributed to preprints and published articles not being matched automatically in Google Scholar. At times further manual merging by authors is needed to connect the preprint and published article (this can be done in Google Scholar). Regardless, we recommend that authors update their preprints with the publication DOI when accepted to journals, especially if their title has changed. This is very easy for authors to do on *EcoEvoRxiv* and should increase the chances that the preprint is correctly linked to the published article and citations are appropriately merged.

352 Despite the early successes of the new initiatives taken by *EcoEvoRxiv*, as described above, much work
353 remains to be done to improve the understanding and use of preprints and postprints within our community.
354 We view this perspective piece as a small step towards achieving that goal. We hope that readers are more
355 familiar with the benefits of using community-driven preprint servers and the unique initiatives they can
356 pursue. Community-driven preprint servers can set their own agenda and are driven by the needs and desires
357 of the community. Supporting these initiatives should be a priority for all researchers. Volunteers at
358 *EcoEvoRxiv* are encouraged to remain open to new and innovative ways to improve publication and open
359 science practices. Our analysis can be used to drive changes in *EcoEvoRxiv* to make it a better platform for
360 our community. We believe that the future of preprints is bright, and community-driven initiatives, such as
361 *EcoEvoRxiv* will play a crucial role in the future of scientific publishing.

362 **Data accessibility**

363 All data and code can be found on GitHub at: https://github.com/daniel1noble/ecoevo_1000. It is also
364 available on Zenodo, <https://zenodo.org/doi/10.5281/zenodo.13841039>.

365 **Competing interests**

366 The authors would like to acknowledge competing interests on the perspectives presented in this paper given
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