

EVALUATING TRADITIONAL PEER-REVIEW PROCESSES AND THEIR ALTERNATIVES: AN OPINIONATED DISCUSSION

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ABSTRACT. The advancement of science requires the timely and effective communication of important findings, which often takes the form of peer-reviewed journal articles. In the past decade, there has been significant changes in the world of scientific publishing with the rise of e-journals, open-access articles, and a greater volume of manuscript submissions. However, the overwhelming majority of journals (particularly in forestry) rely on a traditional peer-review model, which is often inefficient and ineffective. In this discussion, I evaluate the core assumptions of traditional peer-review processes, assess current alternatives to traditional peer-review, and provide recommendations for authors, reviewers, Associate Editors, and Editors. Overall, the intent of the discussion is to raise the importance of this issue and provide some suggestions for change.

Keywords: Scientific publications and journals, pre- and post-publication review, high volume and independent review

1 BACKGROUND

Peer-reviewed publications have long been the 'gold standard' for communicating important scientific findings and are one of the primary metrics of a researcher's productivity. In the last two decades, there have been dramatic changes in how scientific information is published, particularly with the tremendous rise in open-access articles and purely electronic journals like *Mathematical and Computational Forestry & Natural-Resource Sciences* (MCFNS). In fact, *MCFNS* was largely founded to improve how scientific findings were evaluated and presented (Cieszewski and Strub 2009). This significant rise in new journals has coincided with an ever increasing volume of both manuscript submissions and resulting publications. For example, *Forest Ecology and Management* transitioned from publishing 31 articles in 1979 to over 545 articles in 2014, which is a trend consistent (though not so dramatically) with other major journals in forestry (Figure 1).

Given an average acceptance rate of 20–40%, this suggests that most forestry journals are handling between approximately 300 to 1,500 manuscript submissions per year. Assuming that 30% of these submissions are rejected without review, this means each forestry journal needs an annual pool of 500 to 2,000 reviewers plus an editorial board of 20–30. Despite this tremendous change in volume, the process of obtaining peer-review

evaluations has largely remained the same since its origins in 17th century Europe and is relatively undisussed in the literature (Lee et al. 2013). Recently, Kangas and Hujala (2015) provided a succinct overview of current trends in scientific publishing including the need to reassess peer-review.

In traditional peer-review, a submitted manuscript is generally evaluated by the Editor and assigned to an Associate Editor (AE) whom is tasked with finding two or more independent reviewers and making a recommendation on acceptance or rejection. Although there are alternatives to this model (discussed below), nearly all journals in forestry and natural resources use a traditional peer-review process. In contrast, *MCFNS* uses a hybrid system that combines the advantages of the traditional peer-review process and alternative approaches including open public peer-review (Cieszewski and Strub 2009). Given the recent changes in the scientific publishing process, I believe it is time to reconsider how peer-review is conducted and acknowledged (e.g. *MCFNS*).

In this discussion, I highlight the primary assumptions of traditional peer-review processes, evaluate alternatives to it, and provide recommendations to authors, reviewers, AEs, and Editors. This discussion is based largely on my experiences as an author, reviewer, and AE for several major forestry journals as well as on the

current scientific literature on the topic. For example, I have been an author/co-author, reviewer, and AE for 60, 139, and 140 manuscripts since 2008, respectively.

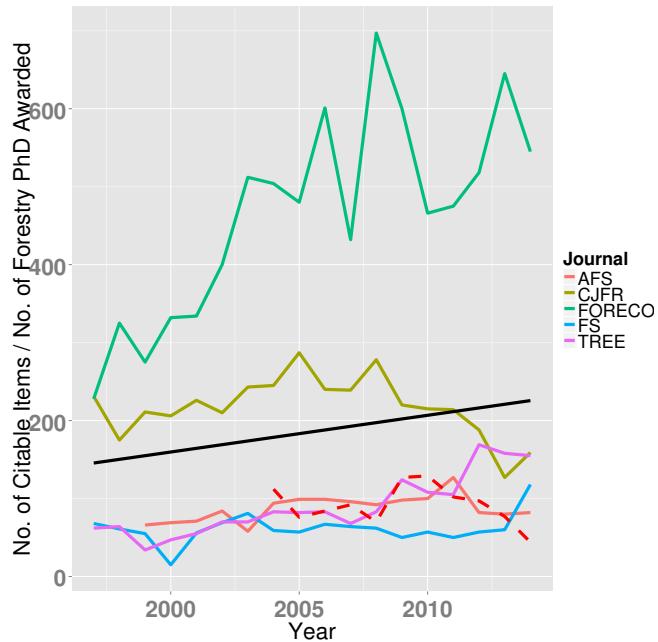


Figure 1: Number of citable items by year from 1997 to 2014 for the major forestry journals including *Annals of Forest Science* (AFS), *Canadian Journal of Forest Research* (CJFR), *Forest Ecology and Management* (FORECO), *Forest Science* (FS), and *Trees-Structure & Function* (TREE). The black line is a linear smoothed trend line, while the red dashed line is the number of forestry PhD degrees awarded by National Association of University Forest Resource Programs (NAUFRP) from 2004 to 2014. The citable item data was obtained from InCites™ Journal Citation Reports provided by Thompson Reuters and the degree data was from the USDA Food and Agriculture Education Information System (FAEIS; <http://faeis.ag.vt.edu/faeisrpt.cfm>)

2 TRADITIONAL PEER-REVIEW

Whether the peer-review process is open (authors and reviewers are disclosed), single-blind (authors disclosed and reviewers anonymous), or double-blind (both authors and reviewers are anonymous), the process is often inefficient and many times, ineffective. This is because traditional peer-review processes are based on several key assumptions including: (1) there is willing and qualified peer-reviewers to call upon for each submitted manuscript; (2) reviewers are internally incentivized to do quality work; (3) the process is unbiased; and (4) double-blind reviews with multiple reviewers is best. Os-

terloh and Frey (2015) also identified several other fundamental flaws of traditional peer-review processes including low prognostic quality, inconsistency over time, a lengthy and expensive ordeal with potential for significant delays, but only the four primary assumptions are discussed in detail below.

2.1 Willing and Able Reviewers Despite the tremendous rise in manuscript volume, there has not been a similar increase in the number of qualified peer-reviewers. In fact, the number of qualified peer-reviewers has likely significantly decreased given observed trends in undergraduate (Sharik et al. 2015) and graduate (Sharik and Lilieholm 2012) student enrollment in forestry and related natural resources fields, which have both steadily declined since 1980 in the United States. In addition, the US Forest Service has seen a 50% reduction in research scientists over the last 25 years (FRAC 2012). Although this trend might be specific to the United States, it does suggest a significant shift in research capacity in forestry. Consequently, this shift has made finding willing reviewers for submitted manuscripts rather difficult. Based on a sample of 64 manuscripts I have handled and sent out for peer-review as an AE for 4 international forestry journals (*Annals of Forest Research*, *European Journal of Forest Research*, *Forest Science*, and *New Zealand Journal of Forestry Sciences*) between 2011–2015, I have experienced an average rejection or no response rate by potential reviewers of $47.8 \pm 25.6\%$ (mean \pm SD). Based on this figure, I would need to contact 4.8 and 7.2 individuals to obtain two or three willing reviewers, respectively. In reality, these numbers are likely higher as I am quite selective in the individuals I invite to review and make the best effort to align authors and reviewers. Regardless, given the size of the forestry profession and particularly sub-disciplines like forest biometrics, these figures are highly unsustainable and not likely to improve.

Although these figures are poorer than the 20% potential reviewer rejection rate previously reported by a survey of scientists (Ware 2008), they are much better than what has been given for other fields. For example, the journal *Ecology* recently reported an average potential reviewer rejection rate of 70% (Brotons 2015). In fact, a recent manuscript submitted to a prestigious ecological journal was rejected because 15 potential reviewers in a row had refused to review it (Brotons 2015). This poses the interesting dilemma of whether manuscripts should be evaluated by the willingness of reviewers to evaluate it (Brotons 2015). For several manuscripts I have handled in the past few years, it is not uncommon to have contacted over ten individuals to find two willing reviewers and the manuscripts have often been rejected in the

end, which suggests that reviewer willingness to review might be one indicator of manuscript quality.

In my own experience as an AE, many of the willing reviewers are graduate students and other young researchers who have the time and desire to contribute, which is an observation that is supported by the 'principal-agent problem' (agent agrees to work in favor of another party in return for some incentives) in economics (García et al. 2015). This also creates an interesting dilemma as should relatively inexperienced researchers be given the critical duty of evaluating other potential scientific contributions that they may not fully understand or be confident enough to criticize? Recently, the publisher Springer introduced the Peer Reviewer Academy (<http://academy.springer.com/peer-review-academy>) that instructs individuals how to conduct and write a review, likely as means for increasing the pool of qualified reviewers. Despite the potential limitations of using graduate students and other early career scientists as reviewers, peer reviewing is a critical part of their education and training. However, for it to be truly effective, students and other early career scientists should be well mentored and supervised for their first few reviews as outlined by Browman (2004). This includes discussing the role of reviewers, the ethics involved, and the details of specific guidelines (Browman 2004). In fact, the majority (68%) of respondents in a large international survey felt that formal training would improve the quality of reviews and over 89% of the respondents less than 36 years in age indicated enjoying the review process (Mulligan et al. 2013).

Identifying and selecting suitable peer reviewers is a difficult task and one that many AEs struggle with. In fact, the majority (58%) of respondents in a large international survey indicated the primary reason for declining a review request was that the submission was outside of their area of expertise (Mulligan et al. 2013), which suggests that there is a potential issue with aligning reviewers with submitted manuscripts. Regardless, potential reviewers are often identified based on those suggested by the manuscript authors or determined by the AE as they were either cited in the submitted manuscript and/or have previously published research on the topic. However, rarely are the full credentials of the individual taken into consideration before being invited to review a manuscript. This flaw has been exploited as some authors have been caught reviewing their own papers with the creation of multiple false online identities (Ferguson et al. 2015). This highlights the lengths that some individuals are willing to go in order to be 'peer-reviewed', and places an extra burden on AEs to not use reviewers suggested by the manuscript authors, particularly when handling a manuscript that is outside of their expertise area (which is often the case).

Resolving this limitation will likely require moving to an alternative method of peer-review or finding a better way to align reviewers with manuscript submissions.

Overall, manuscript submissions are numerous and the number of available/willing reviewers are not. In fact, the most productive reviewers are often overloaded (Figure 2; Ware 2008), which is a condition I commonly refer to as 'peer reviewer fatigue' and is something I have personally reached in my own short career.

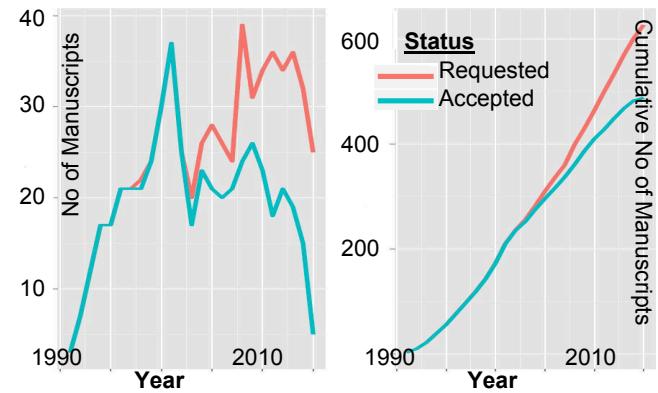


Figure 2: Observed annual (left) and cumulative (right) trends in review requests (blue) and accepted (red) assignments of a prominent North American forest biometrist by year from 1991 to 2015.

2.2 Incentivized Reviewers

Like many natural resources issues, peer-review has been described as the 'tragedy of the reviewer commons' (Hochberg et al. 2009) as a core assumption is that a pool of willing and able reviewers is available to evaluate each and every submitted manuscript with limited acknowledgment of actual reviewer contributions. Currently, credit is primarily given to number of publications (i.e. 'publish or perish') and not the number of completed manuscript reviews. This highlights a primary issue with the traditional peer-review process; i.e. what incentivizes reviewers to do quality work, given that their contributions are largely unacknowledged (i.e., the 'principal-agent problem'; García et al. 2015).

Currently, many journals offer incentives to potential reviewers such as the Canadian Journal of Forest Research's offer to provide a 'free reproduction of one colour plate (a value of \$950) in the next article you publish in the Canadian Journal of Forest Research, if you return your completed review within 2 weeks.' However, these incentives are largely based on time to respond and not the actual quality of the review. Journals generally acknowledge reviewer contributions by providing the names of all reviewers at the end of year and have recently started giving outstanding reviewer awards, but

professionally there is very limited acknowledgment of the time and effort required to conduct a quality review.

Ensuring quality is a difficult predicament for journals because reviewers are generally volunteers and most of the journals have not adapted methods for incentivizing volunteers. For example, one of the key elements of ensuring higher-quality volunteer contributions is to have systematic quality feedback systems (e.g., Moon and Sproull 2008), which most journals do not provide. However, the common practice of blind-carbon copying reviewers on the journal decision letter to the authors does allow reviewers to compare their recommendations to those of their peer(s). Interestingly, *MCFNS* and many of the Ecological Society of America journals currently allow AEs to rate individual reviewers based on their contributions. Although this is largely an internal system, it does prevent the use of non-useful or non-responsive reviewers in the future. In addition, the existence of websites like publons (<https://publons.com/>) does offer the potential for verifying the contributions of reviewers and providing reviewer merit rankings that are publicly available, which may also help to improve professional acknowledgment. Others have suggested incentivizing reviewers by establishing a reviewer exchange system in that authors must have accumulate credits for doing reviews before being able to submit manuscripts for publication (Mutz 2015). However, both publons and a reviewer exchange system focus primarily again on quantity rather than quality.

The current anonymity of reviewers and lack of accountability creates the potential for unprofessional situations. Recently, a reviewer accused a former PhD student of mine of being a 'liar' for accidentally using the wrong citation style. I have seen and heard about other type of unnecessary and unprofessional behavior during the review process. Although there has probably been an element of that type of behavior over time, I believe that it has potentially increased in recent years due to the pressure to publish, higher submission volumes, and greater demands on reviewers. Interestingly, other fields have also identified unruly and unprofessional reviewer behavior as a current issue in the peer-review process (e.g. Glen 2014). This type of behavior is unnecessary and creates a positive feedback loop, particularly for early career scientists, in that people believe that being harsh and condensing are acceptable practices during peer-review.

Reviewers differ primarily in their thoroughness as some give rather brief assessments of the manuscript, while others provide multiple pages of detailed feedback. A survey of researchers indicated that the average review takes 9 hours (median of 5 hours) to complete and they were primarily motivated by altruistic reasons rather than self-interested ones (Ware 2008), which was re-

cently confirmed with an empirical analysis by Sugimoto and Cronin (2013) (i.e. no 'ego' bias in reviewing). Although most manuscripts are between 10,000 and 15,000 words, reviews are often 556.2 ± 528.9 (mean \pm SD) words with no statistical difference in average review word counts between accepted and rejected manuscripts (Sugimoto and Cronin 2013). However, the maximum observed review word count went from 843 words for 'accept' recommendations, to over 4,800 words for 'reject' recommendations (Sugimoto and Cronin 2013). This highlights the large range in quality and quantity of reviewer feedback that can make decisions on manuscripts quite difficult. Consequently, a review should be long enough to provide the authors with enough direction to improve the manuscript, but concise enough in that they can fully comprehend the recommendations.

In short, reviewers and AEs are largely volunteers with limited incentives to do reviews, let alone doing quality reviews. Most reviewers and AEs are simply trying to maximize expected return minus the cost of effort (Garcia et al. 2015).

2.3 Unbiased Process Most judicial systems have an 'innocent until proven guilty' philosophy, while many peer-review situations have a 'guilty until proven innocent' stance (Huntoon 2009). Consequently, peer reviewers are assumed to be unbiased and correct in their assessments, while authors generally must address and refute each and every one of a reviewer's comments. Often it only takes one potential flaw raised by a reviewer, whether right or wrong, to lead to manuscript rejection. However, Lee et al. (2013) identified several sources of potential bias in the peer-review process with some of the most important being: (1) prestige, affiliation, nationality, language, and gender of the manuscript author; (2) content-based (manuscript is consistent with current standards); (3) ego (manuscript cites the journal or reviewer); (4) confirmation (manuscript findings align with current beliefs); and (5) publication (general preference towards positive rather negative outcomes).

Based on a review of the existing literature, Lee et al. (2013) did not find strong evidence of bias during the peer-review process, but did question whether impartiality should be upheld as the ideal for peer-review and called for the need to further evaluate the peer-review process. Recently, Walker et al. (2015) found strong support for biases caused by author gender and their institution, while previous studies have supported the existence of publication bias (e.g., Emerson et al. 2010). Consequently, some have considered publishing in a peer-review framework as a form of 'prostitution' between authors and reviewers (Frey 2003) as 25% of the authors in a survey of 173 published articles revised their

manuscript based on reviewer feedback, even if they felt the changes were incorrect (Bedeian 2003).

Recently, Siler et al. (2015) found that many highly cited articles were surprisingly initially rejected and then published elsewhere in a case study of 1,008 manuscripts to three elite medical journals, which illustrates the potential influences of the biases outlined by Lee et al. (2013). Siler et al. (2015) concluded that peer-review improved the quality of publications and was effective at identifying the 'good' contributions, but was not successful at identifying the outstanding or breakthrough contributions. Hence, peer-review has the tendency to maintain the 'status quo'.

2.4 Multiple, Double-blind Reviewers A standard for most journals is to obtain at least two double-blind reviewers to reduce potential biases and ensure effectiveness of the process, which is in agreement with the majority of researchers' current beliefs (Ware 2008). In contrast, most forestry journals are single-blind and generally prefer two reviewers (but one reviewer has been increasingly used). The Society of American Foresters *Forest Science* journal is one of the few forestry journal with a double-blind approach and has a general policy of requiring three reviewers. Unfortunately, I believe that double-blind has limited effectiveness (and likely a detrimental effect) in small fields like forestry as it is relatively easy to identify authors and can consequently lead to flawed reviews, which is consistent with findings in other fields (Hill and Provost 2003).

In addition, the policy of requiring three reviewers like *Forest Science* burdens the system and creates significant delays, while offering limited value. Interestingly, Sugimoto et al. (2013) found rather high variation in journal acceptance rates based on the number of qualified reviewers, and although there were several significant differences, there was no statistically significant difference between the acceptance rate for no reviewers (AE makes decision) and those with two reviewers at $p > 0.01$. The observed median acceptance rates were approximately 0.28, 0.40, 0.35, 0.22, and 0.25 for manuscripts with zero, one, two, three, and four or more external reviewers, respectively (Sugimoto et al. 2013). Moreover, Sugimoto et al. (2013) found a weak correlation between journal metrics like impact factor and article influence score and average acceptance rate, which suggests the limitation of using acceptance rate as a measure of journal quality. When the pool of available reviewers is relatively small, it appears there is a rather limited benefit to using more than two reviewers, particularly in a double-blind framework.

One of the issues with having multiple reviewers is the general low degree of consensus among reviewers on the same manuscript (Lee et al. 2013) with default generally

being rejection in situations like this. Osterloh and Frey (2015) highlight several studies that evaluated reviewer reliability, and it has generally been found to be quite low. In fact, Bornmann and Daniel (2009) highlight the key element of luck in peer-review as they found 23% of the manuscripts in an international chemistry journal (*Angewandte Chemie International Edition*) would have had a different outcome if a third reviewer was included in the decision. Clearly, this highlights the imperfections of the traditional peer-review model and suggests some improvements are necessary, which is in agreement the majority of scientists (Mulligan et al. 2013).

3 ALTERNATIVES TO TRADITIONAL PEER-REVIEW

As discussed by Lee et al. (2013), several alternatives to the traditional peer-review process exist and include: (1) pre-publication; (2) post-publication; (3) high volume; and (4) independent peer-review. Each is briefly described below and their advantages and disadvantages discussed (Table 1).

3.1 Pre-publication Peer-review In this model, a manuscript (pre-print) is generally posted online to a community of peers and feedback is provided. The revised manuscript can either be simply submitted to an Editor who decides on publication, or submitted to a more traditional peer-review process. Examples of pre-publication peer-review are ArXiv (<http://arxiv.org/>) and the University of California's eScholarship (<https://escholarship.org/>). The advantages of this approach are that it relies on a community of engaged researchers and is more transparent as the reviews are often posted online, while the disadvantages are that the same community gate-keepers could drive the process and a diverse as well as active community is required. In addition, an excessive amount of reviewer feedback could be obtained making revisions difficult and tedious.

3.2 Post-publication Peer-review In this model (also known as open or public review), documents are made available online and ratings and comments are permitted (non-anonymous and/or anonymous), which allows for a dialog between the authors and reviewers. The submitted documents can either be static or dynamic (e.g., Wikipedia) and can be retracted. The advantages of this approach are that there are no information gate-keepers, it is interactive, and open to all. The disadvantages are that it requires an engaged community, has limited filtering, and is prone to abuse. Examples include Faculty of 1000 (<http://f1000.com/>), PubPeer (<http://pubpeer.com/>), and journals such as

Table 1: Advantages and disadvantages of the various methods of peer-review.

Method	Advantages	Disadvantages
Traditional	Widely accepted and regarded; Effective at determining 'good' papers; Generally leads to improved manuscripts	Time-intensive; Often maintains the status quo; Limited interaction between authors and reviewers; Not effective at identifying outstanding or breakthrough papers; Heavily reliant on 2–3 peer reviewers
Pre-publication	Allows vetting from a community of reviewers; Reviews are generally open and available; Reviewers are genuinely interested in the work; Not limited to 2–3 peer reviewers	Community needs to be engaged; Manuscripts often submitted to a traditional peer-review outlet; Reviewers may limit criticisms if feedback is done openly; An excessive number of reviews could be obtained
Post-publication	No delays or information gate-keeping; Minimizes potential biases; Allows for a greater dialog between authors and reviewers; Open to all potential participants and not just scientists; Not limited to 2–3 peer reviewers	No filtering and significant potential for abuse; Requires an engaged community; reviewers may limit criticisms if feedback and ratings are not anonymous
High-volume	Focuses on methodological and presentation of findings rather than originality and uniqueness; Emphasis on efficiency	Limited interaction between authors and reviewers; Primarily relies on 2–3 reviewers
Independent	Reviews are independent of journal's scope and mission; Relies on a community of engaged reviewers; Not limited to 2–3 peer reviewers	Requires an engaged community of reviewers; Manuscripts often submitted to a traditional peer-review outlet; An excessive number of reviews could be obtained

Open Medicine (<http://www.openmedicine.ca/>). Although Kangas and Hujala (2015) supported this idea, no examples currently exist in forestry to my knowledge. At the University of Maine, the Center for Research on Sustainable Forests is currently experimenting with a post-publication review process. The website NorthEast Forest Information Source (NEFIS; <http://www.nefismembers.org/>) allows users to upload both previously published and unpublished documents as well as rate and comment on documents relevant to forest managers in the region.

3.3 High Volume Peer-review The goal of this approach is to efficiently evaluate and publish a high volume of scientific contributions. This is done by using a professional editorial board who make an initial evaluation and then assign it to an appropriate Academic Editor if they feel the submission has merit. The Academic Editor then assigns reviewers much like traditional peer-review, but the primary difference is that the reviewers are instructed to evaluate solely on scientific and methodological validity rather than perceived impact or uniqueness. The advantages of this system are that it is built on efficiency and attempts to minimize information gate-keepers, but it still

relies on invited peer reviewers and provides limited interactivity between reviewers and authors. Examples include PLOS ONE (<http://www.plosone.org/>), Peer J (<https://peerj.com/>), and SAGE Open (<http://sgo.sagepub.com/>).

3.4 Independent Peer-review Although similar to pre-publication peer-review, independent peer-review is slightly different as it is generally not associated with a particular publisher or even journal. Like pre-publication peer-review, a submission is posted to a community of potential reviewers, comments on the submission are solicited, and revisions to the submission made. These reviews can then be transferred to a traditional peer-review journal. The advantages are that it is an open process (like pre- and post-publication review), relies on a community of reviewers, the reviewers can select manuscripts that are of greatest interest to them, and reviews are independent of a particular journal's mission and scope, while the disadvantages are that the community of reviewers must be relatively large and engaged, it assumes journals are receptive to this type of model, and limited incentives for reviewer participation still remain. In addition, like pre-publication review, an excessive amount of reviewer feedback could be obtained,

which can make reasonable revisions difficult. Examples include Rubriq (<http://www.rubriq.com/>) and Peerage (<https://www.peerageofscience.org/>).

In particular, Peerage employs a rather unique model in that both manuscript authors and fellow reviewers rate and critique other reviewers on the quality of their assessment. This helps to ensure a quality review and provides reviewers with much-needed evaluation on their performance as well as recognition for their efforts.

4 RECOMMENDATIONS

Based on my experience as an author, reviewer, and AE as well as my assessment of the existing literature on peer-review, the following recommendations are provided for authors, reviewers, AEs, and Editors.

4.1 Authors

- *Be your own worst critic.* Given the plethora of journals that exist today, some authors adapt a 'submit and see' attitude where they'll simply 'shop' their manuscript around until it is finally accepted. This burdens the system and requires the involvement of multiple reviewers, so it is best to just submit to the journal with the 'best fit'. In today's digital world, publishing in a 'top-tier' journal does not mean the paper will be well cited. If the paper is meaningful, it will be found and cited, which is relatively easy to track and document today with websites like Google Scholar. Obtaining 'friendly-reviews' is a helpful and effective method that can help improve manuscript quality with minimal investment, but is often skipped in the rush to 'submit' (Hochberg et al. 2009). Many organizations like the US Forest Service require an 'internal' evaluation prior to submission and this should likely be adapted by other organizations too.

- *Don't simply recycle rejected papers.* If a manuscript is rejected, take the time to revise as suggested by the reviewers and/or AE rather than simply submit to another journal. On multiple occasions as both an AE and reviewer, I have received the exact same manuscript I had recommended for rejection at another journal with absolutely no consideration of my original suggestions. This is truly unacceptable. In fact, some journal like *Marine Ecology Progress Series* require authors to upload any and all former reviews on the manuscript and their replies to the comments to avoid this type of situation (Risgård 2003).

- *Suggest multiple reviewers that are actually likely to review your paper.* Finding qualified reviewers

is difficult and a significant contributor to the delay in the traditional peer-review process. This is because AEs must literally 'hunt down' potential reviewers and often nag them to complete the review. A lot of this could be resolved if manuscript authors suggested reviewers that were actually likely to review their manuscript. Senior researchers and other prominent figures in the field are unlikely to review the manuscript and are probably not worth suggesting. In addition, it is important to suggest individuals that are relatively independent of the authors to ensure a 'fair yet critical' review and not simply a 'friendly' review.

- *Push back when you feel a reviewer or AE is wrong.* People make mistakes, but this often is not fully acknowledged during the peer-review process as reviewers often act as rulers not partial to critical feedback (Tsang and Frey 2007). Too often, a rejected manuscript is simply submitted to another journal and the process starts over until successful. Based on current journal rejection rates, Hochberg et al. (2009) estimated that between 5 to 10 reviewers were required for every published article. Instead, it would be more efficient to make AEs and Editors reconsider something if there were errors in the original assessment. Alternatively, journals should be willing to assess revised manuscripts if the authors provide previous reviewer feedback and the changes made rather than start the peer-review process anew.
- *Review in proportion to your publications.* A general rule of thumb has been to review twice the number of your publications, but some suggest this should be much higher. Tracking the ratio of publications to reviews on websites like ResearchGate (<https://www.researchgate.net/>) would help shift the focus away from just publications and allow a fuller acknowledgement of reviewer contributions. Elsevier has recently created the Reviewer Recognition Platform (<http://www.reviewerrecognition.elsevier.com/>), which like publons (<https://publons.com/>) records and awards merit badges for reviewers. These reviewer achievements should be listed on CVs and acknowledged by scientist evaluation committees.

4.2 Reviewers

- *Adapt the Golden Rule.* As suggested by McPeek et al. (2009), reviewers should 'review for others as you would have others review for you.' Glen (2014) indicated that this be updated to 'if you wouldn't say it in person, don't say it in an anonymous re-

view.’ This includes refraining from insulting language, being constructive, and limiting insistence (Glen 2014). This is particularly important when handling manuscript submissions from early career scientists (given that the mentors have fully vetted the contribution). The goal of a review should be to help improve a manuscript and assess its general merit, which does not require belittling or other insulting forms of language.

- *Respond to review requests.* An important delay in the peer-review process is waiting to hear back from potential reviewers before inviting additional reviewers. A colleague of mine has said repeatedly that he can’t delete those review requests fast enough despite typically publishing four to six articles per year. Even if you are unable to do the review, a quick reply helps to keep the process moving along. Suggesting additional potential reviewers is helpful too, as most AEs are handling manuscripts that are outside of their expertise.
- *Complete the review if you agree to do it.* Multiple times a reviewer is quick to agree to do the review, but then becomes non-responsive when the review becomes due. This is even more disruptive to the review process than the last item listed above as generally three to four weeks have elapsed since the reviewer agreed and the AE now must either find someone else to do the review or make a recommendation based on a single reviewer’s feedback. Also, I don’t consider a simple ‘looks fine’ or even no comment as an acceptable review.

4.3 Associate Editors

- *Do your job.* The role of the AE is to interface between the authors and journal Editor. To do this, you must find qualified reviewers with some expertise on the topic, ensure they provide a quality review, and make a recommendation based on their feedback. This generally includes synthesizing the findings of the reviewers and helping the authors to identify the key changes that are needed given that reviewers may often provide conflicting recommendations. Too often, the AEs rely solely on the reviewer feedback and increasingly, I have found myself being the sole reviewer on a manuscript with no feedback from the AE, which I don’t believe is fair to the authors or the peer-review process.
- *Do not fear to reject without review.* AEs generally earn their appointment by demonstrating their ability to produce high-quality publications and should know what is publishable or not. Given that volume is relatively high, reviewer availability low, and

manuscript quality varying widely, I do not believe that since a manuscript was submitted that it deserves to be reviewed. Although I tend to give early career authors the benefit of the doubt and obtain reviews when possible, I am quite careful to make sure that each and every manuscript is ready for review before sending it out.

Recently, I reviewed two separate manuscripts for ‘top-tier’ forestry journals that had a non-native English-speaking first author and a ‘prominent’ co-author, but both manuscripts probably should not have gone out for review due to significant language, presentation, and methodological issues, which implies that the co-authors never read the manuscript. However, if an AE rejects without review, they should at least provide sufficient justification for their decision and include several suggestions for improvement rather than simply claiming poor fit for journal or other meaningless feedback. Schimel et al. (2014) provided an interesting discussion on the reject without review debate.

- *Do not request reviews from fellow AEs.* By the nature of the duty, most AEs are rather busy people and not likely to be available as reviewers, particularly in a pinch. Serving as an AE is a demanding and time-consuming assignment, which leaves little time to do additional reviews given that most AEs have other full-time jobs. In particular, I believe it is important to avoid inviting AEs to be reviewers, particularly for the same journal they are currently serving. A journal I formerly served for as an AE has a tendency to request reviews from fellow AEs and had no internal system for designating members of its own editorial board. Despite highlighting the need to change this, I received a flawed review from a fellow AE who was serving as last minute stand-in for a reviewer that had failed to deliver. I fear this happens all too often. To prevent this, a journal should identify editorial board members, notify AEs when they select a fellow AE as a reviewer, and allow across-journal identification of both reviewers as well as AEs for journals that share a common online platform (e.g. <http://www.editorialmanager.com/>).
- *Remove inappropriate or insulting reviewer feedback.* Glen (2014) highlights the detrimental effects of harsh reviews, particularly on young researchers. This is often unnecessary and unprofessional, while its removal often doesn’t alter the review. As mentioned above, this type of language is particularly detrimental for early career scientists as it demoralizes them and creates a positive feedback in that

individuals believe it is acceptable to write harsh language in reviews.

4.4 Editors

- *Be open to change.* The world of scientific publishing is currently changing rapidly and new ways of doing things are much needed. AEs have a pretty good sense of current issues and their feedback should be solicited regularly on what is and is not working. When I became an AE for a certain forestry journal, I sent the Editor a reasonable list of potential ideas to consider and I received a long email essentially detailing why most of the ideas were not sound or unreasonable. Hence, I am no longer an AE at that journal.
- *Provide AEs with feedback.* Just like reviewers, AEs need to be incentivized and it is easy to simply let them do their thing with limited interaction, except assignment of manuscripts. In the last five years I have been serving as an AE, I have never once received any positive or negative feedback from the Editor, which makes me wonder if one or the other of us is not doing their job. The type of feedback can range from a simple note of appreciation to more quantitative assessments like response time, average days to decision, and workload.
- *Consider new ways of reviewer evaluation.* Currently, most journals require reviewers to submit a decision on manuscript acceptance. Instead, it might be more effective to encourage reviewers to simply provide suggestions for improvement, with the decision placed on the AE or Editor (Armstrong 1997). Alternatively, journals could move to an 'as-is' review process where the recommendation is either accept or reject based on one round of revisions (journals today are requesting 2–4 rounds of revisions by reviewers) (Tsang and Frey 2007). To ensure coherent and concise reviews, Peerage uses a standard review template and limits reviews to 1,000 words.
- *Allow AEs and authors to rate reviewers.* As noted by García et al. (2015), keeping detailed records on reviewers allows a better assessment of their capabilities to provide quality reviews. Most journals just keep information on the number of reviews completed, date of last review invitation/acceptance, and average days to respond, which are not particularly helpful in determining if the individual will provide a quality review. As stated above, Ecological Society of America journals and *MCFNS* allow AEs to rate reviewers based on the quality of their reviews, which is helpful in

selecting individuals who can make useful contributions to authors. To my knowledge, Peerage remains one of the few peer-review systems that allows both reviewers and authors to rate each other.

- *Identify the handling AE and the reviewers on each publication.* Although handling AEs are currently identified in several forestry journals like *Annals of Forest Science*, *European Journal of Forest Research*, and *MCFNS*, this should become standard practice and be expanded to include the reviewers. This practice acknowledges the contributions of individuals involved during the review process and allows accountability in the system. Also, if reviewers were aware of this practice, they may limit unprofessional behavior. In a recent survey, 45% indicated that having your name published alongside the paper as a reviewer would make them much less or less likely to review a manuscript, while 18% responded that it would make them much more or more likely to review a manuscript (Mulligan et al. 2013).
- *Diversify editorial boards.* Scientific publishing is a truly international practice now with a growing number of manuscript submissions and reviewers from non-Western countries. However, most editorial boards in forestry are primarily from Western countries. For example, the editorial boards of *Forest Science* and *European Journal of Forest Research* are 92% North American and European, respectively, with no representation of non-Western countries. In 2014, a prominent international forestry journal had at least 35% of its submissions from non-Western countries. Diversifying editorial boards, particularly with greater representation of non-Western countries, can help handle the greater number of manuscript submissions coming from non-Western countries. Currently, *MCFNS* has one of the most diverse editorial boards in forestry with representation from non-Western countries, which should be replicated by other journals in the field.
- *Enact and enforce term limits on editorial boards.* Editorial boards should be dynamic and reflective of the current composition of incoming manuscript both in terms of geography and topic. In contrast, most editorial boards are static and change only occurs when someone resigns. Allowing for more turn-over in editorial boards prevents stagnation, increases innovation, and maintains diversity. In addition, this promotes AEs with an 'end in sight' perspective rather than simple frustration with the endless and largely unacknowledged drudgery.

- *Maintain and provide data on your journal.* Although many journals are willing to report (and even promote) their impact factor, rejection rates, and editorial boards, fewer provide data on average reviewer response rates, time to decision, AE consistency, or country of origin for manuscripts. In fact, I requested this information from several forestry journals in preparing this discussion and either received no response or a response suggesting that they did not track this information.
- *Do not 'penalize' efficient AEs with more assignments.* AEs differ greatly in their responsiveness and most journals have a goal of providing authors with a decision within 60 days of submission. Based on data provided from a prominent forestry journal in 2014, the average time to first decision was nearly 75 days with a range between 0 to well over 200 days and relatively large variation between AEs. Consequently, Editors might avoid using 'slow' AEs in favor of 'fast' ones. For example, I have always notified the Editor that I would handle a set number of manuscripts per year (e.g. 10–15) before accepting an AE position, but most Editors have exceeded that requested number by 100–200% with limited ability to decline potential assignments. This suggests that there is a need to increase the size of current editorial boards and better balance the workload between AEs.
- *Consider moving to an alternative method of peer-review.* Despite the prevalence of traditional peer-review, there are advantages to the alternative methods described above for both authors and reviewers. Even hybridizing traditional peer-review with an alternative method is a positive step forward. This can be as simple as allowing registered users to provide comments on a publication (e.g., PubPeer) or publishing the un-edited reviews along with the final, accepted paper. This recommendation was echoed in the review of Kangas and Hujala (2015), but nearly all journals in forestry (except MFCNS) rely on a traditional peer-review process.

5 CONCLUSIONS

Peer-review has been likened to a mythology (Macdonald 2014) and a 'sacred cow' (e.g., Osterloh and Kieser 2015), but still remains the most trusted source of scientific findings even in the digital era (Nicholas et al. 2015). The survey of Ware (2008) indicated that 90% of the surveyed researchers believe that peer-review improves the quality of the published paper and most (64%) were satisfied with the current system, but only 32% of the respondents in a large international survey

across disciplines believe that the current system is the best we can achieve (Mulligan et al. 2013).

As identified above, there are several reasons of concern with the current system and the situation is not likely to improve with the increasing demand for peer-reviewed publications. Improving the situation can range from relatively simple solutions like modifying how reviewers provide feedback (e.g., Tsang and Frey 2007) to changing the entire process with the use of an alternative system. Likely, requiring reviewers to sign an oath (e.g., Aleksic et al 2014) is unnecessary, but might not hurt.

Ultimately, I think a key solution to the issue is incentivizing authors that quality rather than quantity counts. This is possible today because a variety of citation metrics and altmetrics can be used to assess the relative influence of publications (Sud and Thelwall 2014). Technology will continue to make tracking these metrics possible and provide addition assessment of 'impact', but real change will only likely happen when scientist evaluation committees begin modifying their standards and recognizing the importance of reviewing. This might just move the bar from being simply 'published' to 'published and useful' with a more limited burden for peer reviewers.

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