

Sixty years of ecology with impact

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Abstract

1. *Journal of Applied Ecology* celebrates its 60th birthday in 2024. In this Editorial, we explore how the journal's role has changed since its launch and investigate whether the articles we publish are achieving real-world impact.
2. We designed and ran an author survey for all authors who have published with us between 2017-2021. Authors were asked if their publication achieved real-world impact, and if so, how they achieved it. Forty four percent of respondents achieved real-world impact with their paper, primarily citing engagement with key stakeholders as the reason for this impact.
3. We also assessed our impact in online policy documentation, comparing this to our citations in the published scientific literature. We are the most highly cited British Ecological Society journal for policy mentions with over 2800 citations in total. We also found a weak correlation between policy citations and citations in academic literature, which highlights that fact that paper with relatively few academic citations can have large real-world impact.
4. *Synthesis and application*. Whilst these results are encouraging, there are significant challenges involved in achieving and measuring impact scale. To help address some of these, we launch here a suite of new author services to help our authors to achieve real-world impact with their work. This includes offering plain language summaries and the opportunity to present findings to British Ecological Society's stakeholder community.

Introduction

The multiple environmental challenges facing society require strong evidence-based science to resolve them. Over the years, *Journal of Applied Ecology* has curated and published influential and rigorous applied ecological science with the aim of informing policy and practice and achieving real-world impact. Since our inception in 1964 (Figure 1), we have been a mission oriented journal, with the opening editorial emphasising how “the scope and tasks of applied ecology cannot but increase [...] as development accelerates throughout the world” (Bunting and Wynne-Edwards 1964). However, the initial emphasis was mainly on how ecology could “contribute to the progress of mankind” and “the need to expand the output of food”, with work in the first decades tending to focus on improving the productivity of agricultural ecosystems and the biology of pests (Milner Gulland *et al.*, 2013).

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CONTENTS

	PAGE
Editorial	1
J. N. Black. An analysis of the potential production of swards of subterranean clover (<i>Trifolium subterraneum</i> L.) at Adelaide, South Australia	3
J. B. Free. The behaviour of honeybees on sunflowers (<i>Helianthus annuus</i> L.)	19
A. J. Rutter. Studies in the water relations of <i>Pinus sylvestris</i> in plantation conditions. II. The annual cycle of soil moisture change and derived estimates of evaporation	29
J. P. Cooper. Climatic variation in forage grasses. I. Leaf development in climatic races of <i>Lolium</i> and <i>Dactylis</i>	45
A. D. Ansell, K. F. Lander, J. Coughlan and F. A. Loosmore. Studies on the hard-shell clam, <i>Venus mercenaria</i> , in British waters. I. Growth and reproduction in natural and experimental colonies	63
A. D. Ansell, F. A. Loosmore and K. F. Lander. Studies on the hard-shell clam, <i>Venus mercenaria</i> , in British waters. II. Seasonal cycle in condition and biochemical composition	83
R. W. Edwards, H. Egan, M. A. Learner and P. J. Maris. The control of chironomid larvae in ponds, using TDE (DDD)	97
M. E. Solomon, S. T. Hill, A. M. Cunningham and G. Ayerst. Storage fungi antagonistic to the flour mite (<i>Acarus siro</i> L.)	119
Donald A. Spencer. Porcupine population fluctuations in past centuries revealed by dendrochronology	127
F. H. W. Green. A map of annual average potential water deficit in the British Isles	151
B. P. Uvarov. Problems of insect ecology in developing countries	159
G. Szeicz, J. L. Monteith and J. M. dos Santos. Tube solarimeter to measure radiation among plants	169
J. D. Ovington and D. B. Lawrence. Strontium 90 in maize field, cattail marsh and oakwood ecosystems	175
David Jenkins, Adam Watson and G. R. Miller. Predation and red grouse populations	183
R. H. M. Langer, S. M. Ryle and O. R. Jewiss. The changing plant and tiller populations of timothy and meadow fescue swards. I. Plant survival and the pattern of tillering	197
H. D. Jordan. The relation of vegetation and soil to development of mangrove swamps for rice growing in Sierra Leone	209
Reviews	213
British Ecological Society Summer Meeting 1963 at Bristol	217

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Figure 1: The first issue of *Journal of Applied Ecology* from May 1964 shows the first editorial board was made up of just two Editors and nine Editorial Board members who were all men based in the UK. We now have a Senior Editor team representing three continents, a Commissioning Editor from a fourth and an Editorial Board of over 100 representing every inhabited continent. The board spans 26 countries and women now make up 35% of the board; figures which demonstrate progress and the need for further improvement. Articles in the first issue include ‘The behaviour of honeybees on sunflowers (*Helianthus annuus* L.)’ (Free, 1964), ‘Storage fungi antagonistic to the flour mite (*Acarus siro* L.)’ (Solomon *et al.*,

1964), and 'Porcupine population fluctuations in past centuries revealed by dendrochronology' (Spencer, 1964).

The journal's focus began to shift in the 1990s when conservation and biodiversity became more prominent and there was increasing attention on agriculture's role in driving species loss and other environmental problems (Milner Gulland *et al*, 2013). The changing nature of the submitted manuscripts led to the journal introducing the requirement that the final point of the abstract summarised the "synthesis and application" in 2003, followed by a change of scope in 2005 (Freckleton *et al*, 2005), towards a focus on ecological research that directly informs management practice. We launched 'Practitioners' Perspectives' articles in 2011 to encourage greater communication and collaboration between researchers and practitioners (Hulme, 2011), and added the option of framing the final point of the abstract around "policy implications" in 2014, recognising that some manuscripts were targeting specific policy fora. See Figure 2 for a full overview of the journal's milestones. This was followed in 2015 by the 'Policy Directions' article type, with the option of a rapid peer review process for articles relating specifically to time-sensitive policy decisions.

In 2012, the Editors noted another problem (Milner Gulland *et al*, 2012); how to capture and quantify whether recommendations made in the journal were affecting change in the real world. This was not just a journal issue – research councils in the UK also began to demand greater understanding of the societal impacts of research, with impact case studies becoming part of the UK's Research Excellence Framework (REF) in 2014 (<https://impact.ref.ac.uk/casestudies/>). However, the REF approach has been largely narrative with limited hard evidence of real influence or outcomes (Khazragui and Hudson, 2015). While REF and other similar evaluation activities around the world attempt to measure impact to determine whether research funding is well-spent (Bornmann, 2016), we are interested in understanding *when* and *how* applied ecology research makes an effective difference in management of the natural environment.

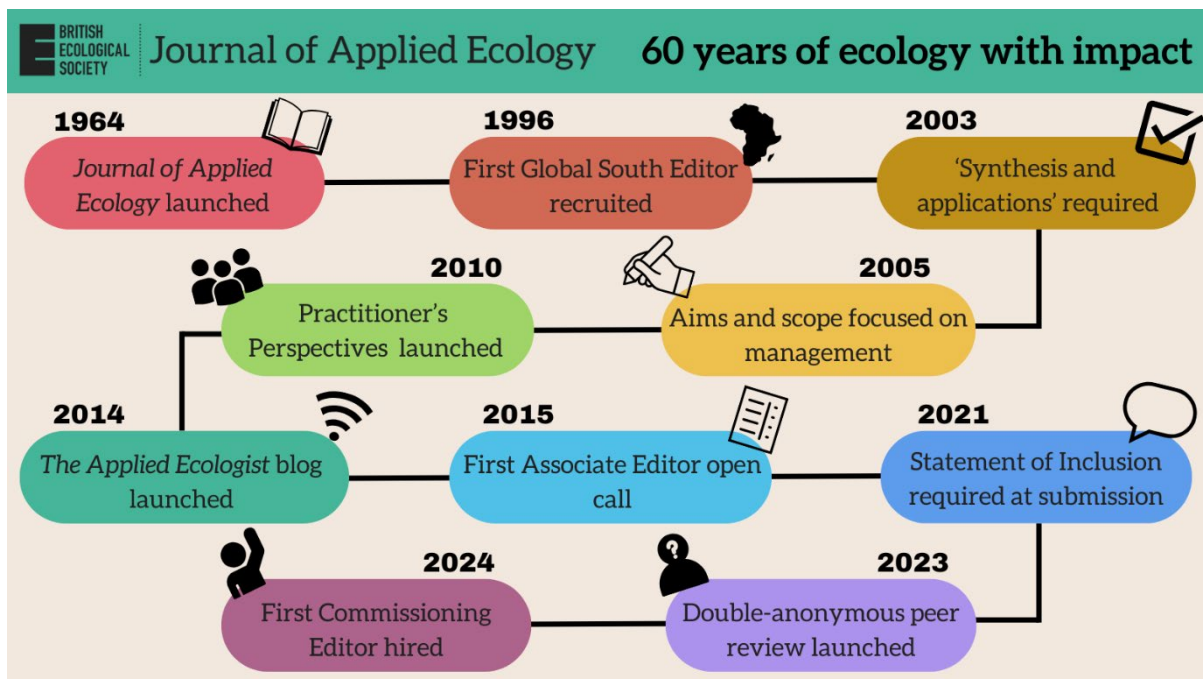


Figure 2: Overview of *Journal of Applied Ecology's* last 60 years and some of the steps that have been taken to improve reach and visibility of the journal, and achieve real-world impact.

There are many ways of measuring impact (Milner-Gulland *et al*, 2012; Bornmann, 2016), but it is important to distinguish between real impact (a change in a policy or practice) and the *pathways* to impact (e.g. dissemination to key stakeholders). As a journal, we strive to support authors in both, but we haven't yet quantified these activities. Here, we aim to close this gap, reporting on how authors achieved real-world impact, and on how frequently papers published in the journal are used as a source in policy documents. We use these results to discuss the challenges and opportunities for enhancing real-world influence.

Impact Survey

To understand the author-led dissemination of our published papers, we designed and launched a web-based survey in November 2023. The survey was sent to all corresponding authors who had published in *Journal of Applied Ecology* from 2017 to 2021, regardless of publication type, topic or career stage – successfully reaching 919 authors after 150 email bounces. A total of 152 responses were recorded. Of these, 84% were based in the Global North and 16% in the Global South, which closely reflects authorship in the journal during this period (85% Global North, 15% Global South).

As recommended by White *et al.* (2005), the survey employed closed-format questions to target factual information and, following on from this, open-ended questions with free text responses to better understand respondents' thought-processes and resulting actions (see Appendix 1 for the complete list of survey questions). When opening the survey, respondents were presented with UKRI's (2022) definition of impact – "an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia" – to situate our questions.

Of those that responded, 44% indicated that their articles achieved real-world impact and, interestingly, 97% stated that they considered the possible impact of their work when writing up their articles. These results are certainly encouraging and well-aligned with the journal's key aim of providing a high-quality evidence base for scientists, managers and policymakers. Seventy one percent of respondents actively took steps to create pathways to impact and disseminate their research. Of those that did achieve impact, they did it mostly through engaging with stakeholders, either through talks (73%) or meetings (66%), though press releases, news articles and blogs were also common (66%), and inclusion in policy documents (54%).

The first-hand narratives shared by authors were particularly interesting, demonstrating how results became impactful and that impact can take many forms. In some cases, impact can also be traced to singular papers that are able to trigger fast-paced change in behaviours, often through a dual approach of talks with stakeholders, press releases and inclusion in policy reports. For instance, Warne *et al.*'s (2021) work around the recovery dynamics of coral reefs led "directly to changes in calculations of reef health indicators maintained by the Australian Institute of Marine Science". Similarly, Hradsky *et al.*'s (2019) development of a simulation model to predict red fox population dynamics saw governmental and non-governmental land managers alike using the model to inform management programs throughout Victoria, Australia. In other cases, impact can be borne out of the collective efforts of many research teams and published articles. Pesendorfer *et al.*'s (2018) study on the role of birds in dispersing seeds to restore Oak trees highlights how "together with other papers, we are starting to convince managers" about the merits of harnessing ecosystem services by corvid seed dispersers. Here, real-world impact has been achieved through development of a strong body of work and the joint efforts of multiple research groups.

These examples and other author feedback uncover different pathways to impact, each one with its own unique actors and narratives, and enabling and boundary conditions - highlighting that impact is multi-faceted and non-linear (Barlow *et al.*, 2016), and there is no single way to navigate the space between research and impact (Toomey *et al.*, 2016). While one study may have been integral in enforcing fast-paced changes in the management of a system, another may have less direct implications – often linking into a broader body of literature which triggers policy changes further downstream. To share the papers which link to such stories, we have put together a Virtual Issue featuring a range of papers which achieved real-world impact between 2017 and 2021, and will be sharing more in-depth stories of applied ecology's successes and failures on our blog (<https://appliedecologistsblog.com/>).

Citations within online policy documents

In addition to the author impact survey, we undertook searches in Altmetric (altmetric.com), identifying online policy mentions for all British Ecological Society journals. A policy mention is logged in Altmetric and other impact tracker tools if the DOI of the paper is referenced in the policy document.

As of July 2024, *Journal of Applied Ecology* has been cited 2880 times in policy documents. Citations in policy reports were limited before 1998, probably reflecting the lack of online policy

documents that can be searched by Altmetric. Total annual citations in policy documents rose steadily over the first two decades of the 21st Century, with nearly a third (28%) of these citations in the last 10 years. There was a decline in citations from 2021, likely reflecting the fact it takes time for a journal article to be cited in policy documents. The peak in 2020 is therefore an outcome of two contrasting patterns: the steady increase in policy citations over time versus the lag between publication and citation (Figure 3a). Most of the policy citations of *Journal of Applied Ecology* captured in the Altmetric database are from the USA and European countries, with the UK having the most number of policy mentions (Figure 3b).

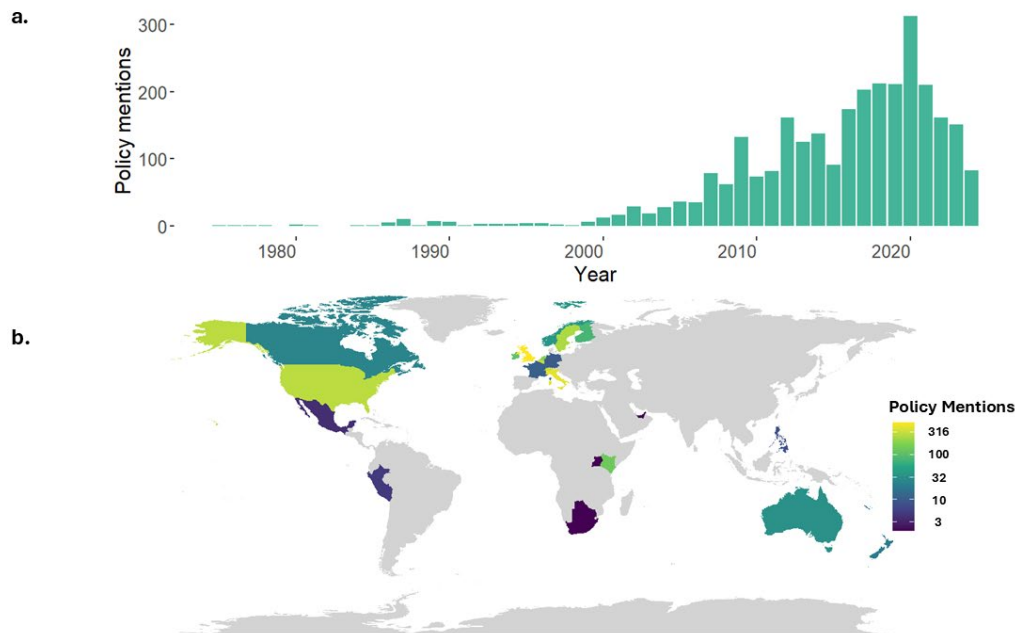


Figure 3 **a**: Policy mentions per year since the journal's launch derived from the Altmetric database (altmetric.com). **b**. All time policy document mentions per country: Australia (32), Belgium (315), Botswana (1), Canada (24), Finland (78), France (10), Germany (9), Ireland (111), Italy (408), Kenya (135), Luxembourg (160), Mexico (3), Netherlands (181), New Caledonia (14), New Zealand (19), Norway (36), Peru (4), Philippines (7), South Africa (1), Sweden (249), Switzerland (317), Uganda (1), United Arab Emirates (1), UK (510), USA (280).

When compared to the other British Ecological Society journals it is clear that *Journal of Applied Ecology* and *People and Nature* are achieving their aim of impacting real-world policy (Figure 4). Whilst *Journal of Applied Ecology* has by far the highest number of policy mentions, and it and *People and Nature* have the greatest number of policy mentions per paper published.

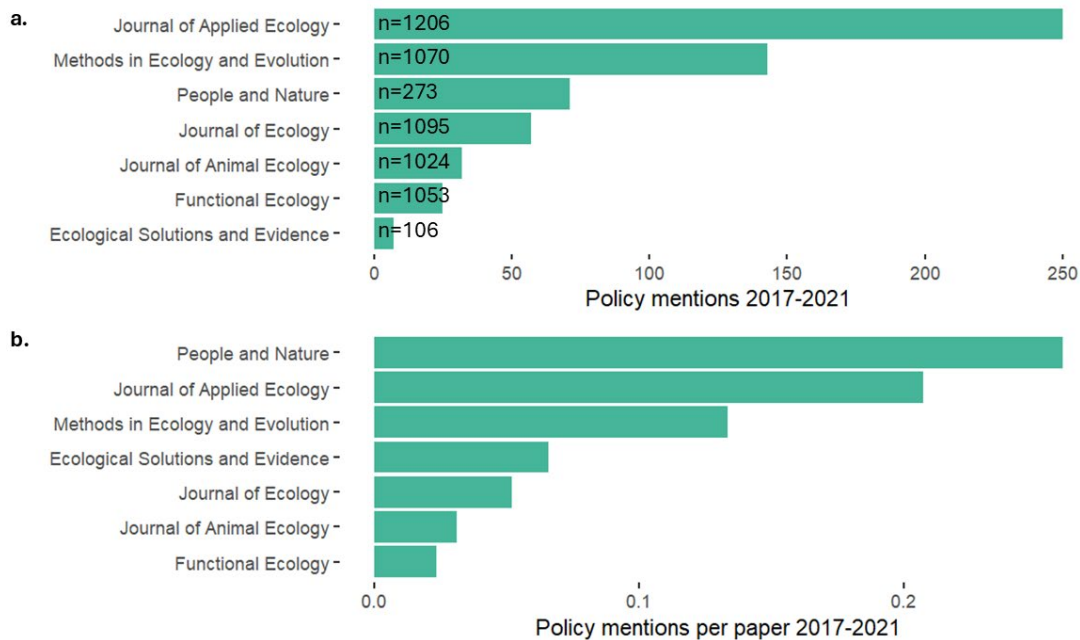


Figure 4 **a.** Total policy mentions over the study period 2017-2021 for all journals: n = number of publications in the period derived from the Altmetric database (altmetric.com). **b.** Policy mentions per paper over the study period 2017-2021.

Interestingly, when we compared policy mentions to article citations, there was only a weak correlation over the study period with the Spearman's rank correlation coefficient ranging between 0.13 in 2019 and 0.30 in 2018 ($P < 0.05$ in 2017, 2018, 2019, 2021). The weak correlation holds even when separating article types (i.e. reviews, or practitioner perspectives). Taken together, these results show that a paper that is highly cited within the academic literature will not necessarily be impactful in terms of policy and practice and a paper that is not highly cited in the academic literature could be having impact elsewhere. As a journal whose mission it is to affect real-world change, and which places value on this more than other metrics which do not capture article usage outside of academia, the extent and breadth of our author's policy impact is rewarding to see.

Challenges for achieving and measuring impact

While it is clear from the survey and Altmetric analysis that many of our authors make efforts to disseminate their work and inform stakeholders of their findings, it is also clear that this is a challenging process. In total, 29% of survey respondents either did not, or only somewhat shared their research beyond academic circles. There were multiple reasons for this, with respondents mentioning that: they did not gather the evidence of impact (53%); that they lacked the resources or funding needed (25%); they found managers or stakeholders had minimal interest (8%); were too busy to present findings to stakeholders (7%); or simply that their paper was aimed at academics rather than practitioners, policymakers or society (7%). Additional comments in this section mentioned other factors such as being too early in their career to trigger and trace possible impact and, in one case, the outbreak of conflict.

Measuring real-world impact is also challenging, and surveys of author-declared impact may over-represent positive stories or be answered more willingly by those already engaged in the impact space. For citation-based data, there is a reliance on the policy documents to correctly reference the journal and article DOI. The conspicuous lack of any policy mentions in the Altmetric database from China or Brazil - our 5th and 6th most represented countries by authorship - as well as other countries in Asia, Latin America and Africa, highlights the limitations of online approaches to tracking policy impact. Policy mentions will be missed if the policy documents are not publicly made available online, are not written in the Roman alphabet, or if the original source is incorrectly cited (i.e. lacks the DOI). Pathways to impact could also be constrained if the research is only published in a language which is not widely used in the country. In checking the Altmetric output, we also found some documents were duplicated, which artificially inflated the score of some articles. For example, UN documents published in both English and French were counted twice by Altmetric, which may partly explain Belgium's high number.

Enhancing impact and its measurement

Despite these and other challenges, *Journal of Applied Ecology* is clearly affecting real-world change. In order to remain a leading venue for applied research, we must continually reflect on how we do things, who this is including or excluding, and how to ensure all contributors to our community are valued.

Achieving Impact Through Diversity, Equity and Inclusion

Diversity of authors is key to broadening impact as most of our readers and papers come from Europe and North America (Nuñez *et al.*, 2019). However, we have seen some improvement in this; between 2017 and 2021 the number of countries that were represented in our authorship increased from 53 to 70 and the percentage of the journal's authors from the Global South increased from 10% to 18%. We have also tried to increase accessibility of the journal. Our aims and scope can now be read in English, Spanish, Portuguese, Mandarin, and Hindi. To increase access in countries where the research took place, we have made some research from Global South authors free to read via our annual [Global South Spotlight](#) series, and we also offer authors the opportunity to publish their abstracts and blogs in multiple languages. Finally, double-anonymous peer review was introduced because it has been shown to reduce bias in the review system (Fox *et al.*, 2023).

Global North researchers working in the Global South are most beneficial when research programmes are respectful, enduring and factor in pathways to influence local policy or processes (Haelewaters *et al.*, 2021). Therefore, we encourage our authors to build meaningful relationships with local researchers that are mutually beneficial rather than extractive. To support this and avoid helicopter science, we were one of the first journals to introduce 'Statements of Inclusion' at the manuscript submission stage, where all authors must describe the ways they engaged with local researchers (Pettorelli *et al.*, 2021). We also recently published an Editorial on the importance of including multiple languages in literature searches when assessing the current state of knowledge in a topic (Zenni *et al.*, 2023).

Listening to and co-developing science with Practitioners

As an applied journal, we are committed to strengthening links with practitioners and policymakers, something that remains a challenge due to the differing demands of practitioners and the inaccessibility of scientific literature (e.g. Pullin *et al*, 2004). But these long-identified science-implementation gaps (Knight *et al*, 2008) are not insurmountable, and we are pleased to have published 54 Practitioners' Perspectives since 2010, covering a diverse range of topics from converting scientific knowledge into practice to aid peatland restoration (Anderson, 2014), the co-creation of models to target social and ecological decision-making in coastal management (Wongbusarakum *et al*, 2019), and standardising broadly-applicable methods to monitor vultures (Perrig *et al*, 2019). Policy Directions articles have also been successful since their introduction in 2014, and the 38 articles cover topics such as the management of spontaneous forest expansion in the Mediterranean (Varela *et al*, 2020), case studies showcasing the strength of citizen science to define low-risk collision areas for wind energy development (Ruiz-Gutierrez *et al*, 2021), and calls for policy to better recognise the threat of escapee non-native aquatic species (Ju *et al*, 2019). In 2024 we appointed our first Commissioning Editor - Kulbhushansingh Suryawanshi - to actively support collaboration between ecological practitioners and scientists through Practitioners' Perspectives and Policy Directions papers.

Reaching non-academic audiences

Much of the feedback from the Impact Survey had one clear request; that we further support authors in translating their work for non-academic audiences. We are therefore introducing Plain Language Summaries. From 2025, authors will be able to optionally submit a short, plain language summary of their paper in English, or in any local language. These short summaries should contextualise the study and its management implications, providing a take-home message which is free of jargon. The summary will be assessed and edited by our Assistant Editor, who will ensure that the summary is clear and valuable to a non-academic audience. This summary will then be published - free to read - alongside the paper, increasing the accessibility of the science we publish to policymakers, practitioners, and the general public.

Another popular request in the Impact Survey was for us to support our authors to connect with relevant stakeholders. We have therefore decided to offer free, live, online workshops tailored for a practitioner audience as a free author benefit. Our online workshops will utilise the British Ecological Society's existing practitioner connections, as well as other agencies around the world, to provide an online forum for authors to share their work with the people who it is most relevant for. These workshops will be run in collaboration with Applied Ecology Resources - the British Ecological Society's grey literature platform - and will be offered as guest sessions of the already successful [AER Live](#) series.

Non-Traditional Media Platforms

Journal of Applied Ecology has successfully established a secure presence on new forms of media, actively sharing details of new articles across various social media channels to a combined audience of over 55,000 at the time of writing. We also frequently share research summaries and topical contributions written by authors – acting as an avenue between ecologists and the wider public. In 2023, our blog had over 89,000 total views – the highest annual amount to-date since its launch in 2014. These non-traditional media forms are an

important pathway to impact, allowing ecologists of any background a platform to share their research in an accessible format. They can be particularly useful for Early Career Researchers and authors from the Global South who may lack experience or funding (Pettorelli *et al*, 2021).

These new initiatives, added to our existing pathways to impact that we facilitate for authors (Figure 5) will help authors to share their research with relevant stakeholders in a way that works best for them. The hope is this will lead to even greater impact in policy and practice.

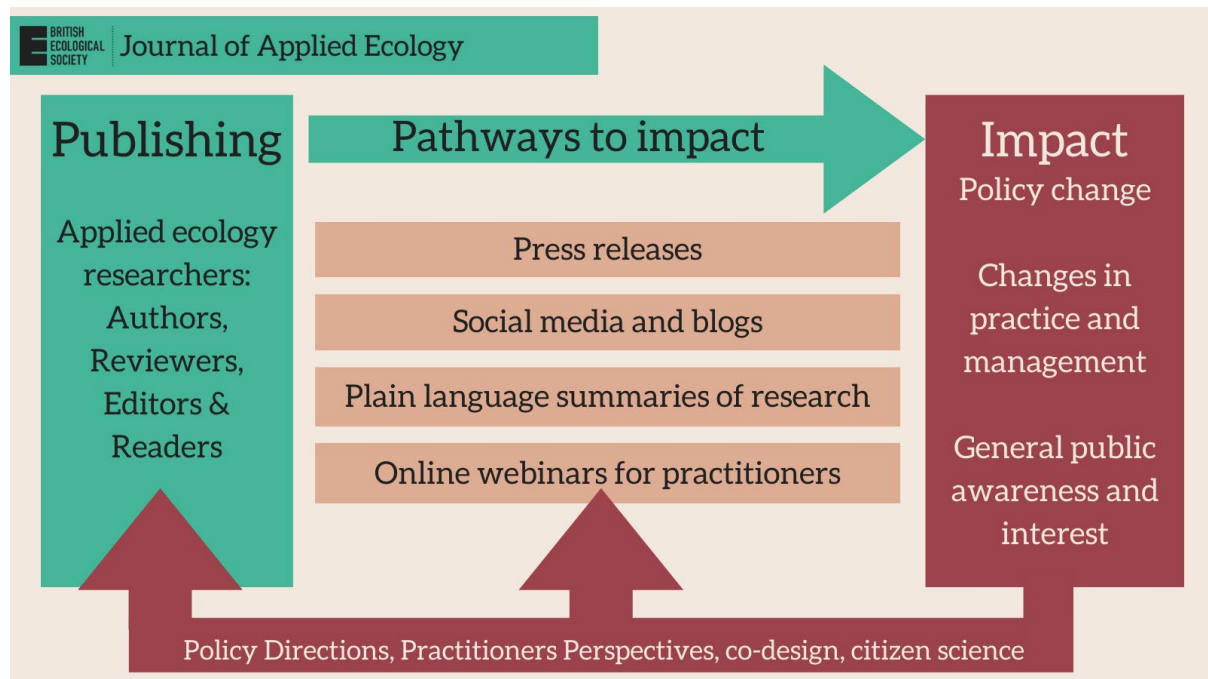


Figure 5: The pathways and connections between publishing in *Journal of Applied Ecology* and achieving real-world impact.

Measuring Impact at the Journal Level

Journal impact factors have become the dominant metric used to assess influence on science. However, despite their name, they are very poor at describing real-world impact. Key limitations include the short time window of two years, which is insufficient for impact to occur (Figure 3), and the focus on citations in scientific literature, which we have seen in our above analysis is only weakly correlated with policy mentions. While no metric is perfect, some alternatives might capture impact better. For example, Google's 5-year journal H-Index captures a longer time period and finds citations outside of academic journals; using this index, we rank 4th in Biodiversity and Conservation and 5th in Ecology Google categories. In the future, we would also like to see journal-level indices for citations in policy documents. What is clear here is that one metric cannot capture the multifaceted impact of a journal or paper.

Conclusion

For sixty years, *Journal of Applied Ecology* has provided a platform for researchers applying ecological approaches to management. While the scope and focus of papers has changed through time, we are committed to our aim of driving forward the field of applied ecology by providing a forum for new ideas and a high-quality evidence base for scientists, managers and policymakers. Given the scale of the ecological and social challenges facing the world, it can sometimes be hard to believe that the science we do will make a difference. But that does not have to be the case - our assessment shows that articles in *Journal of Applied Ecology* are being read and used outside of academia, influencing a broad spectrum of policies and practices across the world. The impact narratives from authors show that this influence can be nurtured and improved over time, and we hope this encourages authors to consider the potential end users throughout the research process. We also strive to promote a two-way flow of information and will continue to provide a platform for policymakers and practitioners to communicate with ecologists and strengthen the ties between research and practice. Impactful and rigorous ecological science will be key to navigating the major social and environmental challenges the next sixty years will bring.

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We thank all of *Journal of Applied Ecology's* past and present authors, editors, reviewers and in-house staff for helping us to achieve a journal that has a strong real-world impact.

Conflict of Interest:

All the authors are *Journal of Applied Ecology* editors and this article represents our views.

Authors' Contributions:

Lydia Groves led on the conceptualisation of the author survey and the overall paper with input from all the authors. Rowena Gordon pulled and analysed the policy document data with input from Jos Barlow and Tadeu Siqueira. Rowena Gordon and Lydia Groves produced the figures with input from Jos Barlow. Jos Barlow, Rowena Gordon and Lydia Groves wrote the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

Data Availability Statement:

Data supporting the conclusions in this paper are available via Dryad <https://doi.org/10.5061/dryad.xgxd254rk> (Gordon *et al.*, 2024)

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