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FORUM PAPER

Priorities in journal selection for authors, reviewers, editors, librarians and science funders

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Abstract

With this Forum contribution I wish to shed light on the problematic developments in scientific publishing resulting from the strong push of science funders towards gold open access (OA). This has given rise to numerous "predatory" journals, that maximise profit at the expense of scientific quality. With a bibliometric analysis in the field of ecology I demonstrate that over the period 2014–2022 the publication numbers in "predatory" OA journals have grown exponentially (+44% annually), while in all other journal types, article numbers were stagnating or even decreasing since a few years. Then I highlight how different OA publication models from society-owned journals to publisher-owned "predatory" journals, differ in the prices authors pay and how the income is split between effective costs, pure profit and money transferred back to science. To help with the recognition of the different journal types, I provide a list journals in the fields of ecology and organismal botany that are owned by academic societies, as well as a list of criteria to recognize "predatory" journals. Authors, reviewers and editors should consider carefully where they submit papers or provide volunteer service. My suggestion is to prioritize society-owned journals, while avoiding cooperation with "predatory" journals. Science funders and libraries have played a major role in the negative developments reviewed in this paper, but at the same time they have the capacity to change the course, mainly by two steps: In the short term they should link the payment of article processing charges (APCs) to strict quality criteria, while in the medium term, they should overcome the gold OA system towards a diamond OA system that would avoid the inflation of low-quality publications and remove barriers not only from readers, but also from authors, while at the same time likely reducing the overall costs.

Abbreviations: APC = article processing charge; AVS = Applied Vegetation Science; IAVS = International Association for Vegetation Science; COVID-19 = Coronavirus disease 2019; DOAJ = Directory of Open Access Journals; JIF = 2-year Journal Impact Factor of the Web of Science; JVS = Journal of Vegetation Science; OA = open access; VCS = Vegetation Classification and Survey; WoS = Web of Science Core Collection.

Keywords

bibliometrics, diamond open access, ecology, gold open access, impact factor, International Association for Vegetation Science (IAVS), peer review, predatory publishing, publication ethics, scholarly publishing, society-owned journal, subscription journal

Introduction

Open access (OA) publishing was put on the agenda of science funders, universities and their libraries more than 20 years ago, with the aims of making scientific results free with unrestricted availability and reducing the costs of scientific publishing (BOAI 2002; Tennant et al. 2016). In the year 2023, still a large fraction of scientific articles are not OA, but the incentives (money) and pressures to publish OA are increasing (e.g. SNSF 2023). Yet, OA publishing, particularly on the so-called "gold route" also comes with collateral damages, the worst being the so-called "predatory journals" (Beall 2012, 2015; Eriksson and Helgesson 2017, Cook et al. 2023, Predatory Reports 2023). Since the early days of OA publishing, critical voices have warned about the threats to scientific integrity that result not from the OA idea *per se*, but from the naivety in which it was implemented (Eysenbach 2008, Beall 2012, 2015, 2017; Bohannon 2013; Shen and Björk 2015, Eriksson and Helgesson 2017, Sorokowski et al. 2017).

As a scientist, editor, author, but also as a taxpayer I am concerned about these developments. However, in numerous discussions with colleagues and librarians (those who often administer the OA budgets and write the OA strategies) I realised that many people are not aware of the problems or, if they are, do not see any solution to overcome them. Recently, all three peer-reviewed journals owned by the International Association for Vegetation Science (IAVS) published editorials on aspects of scholarly publishing from the perspective of each journal, but also looking beyond. The editorial in Applied Vegetation Science (AVS; Chytrý et al. 2023) highlighted the value of publishing in society-owned journals and briefly warned against "predatory" journals. The editorial of the Journal of Vegetation Science (JVS; Wagner et al. 2023) investigated publication trends of that journal and apparently found a long-term increase in the number of papers by authors of any continent (or at least no decrease). Finally, the editorial of Vegetation Classification and Survey (VCS; Dengler et al. 2023) compared the publication trend of VCS with AVS, JVS and other ecological journals over the past five years. From my perspective, these editorials raised valuable points, but fell short of providing an overarching picture and a perspective for a solution.

Thus, I would like to use this Forum contribution to highlight and exemplify the growing problem, including a bibliometric analysis of the recent publication output in different journal types. Then I provide arguments for favouring society-owned journals and for avoiding "predatory" OA journals, addressed to authors, reviewers, editors and readers. To allow people to implement these ideas, I compiled a "whitelist" of some society-owned journals in ecology and organismal botany and a set of criteria of how to recognise "predatory" journals also in not so obvious cases. In the last part, I focus on the role of science funders and librarians whose "naivety" together with the "greediness" of publishers appear to be the key reasons for the problems we are now facing. However, from my point of view, science funders and librarians also have the key to overcome the current problems, and I provide an outline how this could work.

Changes in the publication landscape

Traditionally, scientific journals were produced by academic institutions or commercial publishers in print format and were paid for by subscription fees from scientific libraries or individuals. The advent of the Internet made it possible to overcome, or complement, the print publication with an online electronic publication – but this initially was only accessible to subscribers. Starting in the 1990s, the "open access" (OA) idea emerged among idealistic researchers, librarians concerned about strong increases in annual subscription fees for journals by big publishing houses and science funders who thought that science paid by public money should be publicly available without limitation (see Tennant et al. 2016). This resulted in the Budapest Open Access Initiative 2002 (BOAI 2002). At that time, the so-called "gold OA" way appeared particularly promising to address the main concerns. Here authors pay a fee, the article processing charge (APC), after their article is accepted, and in turn this and all other articles in the journal become freely available on the Internet after publication. Science funders and universities in many countries strongly pushed for this direction, providing significant funds for researchers to cover the APCs while often introducing rules that aim at limiting or even excluding publication in non-OA journals (e.g. SNSF 2023). Apart from "gold OA", there is "hybrid OA", i.e. subscription-based journals in which authors can pay APCs (typically even higher than in gold OA journals) to make their article open. Initially, science funders and librarians were against such solutions, claiming that this is "double dipping", i.e. a publisher receives money for the same article via two channels (Prosser 2015). This attitude has meanwhile changed considerably, presumably under the impression that most of the high impact factor journals are still subscription-based. Now an increasing number of national consortia of research institutions have negotiated so-called "read and publish" contracts (also called "transitional contracts") where an annual fee covers both free access to the content and free OA publication of accepted articles for all members of the institutions of that consortium (e.g. the German DEAL, https://deal-konsortium.de/en/agreements). A third solution is "diamond OA" where neither authors nor readers pay a fee. However, diamond OA is still restricted to very few, mostly small journals with lower impact factors. The reason why this solution is hardly implemented lies in the fact that it is generally not supported financially by science funders or universities; instead, the costs must be covered by scientific societies or institutions philanthropically.

OA publishing has become a huge business, and the number of journals and articles published as "gold OA" is growing exponentially (Laakso et al. 2011, Piwowar et al. 2018, Ioannidis et al. 2023; see also Figure 1). The movement gave rise to many new publishing houses globally. In parallel, traditional publishing houses started numerous new OA journals and successively began to transition some of their traditional subscription journals to gold OA. Now the traditional publishing houses usually have for every field of science a specific gold OA journal with lower impact factor whose main purpose is to make profit with those manuscripts that were not good enough to be accepted in one of the traditional subscription journals. Instead, authors of such rejected papers are informed that they could transfer their article to a gold OA outlet of the same publisher, if they accept to pay the APCs. Typically, the publishers make such a transfer more attractive by offering some discount on APCs and speeding-up of the peer-review by re-using the reviews from the peer-review round in the traditional journal. Effectively, this means that now many articles are published that "in the old times" would not have been accepted due to too low quality or limited novelty, giving the publishers additional profits. Despite this overt practice, science funders and librarians delayed taking serious action against journals making higher profits for lower-standard articles as well as against "predatory" journals and publishers (Beall 2017).

Publication trends in ecology and organismal botany

In the following, some of the aspects are exemplified with a focus on journals relevant for vegetation ecologists (Figure 1, Table 1, Suppl. material 1). Over the period 2014 to 2022, four journal categories in the field of ecology and organismal botany showed an increase in article numbers, except for the IAVS journals in the Web of Science, which published 38% fewer articles in 2022 than in 2014 (Table 1). By contrast, the multidisciplinary journals, whether subscription-based (Nature, Science, PNAS) or OA, decreased their content in the same period by 21% and 70%, respectively (Table 1, Figure 1).

The total numbers of articles in the 36 journals from the field of ecology and organismal botany increased from

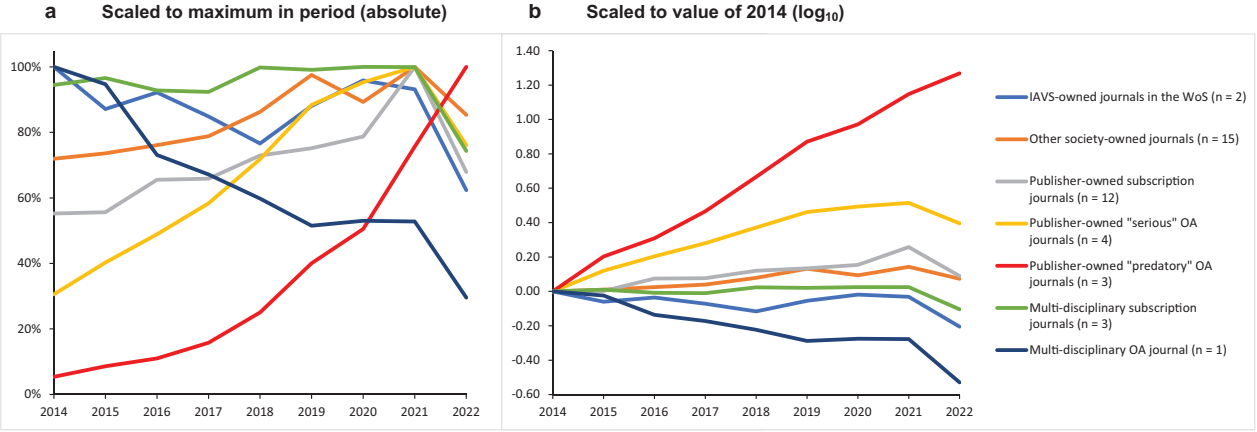

Figure 1. Change of annual publication output from 2014 to 2022 in five journal categories in the field of ecology and organismal biology and two in multidisciplinary sciences, dependent on publication mode and ownership. The publisher-owned OA journals have been split into "predatory" and "serious" at the publisher level based on the criteria given in the section "How to recognise predatory open access journals". All 40 journals are included in the Web of Science Core Collection; for details, see Suppl. material 1. The partial figures a and b show the same data, just with a different scaling.

Table 1. Comparison of the publication output between 2014 and 2022 in five journal categories in the field of ecology and organismal biology and two in multidisciplinary sciences, dependent on publication mode and ownership. The publisher-owned OA journals have been split into "predatory" and "serious" at the publisher level based on the criteria given in the section "How to recognise predatory open access journals". All 40 journals are included in the Web of Science Core Collection; for details, see Suppl. material 1.

	2014			2022			Change	
Journal category	Journals	Articles	Articles per journal	Journals	Articles	Articles per journal	2022 vs. 2014	Average per year
IAVS-owned journals in the WoS	2	218	109	2	136	68	-38%	-5.7%
Other society-owned journals	15	1914	128	15	2270	151	19%	2.2%
Publisher-owned subscription journals	12	2961	247	12	3642	304	23%	2.6%
Publisher-owned "serious" OA journals	3	701	234	4	1746	437	149%	12.1%
Publisher-owned "predatory" OA journals	2	248	124	3	4598	1533	1754%	44.1%
Multi-disciplinary subscription journals	3	9361	3120	3	7368	2456	-21%	-2.9%
Multi-disciplinary OA journal	1	31482	31482	1	9313	9313	-70%	-14.1%

6,042 in 2014 to 12,392 in 2022 (+105%, average annual growth rate: 9.4%) (see Table 1). However, this growth was very unequally distributed between society-owned journals (including IAVS: from 2,132 to 2406 articles; +13%; +1.5% annually), publisher-owned "serious" journals (from 3,662 to 5,388; +47%; +4.9% annually) and "predatory" journals (from 248 to 4,598; +1754%, +44.1% annually) (see Table 1). Thus, the growth rates of "predatory" journals were far higher than the average in life sciences (+4.79% annually since 1940; Bornmann et al. 2014), while those of the society-owned journals fell significantly behind the general trend. If we take the analysed 36 journals as approximately representative of all journals in the field, the fractional distribution of articles has changed from 35% in society-owned journals, 61% in "serious" publisher-owned journals and 4% in "predatory" journals back in 2014, to 19% in society-owned journals, 43% in "serious" publisher-owned journals and 37% in "predatory" journals in 2022 (see Table 1). Thus, we witness a massive shift away from society-owned journals and to a lesser degree from "serious" publisher-owned journals to "predatory" journals.

Around the COVID-19 years, all journals showed deviations from their general trend, except the "predatory" ones, whose growth continued smoothly (Figure 1a, Suppl. material 1). Many individual journals had a depression in the first COVID-19 year 2020, followed by a peak in 2021. This pattern can be explained by the fact that during the lockdowns that occurred in many countries in the first COVID-19 year, scientists could write up accumulated results to papers, which in the majority then appeared in the following year. In 2022, the journals had again a lower number of manuscripts than 2021, which appears logical assuming the authors then had published most of the material in their "pipelines". Surprisingly, however, with the exception of five "serious" (out of 37) and the three "predatory" journals, the article numbers in 2022 remained below, often far below, those of the pre-COVID-19 year 2019 (Suppl. material 1). Deviating from the general pattern, some journals had their peak within the analysed period (thus likely also the all-term peak) not in 2021, but already in 2019, and some started the decline in numbers even before, e.g. Preslia and Journal of Vegetation Science peaked in 2014 (Suppl. material 1).

A short look at the economic side of OA publishing

Scientific publishing costs quite a lot of money, whether it is subscription-based or open access. One can assume that the effective costs are higher in the subscription-based publishing vs. OA publishing as a huge advertising effort is needed to find libraries and individuals to subscribe to the content and, if journals are produced in print, also for paper, printing and shipping. Other costs apply equally to subscription-based and OA publishing: maintaining a manuscript management system, communication between authors, editors, reviewers and publisher, technical editing and typesetting, providing an attractive journal website and feeding the metadata of published articles into relevant databases. Generally, the most time-consuming parts of the publishing process (apart from the work of the authors who normally do it as part of a funded project or an employment) remain unpaid, i.e. the immense service of editors and reviewers, without which quality journals would not be possible. To my knowledge, journal reviewers never receive any financial remuneration and scientific editors only rarely and then usually as largely symbolic honoraria. But why are journal subscription fees and article processing charges (APCs) so high and increasing (Morrison et al. 2022) – despite the "hard" costs became less when moving from print to online only and from subscription-based to gold OA publication? The reason behind are the huge profits that can be made in the publishing business, with profit rates that are way above other fields of economics.

While costs and profits are kept secret by most publishers, we might get a glimpse on the situation with a comparison of four types of journals/publishers, all of which publish gold OA and thus receive money exclusively via APCs paid by the authors (or their funders/libraries). From my experience, the service by the different publishing houses, the functionality of their manuscript management systems and the attractivity of their journal website do not differ significantly, while the APCs vary dramatically (see below and Morrison et al. 2022). It is important to note that each of the four examples is meant to exemplify a wide range of similar journals and publishers rather than the specific journal/publisher presented:

(1) Pensoft (https://pensoft.net/), the publisher of VCS and many other society-owned but also publisher-owned journals, exclusively publishes gold or diamond OA. The pricing model offered to societies is transparent: the publisher requires a revenue of 600–800 EUR per published article, slightly varying depending on the size of the journal and the length of the article. While this is the money the publisher requests for its services, the cooperating societies define the APCs, including the following typical models: (i) diamond OA, i.e. the society pays the full required costs from membership fees, while publishing is free for both authors and readers; (ii) partial subsidies from the society to reduce the APCs for all or certain authors below the actual costs (as currently in VCS); (iii) gold OA with neither subsidies from nor profit for the society and (iv) gold OA with higher APCs than the actual costs, meaning that the journal generates some income for the activities of the society. The important message is that high-quality OA publishing with all the usual publisher services can be done for a price of about 700 EUR per article. We do not know how these 700 EUR are divided into actual costs (for personnel, rooms, computers, software licences etc.) and profit, but let's assume for simplicity that it is about 500 EUR actual costs and **about 200 EUR profit per article**.

(2) Wiley (https://onlinelibrary.wiley.com/), as one of the largest scientific publishers globally, publishes many of the leading journals in the field of ecology, most being society-owned, some publisher-owned, many still subscription-based, some now gold OA. One of the society-owned journals that recently was swapped from subscription-based to gold OA is Ecography. There, the APCs are 2480 EUR per article. Assuming the same actual costs for running the journal as in Pensoft, this would result in an overall profit of 1980 EUR. Roughly knowing that in other society-owned journals, Wiley transfers around 50% of the profit to the owner (in this case the Nordic Society Oikos), this would create a valuable support for scientific activities of nearly 1000 EUR per published article, but the shareholders of the publisher would also make a **profit of about 1000 EUR per article**.
(3) Wiley (https://onlinelibrary.wiley.com/) also has launched publisher-owned OA journals, one of them being Ecology and Evolution. There the regular APCs are "only" 1920 EUR, but assuming the same 500 EUR costs as before, this would mean a pure **profit of about 1420 EUR per article** for the publisher.
(4) Frontiers (https://www.frontiersin.org/) exclusively produces publisher-owned gold OA journals. Their journal in the field, Frontiers in Ecology and Evolution, charges regular APCs of 2720 USD (approx. 2570 EUR) per article. Subtracting the assumed effective costs of 500 EUR, this would give a pure **profit of about 2070 EUR per article**.

In conclusion, the estimated pure profit for the publisher per scientific article varies from 200 EUR (case 1), via 990 EUR (case 2) and 1420 EUR (case 3) up to 2070 EUR (case 4) or in terms of profit margins: 29% (case 1), 40% (case 2), 74% (case 3) and 81% (case 4). Not bad for a legal business! Of concern, money spent for publishing is money that is not available to conduct scientific work. Of course, these estimations are based on simplified assumptions and do not claim to present the true values (which are the secrets of the publishers), but they provide an overall idea how strongly profits and profit margins vary. Based on the Pensoft example, we know that the real costs of high quality open-access publishing, with services on equal level and partly beyond the big publishing houses, can be provided for less than 700 EUR. One might argue that the production costs of a publisher based in Switzerland (Frontiers) or the UK (Wiley) are higher than those of a publisher based in Bulgaria (Pensoft), but in fact it might be even the other way round, since, for example, Wiley has outsourced most of the production-related activities to low-income countries in Asia. Admittedly, the real profit margins will be lower than those approximated as the gold OA journals not owned by societies typically spend a lot of money in intensive, sometimes aggressive, marketing to gain new authors, editors or contracts with science funders and libraries.

Finally, it is also worth to have a look on the financial effects of subscription-based vs. gold OA publishing on the journal quality. In subscription-based publishing, the publishers (or societies) can only charge high fees for journals with very high quality. In this system, there is an inherent incentive to increase (or at least maintain) the journal quality, for example expressed in form of the Journal Impact Factor. However, the economic situation is different for gold OA journals. Since science funders and libraries, from my experiences in two countries, pay the same OA fees for low- and high-quality articles and in low- and high-quality journals, there is a strong economic incentive for publishers to reduce the quality thresholds for publication as each additional article (no matter how low the quality is) will increase their profit (Beall 2017, Jansen et al. 2020). I believe that any reader will agree that the low-quality papers are strongly outnumbering the very few outstanding papers in the field. Thus, in its current form gold OA inevitably comes with an economic pressure to increase quantity at the cost of quality – just the other way round than in subscription journals. This coincides with the observation that all the top journals are still subscription-based, including multidisciplinary journals such as Nature and Science or top-tier ecology journals such as Global Change Biology or Ecology Letters.

Why to prioritize society-owned journals

While the profit from the journal (be it from the APCs of a gold OA journals, be it the subscription fees of subscription journals or both in hybrid journals) in society-owned journals is shared between scientific society and publisher (usually about 50:50), in publisher-owned journals all the profit goes to the publisher (see calculations in "A short look at the economic side of OA publishing"). This means that with the volunteer work of reviewers and the mostly also unpaid extensive work of chief, subject and guest editors, the publisher generates a gigantic profit. As an editor or reviewer, you might ask yourself whether you really want to spend your spare time to maximise the profit of a publisher. Most readers will receive many more requests to serve as reviewer or editor than they can meet. Why not selecting those offers where at least a large part of the income generated will be returned to your discipline? Many scholarly societies receive their income mainly from their journals. In the case of the International Association for Vegetation Science (IAVS), over 95% of its annual budget stems from its two journals Journal of Vegetation Science (JVS) and Applied Vegetation Science (AVS) (Chytrý et al. 2023). Without that, most of the services IAVS provides to science and scientists would not be possible, such as the maintenance of a professional business office, travel grants for young scientists to attend conferences, facilitating working groups and regional sections, and supporting publications that do not (IAVS Bulletin) or not yet cover their costs (the journal

at hand: Vegetation Classification and Survey, VCS). As an author you should know that any paper that you submit to JVS and AVS will add to the income of IAVS, and any paper submitted to VCS will help to turn this journal sooner from a sink to a source of money for IAVS. If you submit the same manuscript elsewhere, this money is missing for scientific activities in IAVS. The situation described for IAVS is very similar for the other ecological and botanical societies listed below, and likewise probably in other scientific fields. Thus, a good reason to prefer journals owned by the societies in which you are active.

When it comes to gold OA journals, the distinction between society-owned and publisher-owned journals is even more important. First, the profit per article is probably higher because the costs are lower (no printing and shipping needed). Second, in stark contrast to subscription-based publishing, gold OA publishing has the serious drawback that it economically favours quantity over quality (see above). Since the funding schemes of universities and science funders usually do not differentiate in their financial support for gold OA publishing between high- and low-quality journals, publishers can increase their income if they manage to publish more articles due to lower rejection rates. The situation is different in society-owned gold OA journals (like VCS): here the scientists themselves decide on publication strategy and quality criteria, thus the chances are higher that quality is given prevalence over quantity.

Examples of society-owned journals in ecology and organismal botany

Numerous international and national academic societies publish respected journals that are suitable venues for articles on ecology, conservation biology and geobotany. As an aid to readers, I compiled an overview of such journals that are indexed in the Web of Science (WoS) or the Scopus literature database, together with information on their latest WoS 2-year Journal Impact Factor (i.e. 2022, published in 2023, JIF). Please note that this list, while containing the most relevant society-owned journals in terms of publication output and article impact, does not pretend to be comprehensive. The journals are grouped by the societies that own them (journals without OA indication are subscription-based):

- International Association for Vegetation Science (IAVS): Applied Vegetation Science (JIF = 2.8), Journal of Vegetation Science (JIF = 2.8), Vegetation Classification and Survey (no JIF yet; gold OA)
- British Ecological Society (BES): Ecological Solutions and Evidence (JIF = 2.9, gold OA), Functional Ecology (JIF = 5.2), Journal of Applied Ecology (JIF = 5.7), Methods in Ecology and Evolution (JIF = 6.6, gold OA), People and Nature (JIF = 6.1, gold OA),
- Ecological Society of America (ESA): Ecological Applications (JIF = 5.0), Ecological Monographs (JIF = 6.1), Ecology (JIF = 4.8), Ecosphere (JIF = 2.7, gold OA), Frontiers in Ecology and the Environment (JIF = 10.3)
- Nordic Society Oikos: Ecography (JIF = 5.9, gold OA), Oikos (JIF = 3.4), Nordic Journal of Botany (JIF = 0.9)
- Ecological Society of Germany, Austria and Switzerland (GfÖ): Basic and Applied Ecology (JIF = 3.8)
- Society for Conservation Biology (SCB): Conservation Biology (JIF = 6.3), Conservation Letters (JIF = 8.5, gold OA), Conservation Science and Practice (JIF = 3.1, gold OA)
- Society for Ecological Restoration (SER): Restoration Ecology (JIF = 3.2)
- International Biogeography Society (IBS): Frontiers of Biogeography (no JIF yet, gold OA)
- Floristisch-Soziologische Arbeitsgemeinschaft (FlorSoz): Tuexenia (JIF = 1.2, diamond OA)
- Swiss Botanical Society (SBG): Alpine Botany (JIF = 2.7)
- Czech Botanical Society (CSB): Preslia (JIF = 3.4, gold OA)
- Italian Society of Vegetation Science (SISV): Plant Sociology (no JIF yet, gold OA)

Most of the larger society-owned journals are now published in collaboration with a professional publisher. However, unlike in publisher-owned journals, the respective academic society still has decisive power on the journal scope, appointment of the Editorial Board and peer-review principles, and it receives a significant share of the profit. Note that there are also a few publisher-owned journals with loose connection to an academic society, such as Journal of Biogeography with the International Biogeography Society and Landscape Ecology with the International Association for Landscape Ecology. Here the societies might receive some benefits from the journal, such as reduced or free subscription rates for its members and some influence on the appointment of Chief Editors, but the publisher has the ultimate say.

Predatory open access journals, and why they are problematic

The term "predatory publishing" was coined by the librarian Jeffrey Beall for OA journals and publishers that "exploit the author-pays model and promote unethical behaviour by scientists" (Beall 2012). The fact that the OA movement has given rise to many "black sheep" had been mentioned before by Eysenbach (2008) and others. The list of "predatory" publishers and journals by Beall, the so-called "Beall's List", with hundreds of entries was online and regularly updated from 2012–2016. In 2013, the journal Science addressed this issue with a famous

"experiment", sending fake papers that contained obvious scientific nonsense to numerous OA journals (Bohannon 2013). Overall, 157 of 255 journals accepted and would have published the bogus paper, with the rate of acceptance being as high as 82% for journals on "Beall's List", but with OA journals of traditional publishing houses also not being always safe. Another experiment showed that a made-up scientist without valid degree and without a single paper published in the Web of Science or Scopus, was happily accepted as an editor in 33% of journals listed on Beall's List, in 7% of whitelisted journals from the Directory of Open Access Journals (DOAJ), but in none of the approached journals indexed in the Web of Science Core Collection (Sorokowski et al. 2017). In 2017, "Beall's List" was withdrawn from the Internet without reasoning, but apparently in consequence of several lawsuits of listed publishers against Beall and his university (see Silver 2017); however, copies are still available online (https://beallslist.net/). A new online platform for "predatory" journals has been launched recently (Predatory Reports 2023).

Since these debates and the non-continuation of Beall's List, there have been a few improvements of the situation: some "predatory" journals were closed, others improved their practice, and DOAJ became slightly more restrictive in accepting journals on its whitelist (see Bohannon 2017). However, the exponential rise in the number of papers published in "predatory" journals documented by Shen and Björk (2015) has continued until today without showing any sign of slowing down (Figure 1). Formerly, "predatory" journals were particularly based in India and Nigeria (Bohannon 2017), the violations of ethical principles were self-evident, and the APCs were rather low (sometimes only a few hundred USD). Now, some of the fastest growing questionable science publishers are based in leading research countries of the western world, have a very professional appearance, do not violate ethical principles so bluntly anymore and in exchange charge much higher APCs. These publishers have their journals listed in indexes often considered whitelists, such as DOAJ, Web of Science Core Collection and the Scopus database, despite none of these "whitelists" has a thorough test against those problematic or unethical practices listed below (e.g. Oviedo-García et al. 2021). "Predatory" journals can even have "respectable" JIFs or CiteScores, which can be achieved by "impact factor engineering", such as various forms of inflated self-citations (e.g. Shen and Björk 2015; Oviedo-García et al. 2021). Another way is to combine in the same journal large numbers of Special Features (see Oviedo-García et al. 2021) managed by respected scientists as editors with regular articles whose scientific quality is not thoroughly evaluated, and which mainly serve as "cash cows" for the publisher by "harvesting" money from researchers who are under pressure to publish internationally but have problems to meet the quality standards of "serious" journals.

There are several general concerns against any degree of "predatory" publishing, with the following three sticking out: (i) the impression that, if a researcher (or his/her institution) has enough money, he/she can publish almost any nonsense in an international journal, undermines the integrity of science as a whole; (ii) the exponential growth of publications in "predatory" journals is largely paid by public money, which in turn is withdrawn from rigorous science; and (iii) with the fraction of "predatory" publications is getting larger and larger (I found an annual growth by 44%, compared to all life science journals with 4.8%, Bornmann et al. 2021) it is getting more time-consuming to find the relevant studies even if everything is OA.

I believe that science funders and university as well as individual researchers should be concerned about the negative impacts of "predatory" OA publishers on science in general, but the latter have additional points to consider:

- As an author or editor: Be concerned about your personal reputation because many colleagues know which the "predatory" publishers are.
- As an author: You might be happy if your manuscript passes "smoothly" through the peer-review process and is published much faster after submission than in other journals. However, you should be aware that the price you pay for less stress is also a lower formal and content-wise quality of your published article that falls back on you.
- As an author (or editor): Be aware that many qualified reviewers and editors avoid journals that are known to be "predatory", thus leading to less expertise in the peer review.
- As an author: If you publish in a "predatory" journal with a nice JIF, Web of Science may de-lists this journal from one day to another because it fails to meet the quality criteria. Recently (March 2023), this happened to more than 50 journals from various publishers (Quaderi 2023). Among them was the biggest journal of MDPI, International Journal of Environmental Research and Public Health, with a JIF of 4.6 in 2021, a total of 17,085 articles and an average of only 42 days from initial submission to final publication in 2022, revision included (Crosetto 2023).
- As an author, reviewer or editor: If you collaborate with "predatory" journals you contribute to redirecting the limited public funding in science from serious science (quality journals, scientific societies) to excess profits of greedy publishers.

How to recognise predatory open access journals

Earlier checklists provided simple identification keys for the worst "predatory" journals, such as no peer-review at all, fake editors or scopes and author guidelines copied form "serious" journals (Beall 2015; Eriksson and Helgesson 2017). Here, I would like to draw attention to practices that are not as obviously "predatory", but still negatively affect science by creating high costs for questionable publication practices:

- Advertisement of very short average times from submission to publication (< 60 days): "Serious" journals would not do that because (a) the overall time from submission to publication is mainly determined by the authors (i.e. the quality of their manuscript and the speed of their revisions), much less by the publisher, the editors and the reviewers; (b) short overall time from submission to publication indicate that the journal does not care much about improving the quality of manuscripts in the peer-review process. Note that instead of the overall time period from submission to publication, "serious" journals would rather announce the mean duration of those parts of the peer-review process that are under the control of the publisher and editors, i.e. the time form submission to first decision and then from acceptance to publication.
- Direct acceptance of articles after a first round of revision: At first glance, this might sound appealing, but it rather indicates low peer-review standards. In "serious" journals, nearly always (>90% of all manuscripts) at least a second revision is needed; top-tier journals hardly ever publish something without multiple rounds of review and revision.
- New/alternative forms of peer review: This in most cases means that the publisher has found a way to organise a less critical peer review so that more papers can be accepted within shorter time.
- Suggestions by the editor or editorial staff to cite papers from the same journal/publisher that do not really fit to your topic or even addition of such to your reference list without asking you.
- Editorial decisions that are either not signed by any person or by a technical employee only.
- No presentation of the name of the handling editor in the published articles: Then possibly there was no subject editor who cared for the quality, just a technical editor.
- Limited influence of editors on the reviewer selection, either because this is done by the staff of the publisher, or reviewers can nominate themselves: Such practices give plenty of opportunity for non-critical reviews from friends of the author or even from the author him/herself under a fake identity.
- E-mails with offers of authorship, guest editorship or subject editorship from a journal in which you never published.
- Reports that (nearly) all chief editors have been replaced: This often means that there was a dispute between them and the publisher regarding holding up scientific standards vs. maximising profit, and they either had been fired or resigned themselves (e.g. Kincaid 2023).
- Pressure on editors to accept/publish more articles.
- Extreme annual growth rates of paper output (+30% and more).

If several criteria of the above list apply to a certain journal, your alarm bells should ring. Evidently, this is not a black-and-white classification, but there are many grey tones in between. Unfortunately, formerly "serious" publishers are more and more tempted to adopt "predatory" practices (e.g. Kincaid 2023). Exceptionally, it can even happen that a society-owned journal becomes "predatory", but in general the chief editors of such journals are controlled by the governing board and this in turn by the members of the society, and their aim is (or should be) to advance science and not to generate profit.

The role of science funders and libraries and ways towards a solution

Why did the reported explosion of OA journals with problematic features happen? One must acknowledge that science funders and libraries played a key role in this development. When the OA movement started, many influential players among science funders and university librarians tried to promote it as much as possible for two main reasons, (a) the idealistic view that there should be no barriers to access publications resulting from publicly financed research and (b) the wish to stop the rapidly increasing costs for subscription journals to be paid by universities and research institutes (e.g. BOAI 2002). There is nothing wrong with these motivations. The problems arose, in my humble opinion, from the naivety in which the whole idea was implemented, while at the same time the growing problems resulting from the path chosen were for a long time not taken seriously.

Gold OA in the current form is inherently problematic even if we exclude the "predatory" journals (see above) from the discussion. The main flaw of this approach is that up to now funding for publication in OA journals was not bound to strict quality criteria of the journals. This led to an inflation of article numbers with decreasing average quality. Since most scientific publications in OA and other journals are ultimately paid by public money, taxpayers pay now more money for a lower average quality than before. Second, while removing barriers for scientists to access other articles, the gold OA system put up barriers for scientists from less wealthy countries and institutions (Smith et al. 2021). Personally, I find these barriers far more problematic than those in the past – because now not the scientific quality of your research, but the budget of your institution decides whether you can publish in a certain attractive journal. On the other hand, even before the advent of OA publishing, it was not too challenging to access articles behind a paywall, most easily by sending an e-mail to the author(s).

Luckily, after years of unwillingness of acknowledging problems with the gold OA way of publication (based on their official strategies and based on personal communication with librarians at various universities; see also Beall 2017), there are now some tender signs that librarians and science funders start to recognise the issues and think of possible solutions. Here are two propositions for ways forward that could be enforced by those who ultimately pay for scientific publishing – the science funders and universities:

Solution 1: reforming the gold OA system

Inside the gold OA system, universities or science funders usually pay the APCs up to a certain maximum amount, but irrespective of quality, scientific integrity and service provided by the publisher. In consequence, some clever publishers raise their prices so high that they are just a few EUR, USD or CHF below this threshold (in my university e.g. 2500 CHF plus VAT). However, if the real costs for high-quality OA publishing can be estimated to be only about 500 EUR or at least less than 700 EUR (see above), why are funders and librarians then happy to pay 2500 CHF of taxpayers' money? Typically, this happens without any quality checks apart from the requirement of being listed in the Directory of Open Access Journals (DOAJ), despite Bohannon (2013) and Sorokowski et al. (2017) showing that among DOAJ-listed journals there are many violating even the most basic publication-ethical standards. It would be relatively easy to set up criteria by science funders and universities for differentiated maximum payments that would direct money away from "predatory" publishers and redirect it to scientific quality. Here are a few possible criteria:

- Average rejection rate and average number of peer-review rounds per accepted paper: The higher both variables are, the higher the scrutiny of the peer-review process and thus the value of the scientific paper; at the same time, these two factors define the costs for the publisher. Thus, instead of paying 2500 EUR/CHF/USD for any paper, one could differentiate between, say, 250 EUR/CHF/USD for journals with rejection rates below 10% and one revision or less on average and up to 5000 EUR/CHF/USD for journals with rejection rates above 95% and an average of three or more rounds of revision.
- The maximum amount of payment could be increased if the journal is owned and managed by a society and a significant fraction of the profit goes back to the society for scientific purposes.
- The maximum amount of payment could also be increased if there are exemptions or strong discounts in APCs for authors from low- to middle-income countries or those not based in a resource-rich institution.

Solution 2: replacing gold OA by diamond OA

However, these proposed actions probably cannot overcome the main "flaw" of gold OA, i.e. that it has an inherent strong incentive to lower scientific standards to maximise profit (Beall 2017; Jansen et al. 2020 and see above). I do not propose to go back to the pre-OA publishing landscape with subscription journals. Instead, we should overcome the drawbacks of both publishing models with three main aims in focus (see Jansen et al. 2020): (i) no barriers in scientific publishing for either authors or readers; (ii) no incentive to undermine scientific standards and (iii) no further increase of costs caused by the inflation of low-quality papers and excess profits of some publishers. I believe that such a solution exists, namely "diamond OA" (sometimes also called "platinum OA"). Diamond OA means that neither authors pay for publishing, nor readers for reading. This would remove the inevitable conflict-of-interest in gold OA where more articles (irrespective of quality) mean higher profit (Cobo 2014, Beall 2017, Jansen et al. 2020). Currently, there are extremely few diamond OA journals in the field of ecology, such as Tuexenia owned by the Floristisch-Soziologische Arbeitsgemeinschaft or Hacquetia owned by the Slovenian Academy of Sciences. Here the costs of the whole peer-review and publication process are paid by the member fees of a scholarly society or by an academic institution. While I acknowledge such approaches as highly valuable and truly philanthropic, it is evident that this can work at best for small niche journals. Science is a public good, and there is a general agreement that the costs of scientific publishing should (largely) be paid by the public hand. Thus: why are not science funders and universities, instead of transferring millions after millions to big publishing houses, some "predatory", some not, but all making huge profits, paying scholarly societies, such as IAVS, to produce high-quality journals? This payment should be for the journal as a whole – irrespective of the affiliation of the authors and with no additional payment by authors or readers. It would cover a pre-agreed number of articles per year and be related to the quality and cost criteria recommended above for gold OA journals. The scholarly society would then pay a publishing house just for maintaining the manuscript managing system and hosting the published articles. As we have seen above, the latter could be achieved at good quality and not outsourced to a developing country for about 700 EUR per article (including already a significant profit for the publisher). Since OA publishing is not bound to very big publishing houses, but can equally be well done by smaller enterprises, there would certainly be enough competition to avoid excessive prices. Thus, if the public hand would pay 1500 EUR to IAVS for each article published in its three journals, this association would in the end have a similar income as now, just that not one publisher on top of it would make another 800 EUR profit per article (in case of the journals managed by Wiley). This means that the total costs would be lower than now in a hybrid OA and gold OA world and there would be no selection towards authors or readers from rich countries or rich institutions. If article numbers and average rejection rate would be agreed in the contract, there would also be no incentive for lowering the standards.

It sounds like utopia, and I agree that this model with all its apparent advantages is not easy to achieve. The main impediment seems to come from national "egoism", i.e. funding schemes of national science funders are normally restricted to scientists from their own country. While across all countries, this model would be cheaper for the public hand than either subscription-based or gold OA publishing, it would require science funders to pay for articles that

are not authored by their compatriots. It might be helpful if one or a few science funders from rich countries would be willing to direct some money to conduct a proof-of-concept, accepting that initially they will have to pay for authors from other nations, too. If it can be shown to work, in a second step it might then be possible to gain further science funders from the other big players in the scientific publishing world. Journals from the field of ecology could be a particularly good starting point for such an attempt for two reasons: (i) as shown above, this field has numerous society-owned journals from a wide range of topics and levels; (ii) unlike fields, such as atom physics, astronomy or cutting-edge medicine, highly innovative research is often done by researchers from resource-limited institutions.

Conclusions and outlook

In this Forum article, I provided arguments why the selection of journals in which to publish or serve as reviewer or editor has far-reaching consequences. Thus, I suggest that authors, reviewers and editors should consider criteria beyond Journal Impact Factors and speed when selecting their journals. Based on the arguments provided, a default sequence would be as follows: (i) journals (OA or subscription-based) owned by the academic society/societies in which one is active > (ii) journals owned by other academic societies > (iii) subscription-based journals owned by publishers > (iv) "serious" OA journals owned by publishers > (v) "predatory" OA journals owned by publishers. The non-comprehensive list of society-owned journals in the field of vegetation ecology provided here demonstrates that there are society-owned journals for nearly any subdiscipline and impact level. Evidently, other aspects also need to be considered, such as topical fit, reach of the intended readership and requirements of one's university or funder.

For librarians and science funders, it would be crucial that they leave their long-term belief that gold open access is good *per se* behind in two respects: (1) They should make the level of payment for OA articles dependent on strict quality criteria, philanthropic approach and ownership of the journals. (2) They should overcome the detrimental developments of gold OA by starting to re-direct their money to diamond OA solutions, which would avoid most of the drawbacks of gold OA at equal or even lower overall costs. Changing the publication landscape from gold OA to diamond OA would acknowledge that science is a global common good. Neither of these two proposed improvements in the publishing landscape are likely to happen without individual researchers and scholarly organisations reflecting their role in the maldevelopments of the past and correcting their attitudes, particularly, how to select journals themselves and how to judge the publication output of others (e.g. in evaluation committees).

Finally, I would like to invite readers to report, for potential future follow-ups, additional society-owned journals from the field and as well as personal experiences with "predatory" behaviour of journals and publishers (please indicate whether I could use this information with your name or only in anonymised form).

Data availability

The raw data of the bibliometric analyses can be requested from the author.

Disclosure of potential conflicts-of-interest

I am Chief Editor of Vegetation Classification and Survey (owned by IAVS, published by Pensoft, gold OA journal) as well as Editorial Review Board member of Applied Vegetation Science (owned by IAVS, published by Wiley, subscription journal) and Tuexenia (owned by the Floristisch-Soziologische Arbeitsgemeinschaft, diamond OA journal). However, I do not receive any remuneration in these functions. In the past, I served as editor and guest editor for various society- and publisher-owned journals, and I am regularly providing reviews for many different, mostly society-owned journals.

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Supplementary material

Supplementary material 1
Details of the bibliometric data of 40 journals used for Figure 1 and Table 1.
Link: https://doi.org/10.3897/VCS.110296.suppl1