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**A GUIDE TO SCIENTIFIC COMMUNICATION
In ecological/agricultural sciences**

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Why such a guide?

Scientific communication is changing rapidly. We should all promote open access publications to make our research available for anyone who wants to read it. For example, to enforce such a change, the Norwegian government has suggested that a journal's impact factor should no longer count as a measure of quality when appointing scientific staff (see [here](#) for further details). Such attitudes are important as it is difficult to change our views and skip the traditional journals. Obviously publishers own too much when they require payment for publishing, for the libraries to subscribe to the journal, and additional payment for open access publishing, most often astonishingly high payment (e.g often US\$ 2500-3000). In addition, if it has not been paid for open access you need access to a library that subscribes to the journal to be able to read the paper.

Below we introduce you to some open access possibilities, and other concepts related to scientific communication.

This is meant as a short guide, mainly using examples from ecological sciences on how to:

- 1) ensure quality in publication channels; and
- 2) measure quality in science through various indexes and impact factors

Open access

Open Access (OA) is about:

- making research openly available for everyone on the internet
- giving public access to publicly funded research
- increasing the visibility and availability of your research
- avoiding the consequences of how commercial control of scientific publishing has grown to be a huge business, where financial issues prohibit small institution's and developing countries' access to research

There are two ways to Open Access: OA-journals (Gold OA) and Institutional repositories.

Open Access journals are openly available online to the reader. They conduct peer review in the same manner as traditional scientific journals. Some OA journals charge an article-processing fee, which some university funds can cover.

Hybrid OA. You can pay most traditional journals to make your article OA. This is often expensive and results in a double cost: The library at your university

pays for the subscription of the journal and you or your university pays an additional OA-fee. Note also that several of the traditional journals has become Gold OA and no longer require a subscription from your library in addition to publication fees.

The number of OA journals are increasing and not all ensure a quality that is recognized in the scientific community. In the *Directory of Open Access Journals* ([DOAJ](http://doaj.org)) you find only Gold OA journals that conduct acceptable peer review and have an editorial quality control. But be aware of the increasing number of *predatory* open access publishing which involve charging publication fees to authors without providing the editorial and publishing services associated with legitimate journals. Beall's List is a regularly updated report listing predatory publishers and independent journals categorised as predatory. Avoid predatory journals by checking Beall's list: www.scholarlyoa.com (for further reading see [here](#),

but also see e.g. <http://crln.acrl.org/content/76/3/132.full#ref-6>, or <http://citesandinsights.info/civ14i4.pdf> for critics of Beall's list).

Author identification

Researchers face the ongoing challenge of distinguishing their research activities from those of others with similar names. You must enter data over and over again, and interact with an increasing number and diversity of research information systems.

ORCID is an open, non-profit, community-driven effort to create and maintain a registry of unique researcher identifiers, as well as a transparent method to link research activities and outputs to these identifiers. ORCID provides a persistent digital identifier that distinguishes you from every other researcher. It supports system-to-system communication and integration of key research workflows such as manuscript and grant submission, and automated linkages between you and your professional activities, ensuring that your work is recognized. Several journals are already asking authors to include their ORCID during the publication process. You can create your own ORCID free of charge at: www.orcid.org.

Databases for scientific publications

The following search engines are commonly used:

- *Web of Science* and *Scopus* are two of the most commonly used academic search engines. In both of these, you can search for literature and create citation reports for individual researchers.

Searching for literature or creating citation reports in any of these search engines most often gives the same results.

Both search engines include the most recognized scientific journals, but you do not find all literature in Web of Science and Scopus. Both select journals for their databases depending on similar criteria. Journals accepted for coverage in Web of Science must be peer reviewed, follow ethical publishing practices, meet certain technical requirements, have English language bibliographic information, and be recommended or requested by a scholarly audience of Web of Science users (for further

information see [here](#)). Scopus requires that journals consist of peer-reviewed content and have a publicly available description of the peer review process, be published on a regular basis, have an International Standard Serial Number (ISSN), have references in Roman script and have English language abstracts and titles, and a publicly available publication ethics and publication malpractice statement (for further information see [here](#)).

You have to subscribe to these search engines, which is quite expensive. Most university libraries do so. Ask your library for access.

- *Google scholar* (www.scholar.google.com) is an open access search engine that covers all literature found in the internet without any selection criteria, such as journals, reports and books. If you search for a specific author or a specific topic you will get much more results by searching in Google scholar compared to Web of Science or Scopus. You also get easy access to download available papers from Google scholar. Google scholar is OA, free of charge.
- *ResearchGate* (www.researchgate.net) is a scientific social networking site for researchers to share papers, ask and answer questions, find collaborators and find vacant positions. It has become a nice database in our field and a lot of literature is easily accessible here. ResearchGate is OA, free of charge.

There are many other data bases, such as [Agris](#) for agriculture or [Green File](#) which connect environmental research with other disciplines such as education, law, health and technology.

Journal's impact factor

A journal's impact factor is estimated yearly based on the average number of citations per article in that year published in the journal the 2 previous years. Hence, an impact factor of 3 in 2014 means that papers published in that journal in 2012 and 2013 were on average cited 3 times each in 2014. [Here](#) you find a list of journal's impact factors from Web of Science, and [here](#) for Scopus. Lately a journal's impact has been estimated in various ways. You find some of these in the two links above.

There are other measures of a journal's impact, such as the *SCImago Journal Rank* (SJR indicator) which accounts for both the number of citations and the impact of the journals where citations come from (www.scimagojr.com), and the *Source Normalized Impact per Paper (SNIP)* which is defined as the ratio of a journal's citation count per paper and the citation potential in its subject field. For instance, journals in mathematics, engineering and social sciences tend to have lower values than titles in life sciences. But also, basic journals tend to show higher citation potentials than applied journals within the same field. SNIP aims to correct for such differences.

A journal's impact depends on the database used to count citations, e.g. in Google scholar a paper will have more citations than the same paper in Web of science or Scopus, which only include scientific journals accomplishing certain criteria (see above).

Author's citation indexes

- *h-index*. A scientist has index h if h of his/her N papers have at least h citations each, and the other $(N - h)$ papers have no more than h citations each. For instance an h of 5 tells you that you have 5 papers with more than 5 citations in the database used.
- *m-index*. Since the h -index naturally increases with the number of years since publication (e.g. h is automatically higher for older researchers than for younger ones) you can estimate *m-index* = *h-index*/number of years since first publication. This facilitates comparisons between academics with different lengths of academic careers. An m -index $m > 1$ is probably above average in many disciplines (<http://blogs.plos.org/biologue/2012/10/19/why-i-love-the-h-index/>, but see other links below).
- *The Mock h-index (h_m)*. The h -index does not take into account the number of publications. The h_m takes into account both the changes in number of publications and citations where $h_m = (C^2/P)^{1/3}$; C =total citations, P =total publications.
- *g-index*: If you have some very highly cited papers, it is not visible in the h -index. To give more weight to highly-cited articles you can use the g -index. The g -index is defined as follows: Rank articles in decreasing order of the number of citations that they received, the g -index is the largest number such that the top g articles in sum received at least g^2 citations.
- *RG-score* is a metric that measures scientific reputation developed by ResearchGate and is based on how all of your research is received by your peers. ResearchGate has not published how RG is estimated, but the number may increase by increasing number of publications, increasing number of followers with high RG-score, and increasing activity in ResearchGate (e.g. asking and answering questions). *For instance, a researcher we follow has an extremely high RG-score of ca 70. His RG-score is based 50% on scientific publications (ca 70 publications) and 50% on answering questions (ca 500 answers).*

All search engines mentioned above estimate the *h-index* for individual researchers. Because the database searched in Google scholar and ResearchGate are larger than for Web of Science and Scopus, the h will thus be higher in Google scholar and ResearchGate than in Web of Science and Scopus. A metric has therefore no meaning unless the database used is referred to. You also find various modifications of the above, such as metrics for the last 5 years, last 10 publications etc.

Remember that even though some metrics may be useful, they are still just part of a researcher's CV, and the quality of research. For instance, none of the

metrics say anything about the authors contribution to a multiauthored paper. You can find many useful discussions about these metrics, for instance, at:

- <http://blogs.plos.org/biologue/2012/10/19/why-i-love-the-h-index/>
- <http://www.benchfly.com/blog/h-index-what-it-is-and-how-to-find-yours/>
- <http://mcinerneylab.com/research/h-index-m-index-and-google-citations/#>
- https://www.researchgate.net/post/What_is_a_good_H_index_for_a_Professor_or_in_Biology_compared_to_a_Professor_of_Psychology
- <http://blog.impactstory.org/four-great-reasons-to-stop-caring-so-much-about-the-h-index/>
- <https://mamidala.wordpress.com/2011/07/10/25/>
- <http://www.iflscience.com/editors-blog/men-cite-themselves-way-more-than-women-in-studies/>

Note also that it may be difficult to compare such metrics between disciplines as the mean metrics vary between disciplines. E.g. Ray K. Iles did a [simple check](#) in Google scholar excluding the extremely highly cited and lowly cited professionals in the UK and found that among 88 academics identifying themselves as full Professors in Google Scholar the mean H- index was 24 and median 20. The top 25% of Professors had a H-index of 30 or greater. There is discipline variation:

Computer Science H-index mean 23, median 21

- Psychology H-index mean 26, median 19
- Nursing H-index mean 20, median 18
- Social Sciences H-index mean 19, median 16
- Physics/maths H-index mean 23, median 22
- Bio-medicine H-index mean 28, median 25

Altmetric is another nice way to illustrate online activity connected to your publication. Go to <https://www.altmetric.com/products/free-tools/bookmarklet/> and drag the blue *altmetric* it button to your bookmarks bar. Then you can check online activity on all papers with a doi-number.

Academic social networks

The number of academic social networks is increasing rapidly with a variety of profiles. These are sites where researchers share papers, ask and answer questions, find collaborators or job opportunities and publish and review papers, among others.

- *ResearchGate* is the most used social networking site and has grown considerably in our disciplines (www.researchgate.net). You can upload additional material in ResearchGate, such as supplementary files, data, presentations etc.
- *Academia* is similar to ResearchGate, has more members, but is less used (www.academia.edu).
- *Mendeley* has become a combination of a free reference manager and an academic social network (www.mendeley.com), but in contrast to ResearchGate and Academia it is owned by a publisher.

You can find a longer discussion on such networks at:

<https://www.timeshighereducation.com/features/do-academic-social-networks-share-academics-interests>

- *Faculty of 1000* consists of various modules (www.F1000.com). You may have to pay for some of these or ask your library to subscribe to F1000 modules:
 - *F1000Prime* consists of more than 11 000 Faculty Members that recommend the most important articles in biology and medicine, rating them and providing short explanations for their selections.
 - *F1000Research* is an open access, open peer-review scientific publishing platform covering the life sciences. Articles are published first and peer reviewed after publication by invited referees. The peer reviewer's names and comments are visible on the site. The data behind each article are also published and are downloadable. Web of Science includes F1000Research.

F1000 describes F1000Research as a publishing platform and not a journal. There is no academic editors making acceptance/rejection decisions following peer review and no article type restrictions. It encourages the publication of small studies and negative/null findings or case reports as well as typical research articles. A journal impact factor is therefore unsuitable and Faculty of 1000 believes that only article-level metrics have relevance - such as number of views and downloads.

Others are about to follow the ideas of F1000, e.g. <http://wellcomeopenresearch.org/>.

- *Peerage of Science* is a free service for scientific peer review and publishing (www.peerageofscience.org). Authors submit manuscripts to Peerage of Science, before submitting to any journal. Submitting Author decides the deadlines for the four stages of the publication process, i.e. the deadline for:
 - sending peer reviews
 - peer-review-of-peer-review, the reciprocal judging and scoring of the accuracy and justifiability of peer reviews
 - sending the revised manuscript
 - final evaluation of the revised manuscript

Once submitted, any qualified Peer can engage to review the manuscript. Peer reviews are themselves peer reviewed by users of Peerage of science, increasing and quantifying the quality of peer review. The peer review process is available concurrently to all subscribing journals, with automated event tracking. Authors may accept a direct publishing offer from subscribing journal, or choose to export the peer reviews to any journal of their choice.

- *Publons* is a network of reviewers, editors and authors seeking more transparency and recognition for peer review (www.publons.com). Here you can keep track of the peer reviews you have done, the destiny of papers you have reviewed, and compare your reviews with others. The site acknowledges the work of a peer review, and helps you organise your reviews so you can use your review work as part of your CV.

Recommendation for scientific communication

- 1) Create your author identification (www.ORCID.org)
- 2) Both to make your publications easily accessible for others as well as to communicate with others make sure you are member of at least ResearchGate www.researchgate.net
- 3) It is useful to create a personal profile in Google scholar which makes it easy to you to follow citations of your papers (to create your own profile follow: www.scholar.google.com/intl/en/scholar/citations.html#setup)
- 4) Selecting a publishing channel. Make sure that at least point a and b below is fulfilled.

Remember that what matters is how often other researchers cite you, not the journal's impact factor. Hence: publish in OA to make your results easy accessible for people to cite them as quickly as possible, without the delays of the traditional journal printing processes:

- a)
- b) Make sure the journal is listed in Web of Science and Scopus (for instance by searching for the relevant publication name and see if the journal is listed in the search engines).
- c) As far as possible choose OA journals and avoid Hybrid OA. Check [DOAJ](#) that your choice is an accepted OA journal.

Appendix 1. Examples of acceptable OA journals

The list of journals below is not at all complete in the fields of ecology and agriculture, but gives some examples of recommended OA journals. They are all listed in DOAJ. They are all available in Web of Science and Scopus. Not all have yet established impact factors.

Journal	Norway)Level	Web of Science Impact factor	Scopus Impact factor 2015	Publication OA fee
Plos Biology	2	8.7	6.0	2900 USD
BMC Biology	2	7.0	5.6	1780 GBP
Conservation Letters	1	7.1	5.0	1850 USD
Plos Genetics	2	6.7	6.4	?
Frontiers in Plant Science	1	4.5	4.6	1900 USD
Plos One	1	3.1	3.0	1495 USD
Frontiers in Zoology	1	3.0	3.3	?
Ecology and Society	1	2.9	3.4	?
BMC Ecology	1	2.7	2.7	1370 GBP
BMC Molecular Biology	1	2.5	2.2	1370 GBP
Ecology and Evolution	1	2.5	2.6	?
BMC Genetics	1	2.2	2.4	1370 GBP
PeerJ	1	2.2	2.0	99 USD*
Boreal Environment Research	1	1.5	1.5	
Aquatic Biology	1	1.3	1.4	1550 EUR
Wildlife Biology	1	0.7	1.0	500 EUR
F1000Research	1	***		1000 USD
Forest Ecosystems	1			FREE
Forest@	1			?
Journal of Forest Science	1		0.6	FREE
Movement Ecology	1			1370 GBP
Open Ecology Journal	1		0.8	?
Royal Society Open Science	1			?
Web Ecology	1		0.4	600 EUR
Wildlife Biology in Practice	1		0.4	FREE

* Publication fee at PeerJ is 99 USD for the first publication, but is FREE for later publications

** Note that The Faculty of 1000 does not recommend journal impact factors (see text above).

Appendix 2. Some traditional journals and hybrid journals

The list of journals below is not at all complete in the fields of ecology and agriculture, but gives some examples of traditional journals. Many of these also function as Hybrid OA which means that you can pay them to make your article OA, which most often means a double cost for your university (or a double gain for the publisher) as the library at your university pays for the subscription to the journal and you or your university pays an additional OA-fee. In many of these journals you still have to pay a publication fee even without OA.

Journal	Level (Norway)	factor Web of Science	Scopus Impact factor
Nature	2	38.1	24.5
Science	2	34.7	18.0
TREE (Trends in Ecology and Evolution)	2	16.7	15.1
Ecology Letters	2	10.8	10.5
PNAS	2	9.4	9.4
Frontiers in Ecology and the Environment	2	8.5	8.3
Journal of Ecology	2	6.2	6.0
Ecography	2	5.4	5.4
Functional Ecology	2	5.2	4.9
Journal of Applied Ecology	2	5.2	5.0
Journal of Cleaner Production	2	4.9	4.9
Journal of Animal Ecology	2	4.8	4.7
Proc. of the Royal Society London, Biological Sciences	2	4.8	2.5
Ecology	2	4.7	4.6
Conservation Biology	2	4.3	4.0
Ecosystems	2	3.8	3.7
American Naturalist	2	3.1	3.3
Behavioral Ecology	2	3.0	3.0
Biology Letters	2	2.8	2.4
Bioscience	1	4.3	3.5
Ecological Applications	1	4.3	4.2
Biological Conservation	1	4.0	4.1
Oikos	1	3.6	3.8
Animal Behaviour	1	3.2	3.2
Biomass & Bioenergy	1	3.1	3.1
Journal of Environmental Management	1	3.1	3.4
Oecologia	1	2.9	2.8
Behavioral Ecology and Sociobiology	1	2.4	2.3
Journal of Wildlife Management	1	1.7	1.8
Population Ecology	1	1.7	1.6
South African Journal of Wildlife Research	1	1.7	1.5
Wildlife Research	1	1.7	1.3
Journal of Mammalogy	1	1.6	1.6
European Journal of Wildlife Research	1	1.4	1.5
Scandinavian Journal of Forest Research	1	1.1	1.1
Scandinavian Journal of Forest Research	1	1.1	1.1

African Journal of Ecology	1	0.9	1.0
Annales Zoologici Fennici	1	0.7	0.8
Ecoscience	1	0.6	0.4
Mammalia	1	0.5	0.6

Appendix 3. Useful links

Author identification: www.orcid.org

List of Acceptable open access journals www.doaj.org

Beall's list of Predatory open access publishers and journals:
www.scholarlyoa.com

Databases and academic social networks:

Google scholar: www.scholar.google.com

ResearchGate: www.researchgate.net

Academia: www.academia.edu

Mendeley: www.mendeley.com

Faculty of 1000: www.F1000.com

Peerage of Science: www.peerageofscience.org

Publons network of reviewers: www.publons.com

You get access to Web of Science and Scopus through your university library.

Journal's impact factor

Impact factor listed for Web of Science:

<http://admin-apps.webofknowledge.com/JCR/JCR?PointOfEntry=Home&SID=2EeXjW1bRsETOdCRRQj>

Impact factor listed for Scopus: http://www.scimagojr.com/journalrank.php?area=1100&category=1105&country=all&year=2014&order=sjr&min=0&min_type=cd