International Union of Soil Sciences

Publish or Perish (2) – How much we write

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"It is easy, after all, not to be a writer. Most people aren't writers, and very little harm comes to them".
Julian Barnes (1946-)

1. Introduction

I know very few people who read a lot and do not write, but I know more people who write a lot and do not regularly publish. Nevertheless the number of books appearing each year is on the increase - not only in the literary world but also in our great world of science.

Scientific careers are increasingly depending on what one has written (and where) and not so much on what one has read. Having read widely and erudition used to be momentous in academic positions, but it seems that publication record is now the most important evaluation criterion. In the majority of job interviews there will be questions about the applicant's publication record, whereas questions like "What was the latest (soil science) book you have read?" are not asked. The answer will involve something like "I have little time to read a whole book, I rather write one".

The emphasis on writing has not missed its goal, and in the past 25 years the number of scientific journals roughly doubled. Also the number of soil science journals has increased, and 5 of the 11 leading soil science journals did not exist in the 1970s. Currently, there are about 25 journals solely dedicated to publishing soil research whereas more than 35 other journals publish regularly soil research papers. There are more than 60 national and international journals in which our research and thoughts on soil science can be published.

In this paper, we have a look at the number of soil science publications over time and for different sub-disciplines. Numbers were estimated using Current Contents published by ISI Philadelphia (USA) and with the help of the information division of CAB International in Wallingford (UK).

2. Our total output

Current Contents displays the tables of contents from more than 7,500 journals and 2,000 books and conference proceedings. It provides complete bibliographic data for every item covered in a journal: articles, editorials, corrections, meeting abstracts, commentaries, reviews and letters to the editor. More than 900,000 publications are listed each year. On-line searches were conducted through the 1994 to 1998 databases with the word 'soil' in the title, or abstract, or any database field (Table 1).

Table 1. Number of publications with 'soil' in article title, or abstract, or any database field from 1994 to 1998 (Data from Current Contents)

	1994	1995	1996	1997	1998
'Soil' in title	3,678	3,940	4,413	4,268	4,544
'Soil' in title or abstract	8,256	8,817	9,548	9,505	10,023
'Soil' in any database field	9,279	10,001	10,804	10,958	11,561

The total number is increasing with about 450 publications per year, or on average 5%. This is probably not the best estimate of how much we publish. The figures are an overestimate because publications from entomologists studying soil nematodes, road constructors, or medical doctors investigating soil-borne human diseases are also included. Those are not the type of papers written by soil scientists. On the other hand, the figures underestimate our total output because it is excluding most non-English documents.

What the searches cannot show is an overview of number of soil research publications per journal per year. The 14 soil science journals listed in IUSS Bulletin no. 95, published 1,612 papers in 1997. So many papers are appearing in agronomic journals or are being published in non-specialised journals. Very few are, however, written in the leading international journals of science: "Nature" and "Science" (Table 2).

Table 2. Number of publications with 'soil' in article title, keyword or abstract in "Nature" and "Science" from 1994 to 1998 (Data from Current Contents)

	"Nature"		"Science"	
Year	Soil	Total	Soil	Total
1994	17	3,330	7	2,528
1995	14	3,308	9	2,597
1996	9	3,104	7	2,791
1997	8	3,086	14	2,753
1998	13	3,082	7	2,727

Less than 0.6% of all manuscripts published in "Nature" and "Science" are related to the study of soils. There is little doubt that much of our soil research is of the highest scientific standard, but apparently very few soil scientists publish in these two high impact journals, probably because their readership is too general. If current trends continue whereby soil scientists are mainly evaluated according to where they have published, that may perhaps change.

3. Papers per sub-discipline

In the 1930s, the Commonwealth Agricultural Bureaux (CAB) started abstracting and classifying soil science publications. CAB, which is now known as the not-for-profit organization CAB International, continues to date to abstract agricultural publications. It has developed a monumental database on soil science publications. From this database an overview was prepared of the number of abstracts of soil science papers published in "Soils and Fertilizers" between 1938 and 1998 (Table 3).

Table 3. Number of abstracts published in "Soils and Fertilizers" between 1938 and 1998 (Data from CAB International)

	Year						
Subject area	1938	1948	1958	1968	1978	1988	1998
Soil Science (General)	15	19	2	0	6	11	20
Soil Chemistry	248	182	342	704	832	1,290	2,204
Techniques & Analysis	221	111	263	465	423	763	738
Soil Physics	123	98	195	316	409	635	922
Soil Classification & Soil Types	139	38	148	346	180	424	126
Soil Fertility	56	4	6	28	44	154	286
Soil Biology	77	110	279	624	750	1,332	1,694
Soil & Land Resources	41	12	21	143	289	334	324
Soil Morphology, Formation & Erosion	80	67	57	109	235	684	560
Soil Management	33	37	29	41	38	105	95
Fertilizers (inc. plant nutrition)	276	215	476	651	506	1,731	833
Reclamation, Soil & Water Conservation, Irrigation & Drainage	54	46	30	76	247	832	909
TOTAL	1,363	939	1,848	3,503	3,959	8,295	8,711

- These figures, taken from the sections "Soil Science" and "Fertilizers. Soil Management. Crop Management" of "Soils and Fertilizers", do not include books, reports, and other reference documentation, except for 1938 and 1948 which include all documentation apart from reports.

The table shows that the largest increase occurred in the 1970s and 1980s, and in 1998 there were nearly 9,000 abstracts. The number of abstracts increased for most of the subject areas listed although differences were large. Relative differences were investigated by setting the number of abstracts in 1938 at 100 (Fig. 1). The most dramatic increase occurred in the field of soil biology. The increases in the area of soil chemistry and physics were similar. There is a declining trend in the number of abstracts on Soil Classification & Soil Types, and this reflects the reduced interest in this area.

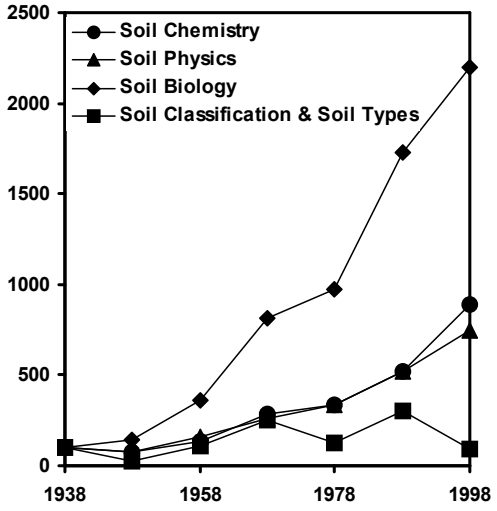

Fig. 1. Relative changes in number of abstracts on Soil Chemistry, Physics, Biology and Soil Classification & Soil Type between 1938 and 1998 (1938 = 100)

4. Compared to others

Both the data of CAB International and Current Contents have shown that the number of soil science publications is increasing. How does the increase relate to other areas? Searches were made with the key words 'soil', 'water' or 'air' and the results are given in Table 4.

Table 4. Total number of publications with 'soil', 'air' or 'water' between 1993 and 1998 (as a percentage of the total in parentheses) (Data from Current Contents)

Year	Total in Current Contents	Soil	Air	Water
1994	887,685	9,279 (1.1)	14,081 (1.6)	35,875 (4.0)
1995	920,746	10,001 (1.1)	14,851 (1.6)	38,275 (4.2)
1996	962,263	10,804 (1.1)	15,978 (1.7)	40,172 (4.2)
1997	967,086	10,958 (1.1)	16,467 (1.7)	41,705 (4.3)
1998	976,088	11,561 (1.2)	17,107 (1.8)	44,036 (4.5)

Although this search has the same limitations as discussed before, the table roughly shows that from the 900,000 articles included annually in Current Contents, about 4 times more publications list water than soil. The table also shows that there is steady increase in all three areas, and total number of publications. The relative increase has been investigated by setting the 1994 figures at 100 (Fig. 2). The increase is similar for the three areas (about 5% per year), and higher than the increase in total number of publications.

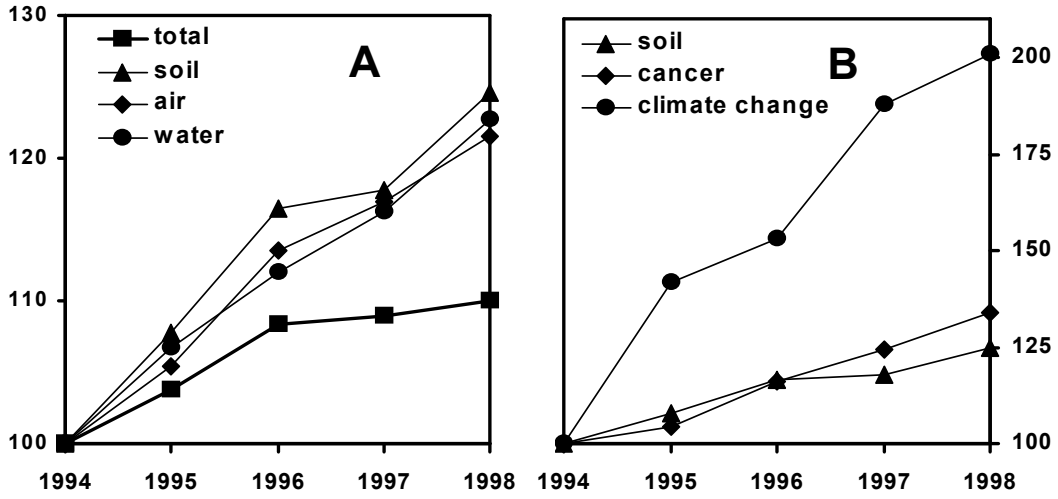

Fig. 2. Relative changes in number of publications on soil, air, and water in relation to total number of publications (**A**), and changes in relation to publications on cancer and climate change (**B**) (1994 = 100).

The increase in number of publications is similar to those on cancer, but largely exceeded by the increase on climate change publications. Absolute number of publications on climate change were, however, less than 1,000 in 1998.

5. Discussion

The number of soil science publications is increasing with about 5% per year. A similar figure was given by Yaalon (1989). Total number of soil science publications fairly well correspond to those reported by Yaalon (1964, 1989) and McDonald (1994). Some reasons for the increase are: increased pressure to publish, increased number of journals, computers facilitating manuscript preparation, computers generating publishable knowledge. And of course the number of publishing soil scientists has increased both absolutely and relatively. World-wide there are currently about 45,000 soil scientists which corresponds to about 19 publications per 100 soil scientists. Between 1974 and 1998, the number of ISSS members increased from 3,958 to 7,042 (van Baren et al., in press) and if it is assumed that the number of soil scientists grew in pace with the number of ISSS members, then there were about 25,500 soil scientists in 1974. This corresponds to 14 publications per soil scientist in 1974. So publication output per soil scientist increased by about 30% between 1974 and 1998.

Even more could have been published if all research which had yielded valuable results, had been written up. We do not know how much this is but it is probably decreasing. A colleague recently made an inventory of unpublished agricultural research in Papua New Guinea, and counted about 400 unpublished manuscripts in research centres, which could potentially yield at least 160 scientific papers (Bourke, 1999). The survey indicated that much of the research has not been published. The situation may also prevail in other developing countries where English is not the mother tongue of the research scientists, and pressure to publish and competition is less.

Is the increasing number of publications not affecting the quality, or as someone recently questioned : "More haste, less science?". Hawkins (1999) found that more and more errors are being published in a leading international journal. Most errors were trivial but also technical errors are on the increase. Production standards are more difficult to maintain and authors are less careful and editors and reviewers less thorough. This is related to increasing complexity and technical sophistication by which errors escape attention of authors, reviewers and editors (Hawkins, 1999). In addition to the increasing number of errors, Geerts (1999) noted that the reader-friendliness of most atmospheric science journals declined over time. But there are also positive sounds. Satchell (1992) stated that the quality of papers improved over time and that papers published 30 or 40 years ago would unlikely be accepted today. He also thinks that standards of acceptance for publication become more rigorous when pressure on journal editors increases. Both arguments suggest that quality improves with increasing number of publications.

A problem facing many soil scientists is keeping abreast of the fast-growing literature: "Who can keep up with all developments in his or her field and who will have time to read even the slightest minority of these publications?" (Satchell, 1992). The answer is strictly personal, but I would like to add to this that accessibility to literature may be as big a problem as keeping abreast. With many journals solely available in electronic form or being slashed from the library shelf, accessibility may be as problematic as quantity. We should be pleased now that 12 major commercial publishers have agreed to link references in the articles they publish to the source papers on the websites of their respective publications (Nature, 18 Nov. 1999). Let us hope it will become accessible for all soil scientists, and that the soil science society journals will be linked to this as well.

Some scientists question whether the increasing number of publications is a proper indication of the advancement of our knowledge, or is it simply the chase after attention – from our peers and the public (Franck, 1999)? That, I think, we should not worry about too much as developments in soil science are staggering, and apparently a lot of paper is

needed to spread the message. Separating wheat from the chaff is, however, something different but perhaps journal reputation still guarantees the quality of a paper. The most important question is, however, whether and how soil science has contributed to society (Greenland, 1991). We all think we do, but the extent goes largely unquantified. Counting publications and quantifying impact on our peers is easier than quantifying the impact on society.

One more point. Is the increasing number of publications a sign that people read more? One could argue the other way around i.e., that those who write a lot have little time to read. Not reading and conducting cutting-edge science are of course mutually exclusive. The leisurely days of conducting science without prolific writing have long gone. More and more is being published about soils and there are no reasons to assume that this trend will reverse. Big changes are, however, on the way as – like it or not – the days of ink on paper are numbered (Anon, 1999), and so are the days to see your name in print.

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In Reply to: "Publish or Perish (1) Journal Prices and Impact"

In the previous IUSS Bulletin (no. 95: 13-17) I have spoken about the relation between the price of soil science journals and their impact factor. I received some questions on the use of impact factors and how they are calculated and I would like to refer to a paper published in Science in 1972 (Vol. 178: 471-479) for a detailed explanation. The paper is written by Dr E. Garfield who invented the impact factor and – if I am correct – was also the founder of the ISI, which publishes these factors annually around September. Most editors, and certainly publishers, recognise the impact of these factors.

I further received a number of e-mails which require a reaction, particularly as this column is meant to stimulate discussion. Ms J. Fegent, managing editor of the "Australian Journal of Soil Research", mentioned that the journal is not published by a national society, as I had written, but by CSIRO Publishing on behalf of CSIRO and the Australian Academy of Science. I stand corrected. CSIRO Publishing is a not-for-profit organization. Having that information, I would still rank the journal as a society journal as not-for-profit is essentially different from the basic principle and strategy of commercial publishers.

Dr Richard Tucker, Senior Land Resources Officer in Alice Springs, suggested to explore the relation between costs, circulation (distribution) and impact factor. No doubt such analysis would be of interest but hard data are difficult to get. Most publishers will not freely provide the number of journal subscriptions nor their geographic distribution. I think that widely distributed journals tend to have higher impact factors: they have more readers and likely will be cited more, hence increasing the impact factor. Society journals are in general wider distributed than those from commercial publishers and may thus have disproportionally higher impact factors.

Dr R. Webster, editor of the "European Journal of Soil Science" noted also that some institutions in rich countries are cancelling their subscriptions. He mentions that universities look at journals over the whole field of their teaching and research and that they will tend to cut subscriptions to expensive journals. Thus, if a journal of soil science costs more per page or per paper than a biological journal then the former is likely to be cancelled, according to Dr Webster. He also mentioned that one university's library has stated that it would have to cancel ALL subscriptions to journals if prices and budgets continue on their present course. That would be very serious indeed, but the situation is different in different places. Mr G. Spikman, journal collection manager at Wageningen University, mentioned to me that they had cancelled 300 of their 4,000 paid subscriptions for the 1st January 2000. Not the number of pages per USD, but the following criteria were used: doubling of subscription (journal is available in nearby institutes); unnecessary subscriptions (for a complete collection but without a direct need for students and researchers); whether journals contain papers from Wageningen University researchers (if not: cancelled). The library policy has changed emphasising "quality rather than completeness of collection" (we all know that that is a cover-up for a slashed budget). Mr Spikman had, however, the impression that annual price increases for journals were currently below 10% thanks to the pressure on the commercial publishers. They used to be about 20%.

The libraries of the University of Wisconsin recently analyzed the costs of their journals (see below). The largest increase in journal subscription price occurred in a society journal and many journals from commercial publishers had price increases below those of national societies. The data were used as one of the criteria to cancel subscription, but as Ms Lois Komai, librarian at the Wisconsin University pointed out, the most important criteria is faculty opinion. So my suggestion is to keep in close contact with your library before they slash what you really need.

Dr D. Czeschlik of Springer Verlag noted that "Biology and Fertility of Soils" was not included in the 1997 overview. The reason hereto was that the information on the subscription price was received too late. For your information, the impact factor of "Biology and Fertility of Soils" was 1.003 in 1997 and number of pages per USD was 0.5 in 1997. The journal ranks 8th on the list and has the lowest page/USD of all journals listed.

I recently received the 1998 impact factors and the picture has changed (Table 5). Despite the large inter-annual variation, the average sequence in top 10 of soil science journals is not changing much. The table also shows that most journals increased their subscription price and the average price increase was similar for journals of commercial publishers and national soil science societies (about 10% per year). Costs/use indicators were calculated as the annual subscription price divided by the number of time a particular journal was consulted in the Wisconsin libraries. As the data are from USA libraries, journals in which the majority of the papers are from the USA have a low cost/use value because they are consulted more often than journals publishing soil science from other parts of the world. This ratio obviously differs for libraries in different parts of the world. It seems that not-for-profit and society journals are not a better bargain in terms of cost/impact than those of commercial publishers – this opposed to journals in physics, neuroscience and economics (Butler, 1999), and the general belief.

Table 5. Soil science journals, change in costs and costs per use (Data from Wisconsin-Madison Libraries), and journal impact factors for 1997 and 1998

Rank †	Journal	Published by:	change in costs 1996/98‡ (in % y^{-1})	costs/use 1996/98‡ (in USD)	Impact factor 1997	1998
1	Soil Biology and Biochemistry	Commercial	+18	4.8	1.326	1.592
2	Soil Science Society of America Journal	National Soil Science Society	+33	0.4	1.336	1.587
3	Soil Science	Commercial	+9	1.0	1.253	1.400
4	European Journal of Soil Science	National Soil Science Societies	+13	13.0	1.811	1.364
5	Plant and Soil	Commercial	+1	9.9	1.193	1.216
6	Applied Soil Ecology	Commercial	nd	nd	1.127	1.157
7	Biology and Fertility of Soils	Commercial	+6	13.0	1.003	1.083
8	Geoderma	Commercial	+8	17.2	0.839	1.059
9	Australian Journal of Soil Research	National Soil Science Society/not-for-profit	+13	7.3	0.868	1.012
11	Soil Use and Management	National Soil Science Society/not-for-profit	+19	20.2	0.595	0.987
12	Canadian Journal of Soil Science	National Soil Science Society	-1	0.9	0.613	0.859
13	Journal of Soil and Water Conservation	Soil and Water Conservation Society	-18	0.3	0.617	0.833
14	Catena	Commercial	nd	nd	0.639	0.788

† ranking based on 1998 impact factor of ISI
‡ change in costs and costs per use calculated from 1996, 1997 and 1998 data published by the libraries of the University of Wisconsin-Madison http://www.wisc.edu/wendt/journals/costben/stee8.pdf
nd - means no data